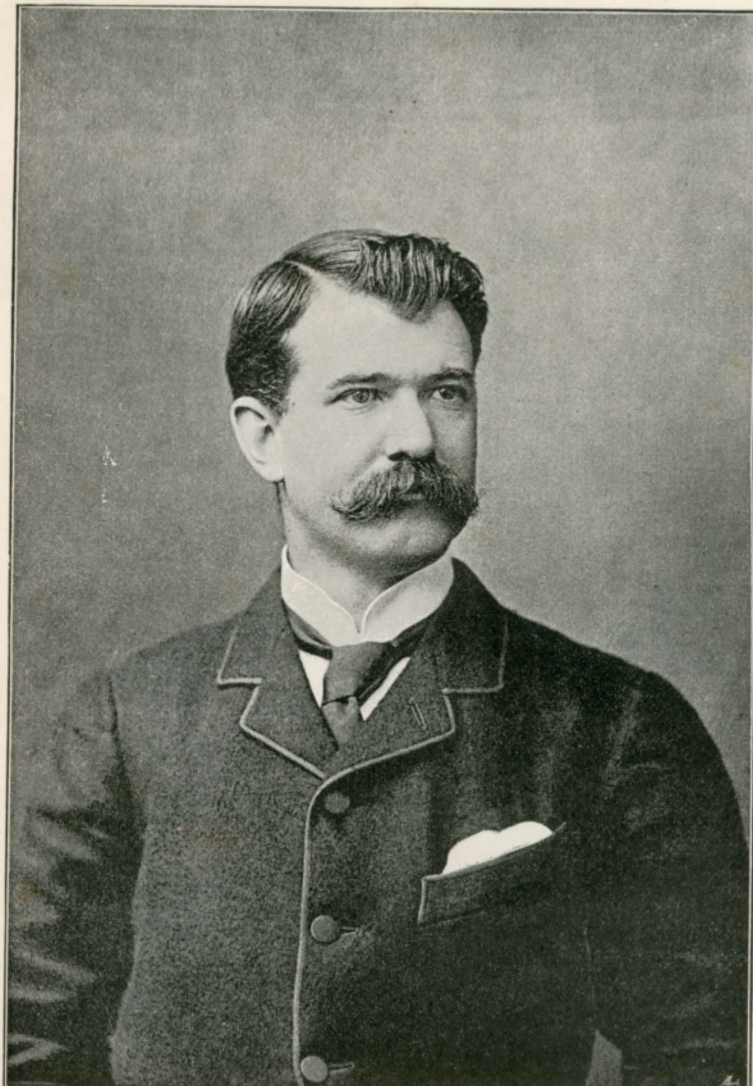

A. Ayton, Edinburgh.

THE AUTHOR.

THE

RURAL ECONOMY AND AGRICULTURE

OF

AUSTRALIA AND NEW ZEALAND

AS SEEN BY

ROBERT WALLACE, F.L.S., F.R.S. EDIN.,

Professor of Agriculture and Rural Economy in the University of Edinburgh,
Author of "India in 1887, *"Farm Live Stock of Great Britain," &c.*

WITH 10 MAPS, 90 FULL-PAGE PLATES AND 24 ILLUSTRATIONS IN THE TEXT.

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TO

THE RIGHT HON.

HENRY THURSTAN HOLLAND

BARON KNUTSFORD, P.C., G.C.M.G.,

Her Majesty's Secretary of State for the Colonies.

PREFACE.

THERE are two familiar ways in which books of travel are written ; the one in the form of a diary and the other as a collection of essays or chapters on various subjects. Each method has its merits and its drawbacks. It has been attempted in the present instance to combine the advantages of both, by presenting the first six chapters as a diary indicating the route taken, and the greater part of the book as special chapters in digested form on distinct subjects. In the former part an effort has been made to relieve the monotony and tediousness of day-to-day detail by accounts of incidents which occurred by the way, but which were not of sufficient importance to occupy separate chapters.

The subject-matter of this work was compiled during the period of my tour through the various Colonies described, where information was directly communicated to me by men of large personal experience in Colonial ways and Colonial life.

Indebtedness is gratefully acknowledged to those who supplied information relating to the various subjects in connection with which they have been from time to time quoted in the body of the work. It was impossible to mention by name all the many friends to whom I was personally indebted for social courtesy and Colonial hospitality. Such kindness will nevertheless remain one of the most vivid and enduring bonds of union between my numerous Colonial friends and myself : and I feel that my appreciation of their attention and goodness will appear none the less sincere, that I preserve in this connection the sanctity of silence.

The opinions recorded were formed after a careful study of a vast amount of evidence taken on the spot and after freely using the various acknowledged sources of statistical information, which are from time to time referred to.

The greater part of the subject is new to a book of travels and is meant to appeal to the desire springing up in all classes of the English-speaking race for further information relating to our Australasian Colonies. The Colonial resident will find in it facts with which he is personally familiar, treated by one who occupies a somewhat different standpoint from his own. He will also find a parallel drawn between corresponding features of interest in the Colonies and the Old World, and mention made of practices and things European and American which the Colonies would do well to imitate or to adopt. The European and the American on the other hand will find the subject comparatively new to them and of such variety that those possessed of a genuine interest in Australasia can hardly fail to find something to attract them.

The farming of the Old World has been seriously influenced by foreign, including Colonial, competition, and the effect has been more keenly felt on account of the rigidity of the long-established methods involved. But changes in system have already been introduced and these have made further changes possible and more easy. Increased facilities in transit have brought prices at home and abroad into greater conformity, and the systems of production must also be influenced in the same direction. While Colonial cultivation will gain something by the imitation of Old World methods, the Old World must to a very considerable extent (not only on account of foreign competition but owing to increasing internal labour difficulties) follow the Colonial example. The exhaustion of land due to too constant cropping will in the future have to be left more to Nature's methods of restoration than it has been under the system of short rotations in this country; and although the total yield may be less, that yield will then be produced at a profit and not at a loss, as it has been produced in Britain during recent years. Less capital would be required and less labour employed, and the surplus in both instances would be set free to occupy a more remunerative field of production. The significance of these remarks may be more fully comprehended after a study of the estimates, which are hereafter detailed, of the cost in the Colonies of producing grain crops and butchers' meat.

It is a very general impression that there is no room for a man in the Colonies who is only possessed of a moderate amount of capital, and that the men to go to New Zealand and Australia are either wealthy men or able-bodied labourers. I came to a very different conclusion. I believe that a hard-working young farmer with a capital of £1,000 would, under existing circumstances, vastly increase his chances of success in his own sphere if he emigrated to New Zealand or to some parts of Australia. Competition there is harder, and profits less, than in the early days, and such a man need not go out with the expectation of rising in a few years to be Prime Minister of a colony or a millionaire; but, if he is cautious at first, until he learns the ways of the country, he can depend upon making for himself a competency and a home-like home among a prosperous people of his own nationality.

It has been my intention to place before the reader in the shortest and most simple form the greatest amount of information which could be conveniently compressed into a book of fully 500 pages.

To suit the convenience of the ordinary reader and the scientific reader alike, the common names as well as the scientific names of plants and animals have been used.

A novel feature in the form of **black-letter type** has been introduced into the letter-press to bring out prominently the text of the various paragraphs. Where it was not possible to single out important words, the black letters have been frequently introduced at the beginning of the leading sentence of a paragraph, to call attention to the commencement of a new subject or to the importance of some portion of an old one. I am quite aware that a departure from the beaten path in a matter of this kind is likely to be objected to by some and even severely criticised by others, still I am prepared to accept the consequences in this connection and to sacrifice something in the matter of appearance on the ground of usefulness.

To further facilitate reference a complete index has been prepared ; and it is hoped that the verbal descriptions and references made in the letter-press, will be rendered perfectly clear and additionally interesting by a perusal of the ninety full-page plates and numerous cuts which have been introduced.

The reader must not expect to find each subject treated in an exhaustive manner. Such treatment is an impossibility in a work of this kind without contracting its sphere and rendering it tedious from excess of detail. One with a special interest in a special subject must not be disappointed if he finds that special prominence has not been given to his own peculiar hobby. Those, for example, who are interested in certain branches of stock-breeding, must not mistake the book for a treatise on stock, or on any single breed of domesticated animals, but accept it as a work treating of a world-wide subject though with special reference to one of the four great geographical divisions of the Eastern Hemisphere.

My aim in going to the Colonies was to continue a somewhat unique line of study to which, for a number of years, I have devoted my months of leisure from official duties in the University. The publication of the results of my labours in this instance has been longer delayed than was first intended, mainly owing to three causes :—(1) The extra pressure of work resulting from the great movement for the spread of agricultural education in the United Kingdom; (2) the desire to secure for the purposes of reference, the statistical returns for 1890; and (3) the call for a sojourn of two months in America to personally investigate the vast irrigation areas of the Western States, in view of the relations of Australian irrigation to the more fully developed American systems.

On the subject of irrigation I claim to be able to speak with the authority of one who has made, on the ground, a special study of the means and methods of irrigation in Southern Europe, in India, in America, and in Australia.

The full-page plates are printed from blocks prepared by Angerer and Gösche of Vienna,* mainly from photographs taken by myself or collected by me with a view to reproduction in this form. The photographs by Mr. Williams of Napier were specially executed for me (at the request of my friend Mr. John Hunter Brown, of Whakaki, Hawke Bay), and add materially to the value of that portion of the work which relates to the North Island of New Zealand.

I was disappointed in a number of cases in an effort to secure photographs of typical specimens of the important breeds of live stock described; and to make good the deficiency, I have been forced to introduce twelve plates from my work on 'Farm Live Stock of Great Britain' of animals bred in this country, for the benefit more especially of those readers who are not familiar with the distinguishing characteristics of the various breeds of sheep, cattle and horses. In doing so I have been enabled in nearly every case to select blocks reproduced from photographs of animals which are closely related to others sent out to the Colonies within recent years, so that, although the originals are only substitutes, they individually represent some of the best Colonial families of live stock.

* The blocks for plates LVII., LXIX., and LXX., were produced by Waterlow & Sons, London.

I consider the excellent series of 10 maps (printed on 8 sheets) prepared under the direction of my friend Mr. John George Bartholomew, Edinburgh, an attractive and valuable feature of this work. The details thereon set forth speak for themselves without elaborate letter-press description, and, being specially prepared and brought down to date, they form an important contribution to the most recent literature relating to the surface features of the Australian and New Zealand Colonies.

I have not hesitated to express a free and unbiassed opinion of the Colonies and their ways and methods—in most instances favourable, but in some unfavourable. I trust that where I am found to dissent it will be taken in the spirit in which it is intended, viz., as friendly criticism, and that my opinion will be the more appreciated that it is not entirely one-sided.

In conclusion, I desire to express the hope that the respective Parliaments of the various Colonies will ratify the statesman-like resolutions which have just been passed by the Colonial Federation Conference at Sydney, that the dream of a United Australia may be realised and that we shall soon see in the position of the first Federal Governor no one short of a Prince of the Blood Royal whose personal charm and intellectual accomplishments have already enlisted in his favour the sympathies of all British subjects at home and abroad.

The most sincere wish of the author would be realised if it could be said that his Australian Work was a record of the position of the subject with which it deals at the end of the first great period of disunion, and that, with its appearance, was ushered in the dawn of a new era of Colonial existence and increased Colonial prosperity.

ROBERT WALLACE.

The University, Edinburgh,
1st May, 1891.

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LIST OF ILLUSTRATIONS.

FULL-PAGE ILLUSTRATIONS.

Illustrations in Text.

ERRATA.

Page 275, *for* "Mr. Roye" *read* "Mr. Roy."

„ 475, *for* "Kilbourn" *read* "Kilburn."


SOUTH-EAST
AUSTRALIA
English Miles 69·16=1 Degree
Author's Route shown thus,
QUEENSLAND
DARLING DOWNS
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
PACIFIC
OCEAN
The Old Man Plain
LAKE EYRE (North)
Lake Torrens
Lake Frome
Lake Gregory
Lake Blanche
Spencer Gulf
Yorke's Peninsula
Investigator Strait
Kangaroo I.
Encounter Bay
ADELAIDE
Port Augusta
Port Pirie
Bourke
Cobar
Wentworth
Mildura
Deniliquin
Echuca
Wagga Wagga
Goulburn
SYDNEY
Port Jackson
Newcastle
Port Stephens
Port Macquarie
Grafton
Armidale
Tamworth
Dubbo
Bathurst
Orange
Wollongong
Kiama
Shoalhaven Bight
Jervis Bay
C. Howe
Twofold Bay
Wilson's Promontory
Port Phillip
Cape Otway
Portland
Port Albert
BRISBANE
MORETON
Stradbroke
C. Byron
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AUSTRALIA

AND

NEW ZEALAND.

CHAPTER I.

RÉSUMÉ OF ROUTE IN SOUTH AUSTRALIA.

Landing—Hospitality and Courtesy—Railway Passes—Appearance of the Country—Leading Men in Adelaide—A Week's Tour of Inspection—Places of Interest lying North and West of Adelaide—Country round Adelaide—Artesian Well—Surface Soil—Auction Sale—Engineering Works at Gawler—A Grain-Stripper—The Broad-Cast Sowing Machine—Recent Floods—The Anlaby Property—Carrion Crows—Magpies—Paroquets—Fences—Wheat Soils—Hill River Estate—Shorthorn Herd—Berkshire Pigs—Grain Crop—Trees—Locust Bean or Carob Tree—Farrell's Flat—Narrow Gauge Railway—Broken Hill Silver-Mine and its Surroundings—A Descent into the Mine—The Ore—Wages—Excitement in Adelaide—The Advantage to the Colonies of Silver and Gold Mines—Bogus Companies—Advantages Resulting from the Discovery of Gold and Silver—Occasions and Entertainments—Visit to the Hon. J. H. Angas—The Country—Soil—Fences—Lindsay Park—Springs Appearing after Trees are Cut—Crops Grown—Population German—Fruits Grown—Orographical Features—Leaving Adelaide by Rail for the South-East—The Long Desert—Government Farm—Emeu Flat—Desert Grazing—Fertile District—Poor Land—Yallum—The Soil—The Underlying Rock—Underground Streams—Limestone—Bay of Biscay Country—Kunka—Corrugated or Corduroy Country—Leave Yallum—Arrive at Glencoe—Soil—Cavernous Rocks—Culture of Wheat on Glencoe Estate—Method of Preparing the Land—Cutting of Wheat—Silage—Implements—Annual Tenants—The Common Bracken—The Grass Tree—Kangaroos—Rabbits—

Opossums—Snakes—The Aboriginal Population—The Bunyip—Mount Gambier—Potato Culture—Natural Beauty of the District—Extinct Volcano—Lakes—Leaving Mount Gambier—"Stuck up" at Narracoorte—Railway Line Washed Away—Limestone Caves—Petrified Black Man—The Journey—Railway Tricycle—Serviceton.

The Author landed at Adelaide on Tuesday, 21st May, 1889, after a voyage of thirty days from Naples on board the Orizaba, one of the finest Royal Mail steamers of the Pacific Steam Navigation Company. The experience in getting ashore was far from comfortable, as, in addition to a downpour of rain, the choppy sea washed over the bulwarks of the open tender by which landing was effected.

The accommodation on the wharf for passengers and their belongings, while undergoing rigid custom-house inspection, can only be described as grievously disappointing to those who possessed anything that could be injured by exposure to weather.

Once landed, he found the **hospitality and courtesy** of the people, as exhibited personally and through the various colonial governments, unbounded. Free Railway **passes** were presented by every colony visited in turn ; and every conceivable facility provided for the acquisition of information relating to the country, its developed and undeveloped resources, its government, and its institutions.

There had been an exceptionally early and abundant **rain-fall**, and, although the year was in mid-winter, the surface of the whole country was covered with the most beautiful sward of fresh, untarnished **green**, which is peculiarly striking and grateful to the eye of one who has been on a lengthened sea voyage

The few days spent in Adelaide were most agreeably and usefully employed in making the acquaintance of, and in profiting by the information freely given by, the **leading men** of the colony of South Australia, many of whose names are well known in Europe in connection with their own special subjects.

Among those to whom special indebtedness is acknowledged may be mentioned the late Mr. Frazer S. Crawford, the great authority on Agricultural Entomology, (whose recent death was a loss to the Colonies not to be easily estimated, and also a loss to the branch of science for which he had done so much admirable service); the Hon. Chief Justice Way, Chancellor of the University and the premier Free-Mason of the Colonies (whose services, in addition to those pertaining to his official position, are indispensable upon all great colonial occasions); Sir Samuel Davenport, who was knighted for his services at the Colonial Exhibition in London (a gentleman whose name is well known in connection with colonial wine and olive oil); and Mr. W. Riddoch of Corega, Mitcham, (the owner, in conjunction with his brother, Mr. John Riddoch, of large sheep-runs on the Darling Downs); the Hon. John Colton, Ex-premier of the colony (who had been a fellow-passenger on board the Orizaba); Mr. Goyder, the Surveyor-General (who perhaps had a wider personal experience of distant parts of the colony than any other person who could be mentioned); Dr. Schomburgk, the accomplished Botanist, and Curator of the Botanical Gardens; Mr. A. Molineux, Secretary of the Agricultural Bureau, and Editor of the 'Garden and Field,' (who had an intimate knowledge of the colony and its capabilities).

In addition to the help afforded by new acquaintances, that of Dr. Mark Symons, an old friend and countryman, the accomplished oculist and lecturer on diseases of the eye in Adelaide University, must not remain unacknowledged.

A tour of inspection was, by the goodness of Mr. Playford, the Prime Minister, arranged by Mr. J. E. Brown, the Conservator of Forests, and Mr. Valentine, the Chief Inspector of Stock. [The Stock Department was formed in this colony in 1852, with the main object of getting rid of scab among sheep, a work which has been effectually completed.]

Under the guidance of these two gentlemen, for whose attention thanks are also due, the following **places of interest lying to the north and west** of Adelaide were favourably viewed :—(1.) Dry Creek silver smelting-works, at the distance of a seven miles' drive from the City ;

(2.) The Roseworthy College and farm, which are dealt with in another place ;

(3.) Kingsford Station, the property of the Hon. J. H. Angas ;

(4.) Anlaby station, nine miles from Kapunda, the property of Mr. F. H. Dutton (lately deceased), which was under the management of Mr. H. T. Morris ;

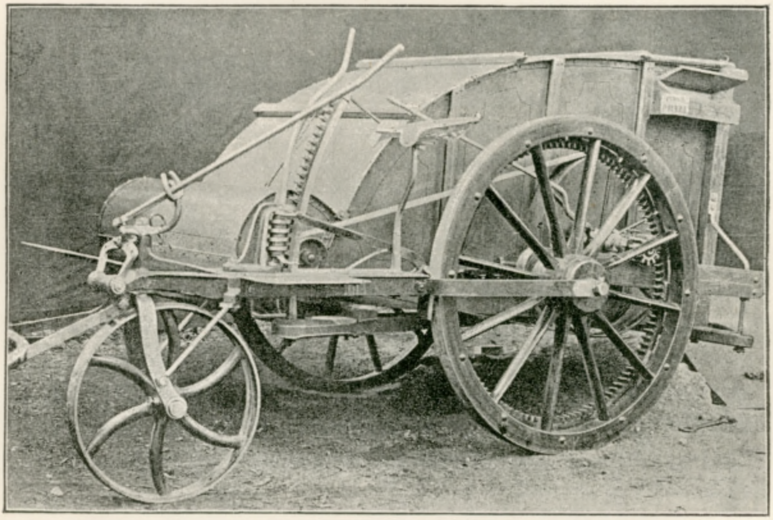
(5.) Hill River Estate, near Clare, also belonging to Mr. Angas, and managed by Mr. Adams.

A week was occupied in seeing the places mentioned, and in subsequently running up to the great silver-mine, Broken Hill, on the western border of New South Wales.

Much of the **country round Adelaide** consists of a great bed of clay twenty to thirty feet thick, with a layer of from one to two feet of nodular limestone above, and a surface covering of sandy loam of varying thickness. Through these strata has been sunk an **artesian well**, 258 feet deep, for the supply of water at Dry Creek smelting-works. The flow was so powerful that it rose twenty-one feet from the surface, and discharged 30,000 gallons in twenty-four hours.

The water was distinctly alkaline or "sweet," and although good enough for stock to drink, and for use in a smelting-works, it was clearly of no value for irrigation purposes, although even at the time referred to, those in authority hoped that it might be shown by experiment to be suitable.

The greater part of the **surface of the colony** in the



I.—Wheat Stripper.

Manufactured by Messrs. J. Martin and Co., Engineers, Gawler.

northern direction from Adelaide, as far north as Lake Eyre, consists of old alluvium, and in some places of chocolate soil of volcanic origin. The loamy soils are mostly light, especially towards the west, where sandstone and quartzite appear; but the country is not devoid of heavy clay soils in certain districts.

During the drive from Roseworthy College to Gawler, a local **auction sale** of sheep and cattle was passed. Full-grown merino wethers were selling at 10*s.* 1*d.*, and large lean three, four, and five-year-old bullocks, which had been brought from the grazing lands in New South Wales, at from £8 to £10 per head.

Though the figures appeared small yet, considering the condition of the stock, the prices were exceptionally high. The animals had not recovered from the long period of starvation to which they had been subjected during the previous years of drought. The fatigue of driving in this reduced condition had also told severely upon them, and it required a mental effort to convince the observer that they belonged to the same species of horned cattle which exists in the British Isles.

At Gawler a thorough inspection was made of the extensive **engineering works** of Messrs. James Martin and Co., the largest makers of agricultural implements in the colony.

Among the novelties peculiar to this colony was the **grain-stripper**, which is the reaping-machine of South Australia—the great wheat-growing colony. By an arrangement of beaters and tines with an outer casing of sheet iron, (which gives the implement a clumsy-looking appearance, as may be seen from the plate), the grain is stripped from the straw and carried along by the implement, while the straw is wastefully left standing, to be afterwards burnt where it grew—as is the case with the straw when the still more clumsy and ungainly "header" of California is employed.

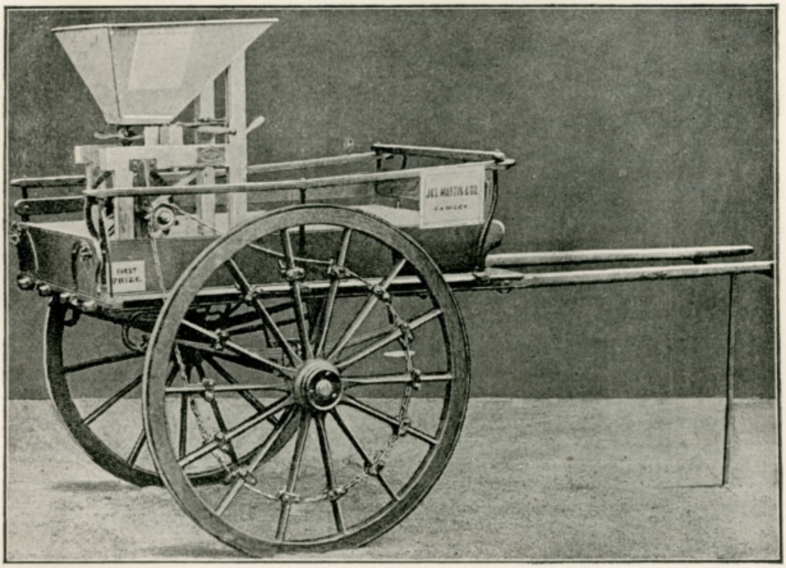
The cost of labour is too great to reap and collect the straw as fodder, and, moreover, the grain can be more quickly secured and inexpensively prepared for market by the stripper, as it is a combined reaper and thresher. Twenty acres of grain can be stripped per day, or twenty-four if the work hours are prolonged.

The broad-cast machine employed in sowing wheat is a simple and unique colonial contrivance. The seed falls on a rapidly revolving disc placed horizontally immediately below the exit hole in the bottom of a hopper, and is discharged behind, as if from a sling, by means of a series of ridges, which rise on the upper surface of the disc and run from the circumference till they converge in the centre. Each pair of ridges forms a pocket, in which the grain is first whirled round with the disc and finally discharged with great force. It is placed upon a cart, as shown in the adjoining figure, and the power is communicated by the wheels of the cart as it is drawn forward.

On the way to Anlaby station from Kapunda, a "dried up" copper-mining village, there had been much damage done to roads and fences by the **recent floods.** Immense areas of the country had been under water, and miles of splendid Macadamised roads had been torn up and obliterated.

The Anlaby property (some 18 miles in length), is enclosed within a ring fence, and carries a stock of about 70,000 merino sheep. In this part of the country sheep are larger in size and stronger in wool than in most other places. Only 12 men are kept to "ride" the fences, to notice and repair damage. They have strict orders never to handle the sheep, but to leave them entirely to nature. The lambing season was about half run at this time, the end of May.

Black carrion crows, perched on prominences as sentinels, watching for any weak or disabled lambs on which to prey, were in abundance.



II.—Broad-Cast Centrifugal Seed Sower, South Australia.

The piebald Australian **magpies** take the place in the colonies of the rooks in this country as worm and grub eaters. They are more active on the wing than rooks, and assume an aggressive attitude to large and lazy-winged birds such as the hawk-eagle—a bird of mottled brown colour, which becomes almost black as it grows old.

The most numerous representatives of the small birds to be seen in driving through the clumps of Mallee Scrub, which dot the surface of the grazing country, are the bright green **paroquets,** which congregate in flights in the gum trees, and keep up a constant chirruping sound, which, although not of a refined musical character, is not disagreeable.

The distance of 44 miles from Kapunda to Clare was covered in an open carriage drawn by a pair of good horses in five hours, in spite of the damaged condition of the roads by floods. Though the prevailing wayside **fence** was of wire, here and there the monotony was broken by a hedge of *Acacia armata.* The middle portion of the journey was made through much excellent **wheat-growing loam,** often of a light red colour. The latter part of the way was more shut in and uneven, and was beautifully wooded.

On Mr. Angas's property of **Hill River,** three miles from Clare, two of the most interesting sights from a stock-breeder's point of view were a stud of about 50 well-bred light-legged brood-mares, and the shorthorn herd of about 100 pure-bred animals established in 1870. **The herd,** though largely, is not exclusively, of Bates blood, and it would appear that excellent results have been got by dashing it with the blood of animals belonging to the more massive and heavier fleshed, though less gaudy, Booth variety of shorthorn.

Berkshire pigs were well represented. No fault could be found with their form or quality, with the exception of the heads, which were decidedly too long to be fashionable at home; the animals also displayed too much white.

A large area of the Hill River estate was at one time under **grain crops**, and the land which had been cultivated is, as is the case with land similarly treated in this country, all the better for being broken up, now and then, for a course of cropping.

A considerable variety of **trees** grows well, including the olive and the **carob tree** (*Ceratonia siliqua*), producing the locust bean, or St. John's bread bean, so largely used as a condiment in cattle food. The trees are furnished with beautiful dark green, glossy leaves, and a single tree will at times yield as much as 6 cwt. of beans.

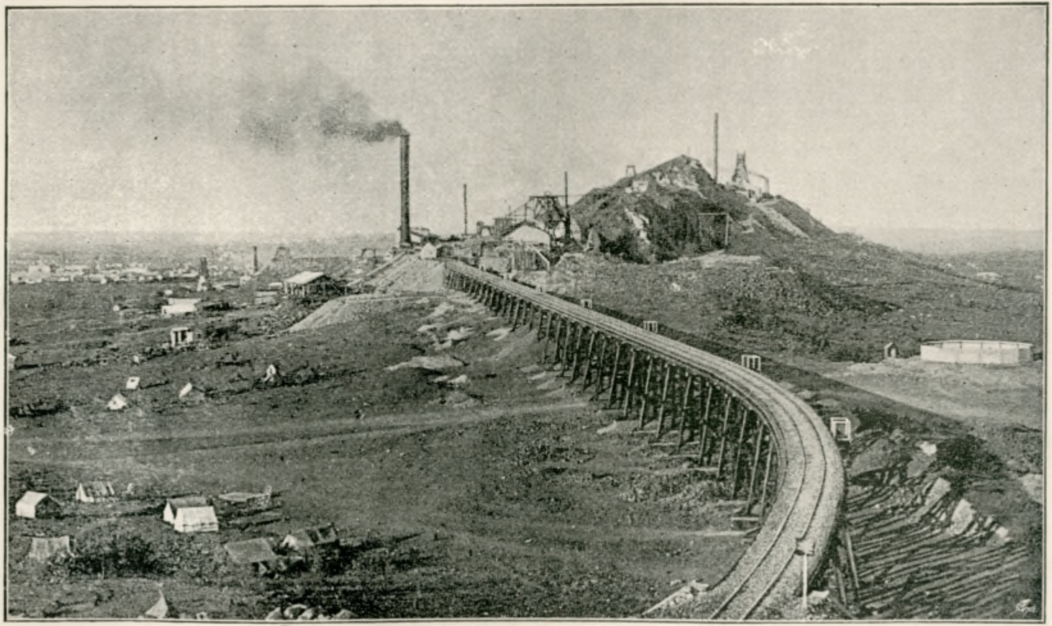
They are planted in clumps, as the male and female flowers are usually on separate trees, although monœcious specimens have been found.

With the exception of two wet days the **weather** had been excellent—like a bright bracing summer at home.

The drive of nine miles **to Farrell's Flat Station** to join the train going north to Broken Hill was made in a downpour of rain; but the angry demonstrations of the elements were more than counterbalanced by a right good Irish welcome extended by a newly-married couple named O'Leary, who had a few days before started business in a wayside, country, or drovers' and carriers' inn. To be from the home, the old country, though neither the host nor the hostess had ever been there, was sufficient to rouse in them a spirit of enthusiasm, and to evoke expressions of loyalty worthy of being recorded.

At **Terowie** the railway going north to Broken Hill changes from the 5 ft. 3 in. gauge, to the **narrow** 3 ft. 6 in. **gauge,** and this formed the first experience of the unfortunate circumstance that the intercolonial railways have different gauge widths; * a fact which has already led to

* The standard gauge in New South Wales is 4 feet 8½ inches, the Victoria gauge 5 feet 3 inches, and the Queensland gauge 3 feet 6 inches.



Patterson and Co.

III.—VIADUCT, PROPRIETARY MINE, BROKEN HILL, N.S.W.

great inconvenience and waste of time and labour, and will, before uniformity is ultimately established, end in the loss of many millions sterling to the colonies.

Mr. **Paton**, the **general manager** of the original Proprietary Silver Mining Company, Broken Hill, an American expert of great skill in the management of underground works, willingly provided (in virtue of an introduction from Mr. Horn, one of the directors), every facility for a thorough inspection of the mining and other works, and acted personally as a guide through the engine-rooms, crushing plant, and washing machinery.

Broken Hill—of which two full-page plates are introduced in the present volume, is the largest silver mining centre in the world—the company's dividends for one year having reached considerably over one million pounds sterling. The argentiferous matrix is the core of an immense hill, which seems to have been bulged out of a comparatively level part of the earth's crust by some great subterraneous action accompanied by intense heat.

The surface of the **surrounding country** is practically oı no value for stock (although sheep would do very well upon it if sufficiently supplied with water), and the area, with its scanty saltbush vegetation, wears the aspect of a desert wilderness, in spite of the houses which have been run up within an incredibly short space of time. The discomfort of the heat and dust during the hot weather, and of the glare of the bright sun from which there is no shade, was described as almost unendurable. **Fever**, the result of bad sanitation, had also been prevalent and destructive, but the recent floods had purified the air and scoured the surface of the ground in a most beneficial manner.

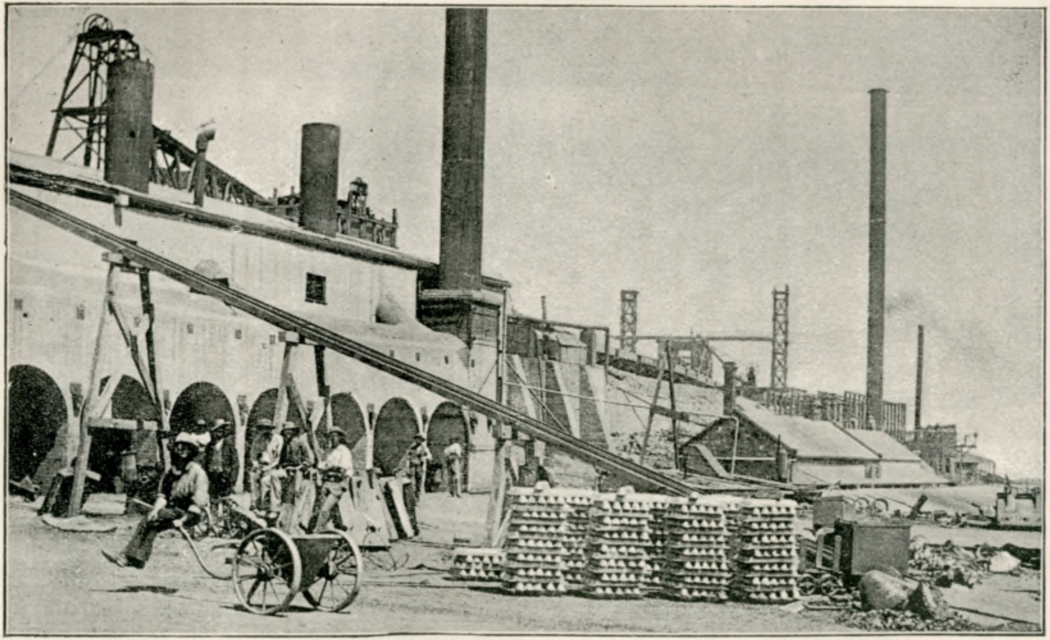
Clothed in tight-fitting overalls and slouch hats, the party made a **descent** in a cage to the 143 feet level, and the working points were reached both above and below by ladder. **The ore** is very various in quality and character, but was then yielding an average of 20 per cent. of lead and 65 oz. of silver to the ton. A silicious iron ore, containing 10 to 12 oz. of silver per ton, is used in the furnaces as a flux.

Silver is mostly in the form of beautiful little sparkling crystals of the chloride, while lead occurs on the higher levels as the carbonate, and below the water-table in combination with sulphur as galena. A German chemist, Mr. Schreieer, and two assayers are constantly employed in testing the ore, making as many as 250 assays daily. The refuse slag contains seven or eight per cent. of silver, but the cost of separating this from the slag by any known method is yet too great to be a paying transaction. From the large mine there were being weekly extracted 110,000 oz. of silver and 450 tons of lead.

Smelters at Broken Hill were in receipt of 10*s.* per day as **wages,** which, on account of the discomforts and the distance from civilisation, were above the ordinary rate at which skilled labour is paid in the Colonies—viz., 8*s.* for eight hours' work. In Germany a skilled workman will work twelve hours for 2*s.* It is evident, from a comparison of these figures, that the colonial workman cannot hold his own in competition with the German workman in the production of materials to be disposed of in the open market.

The advantages to the Colonies of such a literal **mine of wealth** in which to employ surplus labour is undoubted, in spite of all the associated drawbacks of chronic dissatisfaction, unrest, and even gambling, which is thereby created. It is fortunate for the community that only a few are lucky and make colossal fortunes; the others, after a few valuable lessons, which teach them to bear disappointment with a good grace, retire from the business of dealing in mining and other speculative shares, and settle down in earnest to legitimate business, frequently poorer but wiser men.

Adelaide was in a perfect fever of **excitement** at the



Patterson and Co.

IV.—OLD SMELTERS, PROP. MINE, BROKEN HILL.

time referred to, and Broken Hill received more speculative thought than all the business of the city put together. The original shares had risen to a fabulous value, and a re-arrangement had taken place by which the original shares were divided up to suit the demands of the public at smaller figures. The new shares were selling at the time of the writer's arrival at about £27 or £28. On his return from the tour to the north at the end of a week they had risen to about £35, and before he left the Colonies they had touched £46, and they went even higher at a later date.

Men were named who had made fortunes of £80,000 and £100,000 within a few weeks through being the fortunate possessors of a very limited share of the original property. It is only the wealthy few that the world gets to know about after the fever is all over, but the numbers who have lost by speculative ventures, especially in connection with gold and silver mining in the Colonies, are to be counted by the tens of thousands, and to be found everywhere.

It is said that more money has been spent in mining precious metals than ever was taken out of the earth's crust. Without an elaborate reference to statistics, it would be impossible to confute the statement, but if a deduction were drawn from it that gold and silver mining ought to cease as a branch of business which did not pay, the position would not be a tenable one.

It must be remembered that the great expenditure in mining is in the payment of wages for labour employed. It is also clear to those who have experience of the matter, that work of this description has a certain fascination for some men, who would rather remain idle most of their time than work for low wages or at ordinary occupations. It is also abundantly plain that, had the ordinary labour market been flooded with the additional labour of the mining population—at least as far back as 1873—the consequences would have been serious.

Whether gold and silver mining **pays** the promoters as a whole, is one question; whether it pays the labouring classes, and in consequence the community, is another. There is no necessity for hesitation in answering the latter query in the affirmative, and with the reservation that **bogus companies** are excluded, the first may be replied to in similar terms.

It is, however, a deplorable fact that a regular trade exists in floating companies on the strength of the possession of mining rights which are of no value whatever. Owing to the very nature of the undertaking, it is necessary for people to exercise a greater measure of faith than is demanded in any other line of business. It is impossible to know what kind or quality of ore is present on account of the absolute want of uniformity of subject, until a trial is made. Trials are too expensive to be undertaken by single individuals, and consequently the company must be formed before there is any reasonable certainty that they have got a property worth the cost of exploitation.

If companies were only started when, from certain surface indications, there existed feasible grounds to suppose that success would follow, there would be no one to blame; but many companies are annually launched when there is not the remotest prospect of success.

It is difficult to define in a few words the **advantages resulting from the discovery of gold and silver** in a country. The products must be looked upon as something more than ordinary commodities, and consequently their importance cannot be measured by the ordinary commodity standard of trade. Apart from being the most important incentives to immigration, they create around the scene of operations the necessity for the development of the various trades and professions which are essential to the existence of an active and busy community. Gradually, certain classes of people, attracted by the sound of success, but inexperienced in the line of life necessary to lead to it, hive off and betake themselves to the development of other natural resources of the country.

In this fashion the colony of Victoria was developed; men came to be gold-diggers and ended by settling down to all kinds of occupations. It is not indulging in exaggeration to affirm that, but for the discovery of gold in **California**, Western America would have been undeveloped and uninhabited, and would have been, to all intents and purposes, a howling wilderness, occupied only by a few stray bands of Red Indians.

Without mineral wealth of some sort, a country cannot, it would seem, develop rapidly with safety to its financial position. The precious metals, of all our important mineral products, are by far the most easily disposed of, and, consequently, a country can rise more rapidly on the basis of gold and silver resources than on those of iron or of steel.

There are two grand negative instances to be pointed to in verification of the truth of the position assumed above:—viz., **Ireland** and the **Argentine Republic**. The first is the case of an old country, with an excellent soil and an able-bodied people, which has drifted into a condition of distressing and almost hopeless pauperism; and the second, of a new country full of life and vigour, which, for lack of gold, has fallen into a condition of utter and helpless bankruptcy.

Gold and **silver** have infinitely more to do with national prosperity than the casual observer ever dreams of; and it appears that, owing to various causes now at work in their own subtle and obscure fashion, their influence in the future will be greater than in the past. Come what may, the Australian and New Zealand Colonies have little to fear on this question, as it is believed on good authority, they yet possess vast stores of undiscovered treasure, which will at all times enable them to meet their liabilities in specie, whatever premium it may rise to.

Among the **events and entertainments** in which it was the writer's privilege to participate during his brief residence in Adelaide were the first ball given by the new Governor, Lord Kintore, at which the youth and beauty of the colony were assembled, and where the Scotch reels and Strathspeys were danced by a limited number in excellent Highland form ; a State Levée ; a grand reception at the University by the Chancellor ; a race-meeting ; a concert in the Albert Hall (a most creditable performance) by the Adelaide Orpheus Society ; and a breakfast given by Chief-Justice Way to the Admiral of the British Fleet, Admiral Fairfax, C.B., who was attended by Captain Kaine, the gallant officer who saved the *Calliope* from the disastrous storm in the Samoan Islands, in which three German and three American men-of-war were overwhelmed.

Some readers may take an interest in perusing the following account of "The Disaster in Samoa Harbour, in the South Pacific," written by the Author for *The Student* (Edinburgh) of 5th March, 1890. The writer had the privilege and pleasure of meeting a number of the leading personages : Admiral Kimberley and two of his lieutenants, (who were on board the *Trenton*, the U.S.A. flagship) ; Captain Kaine ; and Mr. Gurr, (who watched the work of the elements from the shore), who were all eye-witnesses of the terrible storm which broke upon the harbour of Samoa, and played unprecedented havoc with the mixed fleet of warships at the time assembled to watch over the respective interests of the three Powers that had taken the Samoan group of islands under their joint protection. It is no secret that for years German aggression and oppression had made the lives of the peaceful Samoan people miserable. They had actually kidnapped and carried away the native king, Malietoa Laupepa, and established his rival Tamasese in his stead. The English residents had appealed in vain to the British Government ; no remonstrance was made till the American Government "went for justice." The warships, seven in number, the *Trenton*, *Vandalia*, and *Nipsic* (American) ; the *Olga*, *Adler*, and *Eber* (German) ; and the *Calliope* (British), were watching the development of a partial state of siege existing between Germany and a large majority of the people who had rallied under the leadership of Malietoa Mataafa, who has been called

"The Wallace of his country." Nature in her own rough way, in this case, settled the matter in dispute, and cooled the ardent passions and fervid imaginations of those who were taking sides in the struggle. The harbour in which the vessels lay at anchor is formed by a hollow, scooped as it were out of the shore like the belly of a new moon. The bay is partially defended from the sea by a cordon of coral reefs. In the deepest concavity of the shore-line is another low reef, which played a most important and disastrous part during the violence of the gale. There is but a narrow passage into the harbour on the north side lying to seaward, formed by a break in the coral reefs. About noon of Friday, 15th March, a dead calm fell upon Apia, the capital, situated on the shore of the harbour, and the barometer fell forebodingly low. The roofs of houses were tied down, and other precautions taken both on sea and shore to meet an ordinary storm. About one P.M. wind began to blow from the land (the south) side. It veered round to the east about eight P.M., but still all went well. At three next morning it had shifted to the north, and the vessels began to ride heavily. Enormous billows and tremendous surf rolled in at the mouth of the harbour, and broke over the contiguous coral reefs. The ships kept steaming up to their anchors, and seemed, while they could be observed, to be weathering the blast well; but the sea got so high that the vessels, though distant only from two hundred yards to a mile from the shore, were at times completely hidden. The sea struck with terrible violence even against the inner reef, and wave succeeded wave so quickly that the water could not get back, but broke away to the left, sweeping round the shore like a whirlpool. This current carried away many who were washed off the vessels, and prevented them from being thrown up on the shore, as would have been the case had there been no current.

The *Eber* (German) was the first in trouble—her cable got entangled in her propeller, and she was thrown against the reef, and sank with her crew of eighty or ninety men, save five who were rescued by the natives. The *Adler* was next (about eight A.M.) thrown, from deep water on to the reef, a distance of a hundred yards. She lay on her side, with her deck towards the south, and the crew, who stuck to her, were thus protected and saved. All the vessels were now dragging their anchors. The *Olga* collided with the *Nipsic*, and carried away her smoke-stack. The attempt to raise steam by throwing pork on the fires of the *Nipsic* proved a failure. She drifted on to the shore, having fortunately escaped the reef. A little schooner was sunk, and all on board but the captain drowned. He swam, and coming up alongside the *Olga*, clung to her chains, and then drew himself up into the hawsepipes, where he remained exhausted for an hour before he could struggle on deck. He turned out to be the harbour pilot, who, taking command of the *Olga* later in the day, beached her in a place of safety. The *Olga* and *Nipsic* were the only two vessels that were afterwards got off. The *Vandalia*, with her full power of steam on seawards, drifted on to the reef at eleven o'clock, and began to fill with water. As she settled the crew took to the rigging and some to the poop, but huge seas continued to break over her and wash many of them away. Only a few escaped, and all these by assistance of the natives on shore. The stern of the *Nipsic* swung round and almost touched the bow of the *Vandalia*. The natives bound the two ships together with a cable as thick as a man's ankle, and enabled a number of the crew to escape; but a lurch of one of the vessels slackened the cable, and as it was immediately afterwards tightened, it threw the men on it at the time up into the air, and snapped like a piece of cotton thread. About three or four o'clock the *Vandalia* seemed to break in two. The *Trenton*, *Olga*, and *Calliope* were now in imminent danger of one another, and near to the reef. The *Calliope* seemed to be only a few fathoms from the reef, and the two other vessels ready to dash into her. At this critical moment, when she must certainly have gone on the coral reef, or been damaged by one or other of the two remaining vessels, she slipped her cables, and was seen to make slight headway. With full steam on she could not make one knot an hour. She had first to steam through the narrow passage left between the *Trenton* and the inner reef. She plunged so that she seemed to stand on each end alternately, making her headway by jerks. At one time she swerved close to the stern of the *Trenton*, and in the wild tossing to which both vessels were subjected the spars on the masts of the *Calliope* are said, as she sank into the trough of the sea, to have missed the bulwarks of the *Trenton* by only eighteen inches. It was as the *Calliope* passed the *Trenton* that the crew of the latter cheered the efforts of the British to save their ship, although they saw they must themselves inevitably drift upon the reef. Captain Kaine raised his hat from the bridge when about three hundred yards from land, and disappeared into the mist and darkness, and nothing was heard of the vessel for some days. To grope his way in the spray and wind-driven rain and find the narrow outlet passage between the reefs was a work which required not only seamanship but pluck. Both of these qualities were not only admitted, but extolled and appreciated by the American officers, who witnessed the departure of the *Calliope* from the position of danger. The *Trenton*, now the only one left, struck the reef about sunset, but her crew were saved, as the storm, which had been short but furious, began to abate. About nine P.M. the wind began to go down and to veer round to the west; and on the next (Sunday) morning there was a calm, and the harbour speedily assumed a smooth and placid surface like glass, as if exhausted with the giant efforts of the two eventful preceding days.

Before leaving Adelaide a hurried **visit** was paid on 4th June to the **Hon. J. H. Angas,** at Collingrove, Angaston, a gentleman who has probably done more than any other man for the improvement of farm stock in the colony of South Australia. The journey was made by rail to Freeling—a run of about an hour and a half to the north—and by coach for the remaining sixteen miles of the way to Angaston.

The country passed through in driving was mostly devoted to wheat growing, and laid out with townships every four miles. **The soil,** chiefly of a red colour, with black patches here and there, improves in quality as Angaston is approached. **The fences,** mostly of three wires, are insufficient of themselves to keep back the inferior cattle of the small-farmer population, and a pole is tied to the neck of each animal, or a branch of a tree forming a cleft or fork is placed over the neck and tied below, to form an obstacle to any attempt to pass through between the wires.

During the inspection of the property under the conduct of Mr. Angas, the drive lay through **Lindsay Park** and past Lindsay House, where the first Mr. Angas, the father of the present owner, lived, and where he died about ten years ago. The private park was picturesquely dotted and ornamented with **gum trees** of great age and beauty; many were furnished with a draping of drooping boughs and leaves like the limbs and foliage of the weeping ash. A thick sward of **green pastures** and beautiful white-thorn hedges lent their aid to give the amenities of the place an old English appearance which is not often to be met with in the Colonies.

An interesting **physiographical phenomenon** was demonstrated by the way. It appears, contrary to what one would naturally expect, that in Western Australia springs break out in places where trees have been cut. It is supposed that the water, which the trees by their roots take into circulation and finally evaporate from their leaves, is so much at certain spots, that when trees are cut the water wells up in springs and appears on the surface. A creek was pointed out in which water now constantly runs, which was dry before the trees were cut to prepare for a settlement.

Fully 1000 acres of **crop**—wheat, oats and barley—are grown for home consumption to support the stud of over 200 pure-bred Clydesdale horses and other pedigreed animals which will be described anon. The quality of grain grown is excellent. An exhibit of 100 bushels of wheat, which secured a cup valued at £50, weighed 70¼ lbs. per bushel.

The **people** of the district are largely **Germans**, who make industrious, frugal, and hardworking settlers.

The late Mr. Angas brought out a colony of 700 Germans about 50 years ago, and spent a large sum of money in developing the district of which Angaston is the centre.

The light German waggon is not unnaturally the prevailing agricultural implement for carriage in the district.

A farmer of 400 acres, who may be accepted as a typical representative of his class, volunteered the information that he sowed 90 acres of wheat with a seeding of one bushel to the acre, and harvested seven to eight bushels in return. He also grew vines, from which he sold about a ton of **grapes** per acre at £4 to £5 per ton.

The great question here and in the North Rhynie country a little further north, also largely settled by Germans who grow grapes, is how to get quit of the surplus produce. Apricots and other stone fruits were grown for preserving, but since the establishment of various tinning-works, the competition had so greatly increased owing to a large area being planted with fruit-trees, that prices had been reduced within a short period by as much as 50 per cent.

Turning to the question of the colony as a whole (exclusive of the Northern Territory), **vine culture** is possible as far north as Davenport. Many of the common descriptions of **fruit**—walnuts, oranges, peaches, &c.—have been grown to the northern limit of Quorn near Port Augusta.

The soil in this division of the country is very various.

The orographical features are not of special interest. Gordon and Gotch's 'Handbook of Australia' points out that there are millions of acres of land, chiefly timberless, forming extensive plains from Aldinga, a point 27 miles south of Adelaide, to Mount Remarkable in the north, flanked by a more or less broken chain of mountains of moderate elevation terminating in the north at Cape Jervis. To the east and north-east of the range the country is better wooded, broken, and hilly, and contains much of the best agricultural land in the colony.

The Murray River valley is half a mile to a mile wide: the soil, rich alluvium, on which in many places large gum-trees grow.

Adelaide was left on the morning of 5th June, in company with Mr. Brown and Mr. W. D. Glyde, and a journey was made into the **south-eastern part** of the colony, which embraces the district of Mount Gambier, and has been called the garden of Australia.

The railway rises rapidly from the plain of rich land, and the hills are well-wooded on each side. Messmate or stringy-bark tree (*Eucalyptus obliqua*) covers the tops of the hills, and the red and blue gums grow at lower elevations on their sides. Many fruits grow well along the high lands on this line of railway, the main route to Melbourne from Adelaide, but the climate is too cold for oranges.

On descending from the hilly range, **The Long Desert** or Ninety Miles Desert is entered, an immense plain of 14 million acres of worthless, calcareous, hungry sand, three feet deep, overlying a heavy clay and clothed by a miscellaneous growth of stunted trees and scrubby brushwood, which furnish abundant evidence to a practical observer of the absolute worthlessness of the soil.

An effort had been made to establish **a government farm** at Emeu Flat, a little oasis of about 80 acres of good land which had been made a resting-place for sheep for many years, and had been rendered richer by their droppings and by the carcasses of those that had died there. In addition to this, 1200 acres had been denuded of scrub; but it was found impossible, without excessive expenditure, to keep this kind of land clear, and it was in consequence rapidly going back to forest.

The desert grazing was on offer by Government at 2*d.* per acre, but it was found impossible to keep sheep upon it on account of the large number of wild dogs. The herbage, moreover, is so poor in ash ingredients, and consequently in bone-making material, that the legs of sheep kept upon it get brittle and readily break.

On leaving the desert a very **fertile district** near the borders of Victoria was passed through and a desert lying to the south was traversed, after the party joined the narrow gauge railway which branches from the main line at Wolseley.

On the poor land another variety of stringy-bark tree (*Eucalyptus capitellata*) was prominent, while the chief undergrowth consisted of the scrub honey-suckle (*Banksia ornata*), which has a handsome cone-shaped flower without

The Author.

V.—Yallum.

The residence of Mr. John Riddoch.

the remotest resemblance to the honey-suckle of this country.

The first halt was made under the hospitable roof of Mr. John Riddoch, at **Yallum** Park, near Penola. This gentleman has a handsome and capacious residence, to which justice is not done in the accompanying plate, owing to the unfortunate tilting of the camera when the original photograph was taken.

A thorough investigation was made of **the soil** on Mr. Riddoch's property, which resembled in many particulars the good land which had been passed after leaving the Ninety Mile Desert. The opportunity was taken to examine numerous trial-pits, which had been dug with the object of showing intending purchasers of small blocks the depth and nature of the soil.

The underlying rock, a shelly limestone, is honeycombed and water-worn into a reticulation of courses and water-channels. Natural sinkhole drainage is consequently prevalent; the only outlet of certain lakes or ponds being a hole into a subterranean cavity connected with some hidden stream. From the Murray to the Glenelg River on the borders of Victoria—a distance of 250 miles—there is no surface-river flowing to the sea, and all the heavy rainfall makes its escape by **underground streams** at a depth of fifteen or sixteen feet.

Limestone crops out here and there, at places where the surface is slightly higher than the surrounding country, but yet not high enough to be called a ridge. The condition of the rock when first dug up is soft, except when it is taken from near the surface, but it becomes hard on exposure to the air. It appears to have been formed from a state of solution in water, just as the layer of limestones on the surface of the clay round Adelaide was probably produced.

It would seem as if the appearance of lime in this condition on or near to the surface had been caused through the subsoil water from some cause being more abundant, or rising higher than in the general body of the surrounding soil. Water-holes for the use of stock are invariably dug in the high ground where lime appears and not on the adjacent low and flat land.

Bay-of-Biscay country takes the name from the pitted, wavy, or uneven nature of the surface. The condition which gives rise to the name, prevails on an immense area of the best of the flat land in the whole of the Australian Colonies. It is one of the conditions which render irrigation in Australia difficult and expensive, as much as £5 per acre being at times expended in getting the surface into a fit state to make irrigation possible.

Bay-of-Biscay land corresponds to the Hog-wallow land which appears on the American Prairies. On examination it is usually found that lime is abundant and that it forms little rounded pea-like nodules, which are mixed up with the soil in a fine state of division.

The Nodules, consisting of clay and lime, have been produced by the settlement of lime from solution round nuclei; and it would appear that the elevation of the surfaces of certain parts is due to a somewhat similar cause to that credited with raising those larger heights, in which water-holes are dug and in which artesian water is sometimes tapped. In this instance, in place of forming in large masses of stone or rock, the lime assumes the form of nodular concretions, which, as they gradually develop from year to year, heave up or elevate the soil, and finally leave the surface of the part in which this work has been going on higher than the adjoining surfaces.

It is not determined what influence is at work to induce in one part of a soil, more than in another, a greater amount of capillary action, which is no doubt the agency by which the lime is brought near to the surface from the subsoil or rock-stratum underneath. It is, however, well-known that a very little difference in the mechanical condition (so little that it is not perceptible by physical examination) is enough under the influences of evaporation and capillary action to render one soil worthless while another remains fertile.

The so-called **biscuit formation**, consisting of little rounded flat stones of carbonate of lime, which lie about on the surface like so many biscuits, appears to be a modification due to some local cause, of the formations in which lime accumulates underneath the surface of the soil ; the lime having been by capillary action brought up in solution either from hard blue limestone rock or from clay containing lime.

Kunka—the jagged nodular limestone so much used in India for road-making—is also formed beneath the surface of soil which is under the influence of surface-evaporation and consequent capillary action ; but the difference of local surroundings gives a different result in all the three instances, which have above been referred to.

Even in Australia the surface appearance is not always similar under the influence of the action which seems to have formed the Bay-of-Biscay country. At Warwick, near the borders of New South Wales and Queensland, the irregular surface where the land rises from the plain takes the form of **ridges or corrugations**, which run right up and down the hill, and give that peculiar appearance which has originated the name of **Corduroy Country.**

On the flat land at the bottom of the rising ground, the true Bay-of-Biscay surface is met with. In these ridges, lime nodules similar to those described, present themselves ; and no doubt it is the escape of a certain amount of the rain-water which tends to throw the elevated portion of the surface into well-defined ridges.

The uneven distribution of **rain-water** on Bay-of-Biscay land through more of it resting in the hollows than on the heights, no doubt tends to aggravate the condition under which capillary action does its work.

From Yallum, a drive of twenty-eight miles to the south through a poor wet country which is the haunt of black swans and wild ducks, led to **Glencoe**, an outlying station carrying 62,000 sheep and 1600 cattle. The original settlers, the Messrs. Leake, from whose representatives the Messrs. Riddoch bought the property seven years before, had in colonial phraseology "picked the eyes out of the country" in making their selection.

The quality of the land was excellent for cultivation or for grazing. The best natural pasture was good enough to support three sheep per acre, and land which had been sown with English grasses kept four sheep. Here also the **cavernous condition** of the subjacent rocks extended, and every here and there was a large pit or depression like a deserted quarry which had fallen in. From some of these so-called "blow-holes" water could be pumped for the stock in dry seasons.

On the Glencoe Estate **wheat cultivation** was begun about six years ago, when 1600 acres were planted. In 1888 about 5000 acres were sown, and in 1889 as much as 7000 acres. The local rain-fall of thirty to thirty-five inches is sufficient to admit of the growth of an excellent crop in most seasons.

The **method of preparing the land** is as follows: A block is laid out to be cleared, and the trees that are ultimately to be got rid of are ring-barked about three feet from the ground. Dead trees and also the roots which lie near the surface are grubbed up, and, with the fallen timber and branches, burnt in heaps on the ground. The cost ranges from a few shillings to thirty shillings per acre, according to the amount of work to be done. The single-furrow plough is employed to break in the land, but the work in subsequent years is done by double-furrow ploughs drawn by teams of three horses yoked abreast.

When the ground has been thoroughly cleared of weeds by succesive wheat-cropping, English grass and clover seeds are sown with the last crop of cereals or more frequently alone.

This is a district of country which, from all appearance, is admirably suited for dairying, and in view of this fact it is to be hoped it will not be too severely denuded of standard trees, so requisite both for shade and shelter.

The crops grown on the Glencoe property are wheat, oats, barley, and potatoes. Wheat is sown till the end of July, one bushel of seed being used per acre. Wheat is **cut** about Christmas or in January. From twenty to thirty bushels of grain of excellent quality per acre are obtained. Crops are cut with string binders, and not by "strippers," as in the wheat-growing districts to the north of Adelaide. The straw is consequently available for fodder during summer and early winter when the grass is liable to be too succulent.

Silage is prepared for use at a later date, when food is less abundant.

The after-growth of young ferns and weeds upon the wheat stubbles of land newly broken-in, is so luxuriant that it is sufficient to carry five sheep per acre until the time for the next year's ploughing comes round.

At the time of the author's visit, seventy **ploughs** and twenty sets of harrows were in use, worked by 250 horses and 150 men.

At harvest the numbers of men and horses remain the same, but the work undertaken is that of reaping, threshing, and putting the grain on rail.

A portion of the land is let to **annual tenants**. The owners clear the surface and provide the seed. The tenants do all the work of planting and harvesting the crop, and after returning grain equivalent to the amount of seed, they pay, as rent, one third of what remains of the grain, and they leave the straw in stack. Should the crop be less than fifteen bushels, the seed is not claimed by the owners.

The common bracken (*Pteris aquilina*, Linn.) grows luxuriantly and abundantly on the dry land. It is said to have come into the part of the country referred to since the land was cleared of trees within the last thirty years. The only way to keep it in check is to take two or three successive crops of wheat from the same soil.

The grass tree (*Xanthorrhœa Australis*) is a prominent feature of the wet land jungle. One species grows to a height of thirty feet, and a kind of resin is manufactured from its stem. The appearance of the plant is unique. A tree-like stem is crowned by a bunch of long, narrow, rigid leaves which spread out like an umbrella.

After a bush fire (which, instead of destroying it, seems to be an essential in the cycle of its existence), a tall cylindrical flowering spike, densely covered with numerous sessile flowers, is thrown up. Heaths with bright flowers of various colours also tend to break the monotony of the jungle.

Kangaroos are now almost extinct in this section of the country ; but when Mr. Riddoch became the owner of the property they were in immense numbers. As many as 40,000 have been destroyed since that time at a cost of *8d.* each. **Rabbits** do not thrive in the district, owing to the amount of rainfall, and the liability of the low-lying land to flood.

Opossums are numerous. They are killed by the aborigines and cooked in wood ashes as hedgehogs are cooked by gipsies in this country.

Snakes are also eaten, and they are so numerous that, where cottagers live near to native jungle, men have been known to apply to their masters for a day off work for the purpose of destroying snakes.

At Glencoe a photograph, the original of plate IV., was taken of the remnant of the black race in the district.

The Aboriginal population of South Australia numbered

The Author.

VI.—REMNANTS OF THE SOUTH AUSTRALIAN ABORIGINES,

AT GLENCOE, SOUTH AUSTRALIA.

12,000 * at the time the colony was founded in 1836; but the total numbers have considerably decreased since that time through the injurious influences of contact with Europeans. † Being a race inferior even among savages, it has suffered the full measure of the evils which result from immorality, the adoption of European clothing, and the excessive use of intoxicating liquors. There are, however, indications, in some districts at least of Australia, of an improvement in the morality and habits of the natives.

In the colony of South Australia there are five special **reserves** set apart for the black people, and an annual **vote** of £5,104 given for their benefit. These reserves are under the management of a regular staff of officials, including a Protector, whose duty it is to attend to their needs.

The representatives of the race in the Mount Gambier district were very inferior compared with those of some other districts. The worst fault of the natives in the early days was that of stealing. They contrived to break the legs of sheep going at pasture, and were then able to get hold of them. Now the few that remain work moderately well in an intermittent sort of way.

Infanticide, a common custom among the Aborigines of Australia, was practised with the object of keeping the population down to the possible food supply, which must then, as now, have been seriously influenced by recurring periods of excessive drought. **The wives** or **lubras** are badly treated by their husbands, and are little better than slaves.

They have **no religion** beyond a fear or reverence for the moon. They dance when the moon is full, and

* The total aboriginal "civilised" Australian population, exclusive of Western Australia, is by the most recent returns (1881) estimated at 31,700, and the total number of blacks in the entire continent about 200,000.

† The numbers in Victoria have decreased from the original 6000 to 806.

congregate in certain places at particular periods, but it is not known for what object. McGrath's Flat was a famous meeting-place at one time. In place of burying their dead they have a peculiar custom of propping them up in trees. On Rabbit Island, opposite to McGrath's Flat, large numbers of bodies were at times stowed away in the branches of the she-oak (*Casuarina quadrivalvis*).

As evidence of the superstitious character of the black people, there may be mentioned the **bunyip**, a fabulous animal supposed to possess the form of a seal, to live in holes or swamps in the open country, and to make a hideous roaring noise. It is said to be seen by natives, but not by educated Europeans. **Seals** have been caught inland, just as the vole or water-rat in this country has been found far away from water, but it is not possible that a seal could be mistaken for this monster, as the Bunyip is described to be an animal with the dimensions of a bullock, with large mouth and eyes.

The race is so low in the **scale of humanity** that before the arrival of Europeans they had no cultivated plants, and consequently no grain. **They ate** wild yams, roots of fern and other plants, and wild fruits, together with fat moths, grubs, snakes, opossums, and such other wild animals as they could capture.

The black man's **my-my** or **hut** and his canoe also are made of bark—one or more sheets being cut from the trunk of a large gum-tree; and the operation is performed so that the tree, although seriously injured by the treatment, is rarely killed, as a broad perpendicular strip of bark is almost invariably left on one side to carry on the circulation of the sap. The typical hut is cone-shaped, and an opening of about one quarter of the external area of the cone is left on one side as a doorway, a chimney, a window, and as a means of ventilation.

One fruitful **cause of death** among Aborigines is the adoption of clothes, which is made obligatory by law when they go into town during the day, together with the removal of the adopted covering, when they retire to their huts at night. Moreover, during wet weather the clothes get wet and chill the wearers. The method employed by one of these people to keep himself dry is to put a sheet of bark over him when it rains, and when he lies down at night on wet ground, he places another sheet of bark beneath him.

A very small fire is proverbially termed in Australia a **black man's fire**, as he makes his fire so small that he can place it within the entrance to his "my-my," and coil himself round it when he goes to sleep without fear of conflagration or of the risk of an injuriously high temperature. He must, to reap the full benefit of a fire and yet not suffer from the results of it, make it so small that he can get close to it.

The names of places in the language of the black people are often very pretty, for example—Ulinda, Perlawa, Wilbatree, Burrundalla, Putabucca, Guntawong, Wiadara, Gulgong, Telbrega, Coolah and Coonanbarra. The last is the original name of the Hunter River, and it is infinitely more beautiful than the harsh and business-like new title.

Mount Gambier, at the distance of a sixteen-mile drive from Glencoe, will no doubt one day be the centre of an important agricultural country. It is the capital of a fertile spot or oasis in the uncultivated waste of the south-east corner of the colony.

The chief industry of the district is **potato culture**, although a number of small cheese factories have recently been erected, and the dairying industry is developing.

The rich volcanic soil is peculiarly well suited to the production of tubers of good quality. The Brown River potato from Tasmania is the common variety cultivated.

The crop is planted in August, September, October, and November, 3 feet wide between the rows and 2½ feet apart and from seven to nine cwt. of sets are used per acre ; a variation resulting from the difference of practice among growers, who sometimes plant whole potatoes and at other times cut them into sets. The potatoes which are last in being dug are best for seed.

The cost of **digging** or raising, which is all performed by hand, is about 5*s.* to 6*s.* per ton, and the operation goes on from December till the beginning of June. The average yield is about five to six tons per acre, the best crops running up to seven or eight tons.

The haulms grow to an immense size, which accounts for the exceptional width left between the plants ; and a good crop flowers twice and sometimes three times, but the fruit, the potato apple, does not form so abundantly as in Britain.

The potato **disease** (*Phytopthora infestans*) does not attack the crop, but a scab appears on the skin if the land is manured immediately before planting. Manure may with safety be applied to a previous grain crop, but not directly to the potato crop. Even dust blown from the highway, on account of the lime present produces scab.

The usual **price** is from £2 to £2 10*s.* per ton. At times, in years of scarcity, it runs up to £10 per ton, at other times, when crops are extremely abundant, they cannot be marketed at any price. Chats are sold to distillers at 12*s.* 6*d.* to 15*s.* per ton.

Some soils grow potatoes of greater specific gravity than other soils, so much so that at one place 12 bags of potatoes go to a ton, while in other paddocks (fields), 13 bags are necessary to make up that weight.

Sometimes the **sets** remain fresh and do not decay in the soil after the haulms have developed ; they remain "staggy" or hard and woody, but growers prefer the decay or disappearance of the sets, which is the natural result in this country. The amount of potatoes exported from Mount Gambier averages 15,000 tons annually, but the year 1889 being an unfavourable one for the trade, it did not exceed 10,000 tons.

Tasmania is the great potato-growing centre, said to be the best in the Colonies.

The district of Mount Gambier was seen under the most favourable auspices through the courtesy of Mr. Thomas Williams (manager of Dr. Browne's excellent Moorak Estate), to whom the writer had been passed on by Mr. John Riddoch, jun., who, assisted by Mr. John Laird, the manager of Glencoe, had acted as conductor in the inspection of that property.

The **natural beauty** of Mount Gambier is unique. A town, with a population of 5600, has sprung up in the proximity of an extinct **volcano**, which at some ancient date discharged as ashes and lava the material now forming the exceptionally rich surface layer covering the immediately surrounding country.

Prominent among the sights of the place are two **lakes at a high elevation**, imprisoned by precipitous rocky walls —the one, the Blue Lake, now supposed to have been formed by the falling in of the roof of an immense cavern —the other to have been formed into its present condition by the union of Browne's Lake and Valley Lake, transformed into one by the rising of the water fed from an artesian source.

The latter of the two lakes is supposed to have been the mouth of the crater, and between them lies the **Leg of Mutton Lake**, with a forest nursery and reserve close to it, in which may be seen growing side by side in full vigour the Scotch fir and the Tasmanian blue gum.

Mount Gambier was left by train early on the morning of 9th June. At first the fog was dense and dark. Much level grazing-land of good quality, but in great need of draining, was passed through.

After about three hours' run the amount of surface-water steadily increased until almost the whole surrounding country was covered by water. The flood was the result, not of local rainfall but of wet weather up north. The water moved at a good pace, and more than half of the ballast had been carried away from the railway sleepers by the current, which had cut channels at distances of a few yards apart.

At Narracoorte the train was brought to a standstill for nine hours, owing to the railroad ahead having been washed away in several places. Information soon arrived that one of the low pile-bridges in the rear, over which the train had successfully crossed, had within twenty minutes thereafter, been **washed away**. The weight of the train had shaken the piles and aided the current of water in removing the earth which held them.

Had there been any certainty as to the length of delay, there would have been ample time to visit the interesting **limestone caves** only a few miles distant.

The caves are located in a forest reserve, and the conservator of forests in the year 1889 disposed of 500 tons (at £1 per ton) of bat guano—the droppings and remains of vast numbers of bats—got from the caves.

It was in one of those caves that a veritable, petrified black man with a wound in his body, supposed to have been shot by some early pioneer who had possibly suffered from the fellow's natural pilfering proclivities, was found.

After a tedious and uncertain **journey** over the way, which had been temporarily repaired by the aid of sandbags and piles of wooden sleepers, the train reached Wolseley in time to miss the express for Melbourne by eight minutes. As the express was the last train for the night, and as the morning train started from **Serviceton**, five miles away on the Victorian boundary-line, the journey had to be made on an American **railway-tricycle**, a light, three-wheeled trolly, worked by a porter, who covered the distances in forty minutes, in spite of the extra load of luggage and the fact that a part of the way was on an upward incline.

The Serviceton station was undergoing repair and enlargement, and the only available quarters for the midnight arrival was in the old refreshment-room, with the boots of the hotel. Owing to some confusion over the change in the railway time-table, and also the change of time from that of South Australia to that of Victoria, only twenty minutes were left in the morning in which to dress, breakfast, and find the way to the new platform by seven o'clock.

CHAPTER II.

RÉSUMÉ OF ROUTE, CONTINUED—COLONY OF VICTORIA.

Journey from Serviceton to Melbourne—Australian and New Zealand Clubs and Club Life—Introductions—Flemington Race-Course—The Melbourne Cup—Income of the Victoria Racing Club—Amount of Added Money—Expenditure on the Course—Arrangements for Comfort and Convenience—Visits to Heidelberg and St. Hubert's—Evidence given before the Royal Commission on Vegetable Products—Journey to Deniliquin—Warbreccan Station—Bush Cooking—Kangaroos—A Kangaroo Hunt—Perricoota Station—The River Murray in Flood—Riding Parties—Irrigation—Return to Melbourne—Western District of Victoria—Wages—Soil—Mertoun Park—Scenery—Fences—Injury by White Grub or "Take-all"—Natural Enemies of the Grub—Return to Melbourne—Difficulties of Colonial Agriculture through Uncertainty of Climate—Sheep-Market—Goldsbrough, Mort and Company—The Mint—Silver and Copper as Alloys in Gold—Departure from Melbourne for Dookie College—Arrival at Sydney.

Leaving Serviceton by the morning train on 11th June, a flat country was traversed on the way to Dooen Station, where a détour was made to inspect the recently established Agricultural College at Longernong. Some good arable **land** and also tracts fitted for sheep pasture were within sight, and the peculiar Bay-of-Biscay formation was well-represented over a large surface. A halt of a few hours was made at Ballarat, and **Melbourne** was reached during the forenoon of June 12th.

The visit of a stranger to the Colonies is rendered exceptionally comfortable and agreeable by the existence of commodious and well-managed **clubs,** which are owned and frequented by the floating masses of business-men and land-owners, whose houses or residences are out of town or up country. The comfort of a well-organised club is more like the comfort of home-life than that of an ordinary hotel; and it must be freely admitted by all who have travelled much in the Colonies of Australia and New Zealand that club-management there is reduced almost to a science, and that club-life is not only comfortable and agreeable, but the cost of living moderate.

The facilities afforded by the common rooms of a club for a stranger—who of course requires in the first instance to be properly introduced and duly proposed, and elected a temporary member—to become acquainted with the various classes with which he desires to mix, are peculiarly useful to one bent upon gaining information of a practical kind.

Squatters or run-holders from the country are usually members of the clubs, and, on being introduced to strangers are extremely hospitable and courteous in giving invitations to visit them in the country, where ample opportunity is offered for enjoyment and instruction.

The following clubs—given in order of election—were good enough to elect the author to a membership such as strangers are enabled by rule to possess :—

The South Australian Club, Adelaide.
The Australian Club, Melbourne.
The Melbourne Club, Melbourne.
The Union Club, Sydney.
The Queensland Club, Brisbane.
The Fernhill Club, Dunedin.
The Hawkebay Club, Napier.

Introductions were presented to the following gentlemen, to whom thanks are now given for information supplied and assistance rendered :—

His Excellency Sir W. C. Robinson, G.C.M.G., Acting Governor in the absence of Sir Henry B. Loch.

Baron Ferd. von Mueller, K.C.M.G., M.D., Ph.D., F.R.S., etc. etc., Government Botanist for Victoria.

The Hon. Sir James MacBain, President of the Legislative Council.

The Hon. Sir William Clarke.

The Hon. J. L. Dow, Minister of Lands and Agriculture.

The Hon. W. Madden.

The Hon. Wm. McCulloch.

Professor Allen.

Mr. D. Martin, Secretary, Agriculture Department.

Mr. J. J. Shillinglaw, Secretary, Vegetable Products Commission.

Mr. William Drysdale.

Mr. George Anderson, Master of the Mint.

Mr. H. Byron Moore, Secretary, Victoria Racing Club.

Mr. W. G. L. Spowers, of the *Argus.*

A most interesting visit was paid on Wednesday, 19th June, to the **Flemington race-course**—the equine battle-ground of the Victoria Racing Club—with the Secretary, Mr. H. Byron Moore, whose energy and powers of administration and organisation have made the Flemington Race-Course and its various buildings and furnishings the most complete racing centre in the world. The journey was made from the Essendon platform to the suburban station of Newmarket, where the railway accommodation is so ample and so admirably constructed, that 23,000 people have been despatched by train, at the end of a race-meeting, in seventeen minutes.

The course is oval in shape, and the straight home to the winning-post branches off from one end at a tangent. The straight is not quite so long as that at the Randwick course at Sydney, and the form of the ground of necessity makes the turns somewhat sharp, but nevertheless it is a remarkably fast course in dry weather. It can be irrigated or flooded when necessary, and therefore its condition as regards moisture is under control.

The training-tracks are three in kind and in number—grass, sand, and tan—so that one track is at all times in condition, whatever the weather may be. The tan-course, while being constructed, was dug out and two feet of porous stone taken from a quarry in the grounds put down as a foundation, to admit of the escape of water.

The steeplechase course is fitted with permanent obstacles of various kinds, including red-gum post-and-rail fences, 4 ft. 8 inches high, and so strongly constructed, that they do not give in the event of a horse making a mistake.

The race-course **grounds** extend to 330 acres of land, which are admirably suited for the purpose, as they consist of a level plain, with a low hill or rising ground at one end. On the sides of the hill the **grand stand**—the main body of which is 600 feet long—is erected. The grand stand and the adjoining suites of apartments for notables, for ladies, and for the use of the committee, are capacious, and furnished on an elegant and luxurious scale. Every convenience and comfort which one could possibly wish for, during a complete holiday, is provided for those who occupy the grand stand.

The "upper ten" are not the only class which participates in the results of the forethought of the club managers. **The hill**, or half-crown enclosure, is also provided with suitable conveniences—even to hot water for tea—for the class of people who occupy it. Many families of well-to-do working people, who go to the hill, take with them luncheon-baskets and make a regular picnic or holiday on the grounds.

Even those who do not pay are permitted to enjoy the sport, as the "flat" or centre of the race-course is free to all.

The popularity of the sport of good racing may be gathered from the fact that, as many as 143,000 people have assembled on the grounds on a Melbourne Cup Day, and in all 300,000 during the four days of one race-meeting.

There are about six meetings in the season, the three chief divisions being termed (1) The Spring; (2) The New Year's Day; and (3) The Autumn meetings. The great event of the season is the **Melbourne Cup**, which is the leading feature of the spring meeting held in November. The occasion is made a general holiday, and people flock to Melbourne from all the Colonies to take part in the festivities.

The following notice, extracted from the programme of the Victoria Racing Club (the V.R.C.), will indicate the character of the race:—

MELBOURNE CUP, 1889.

"A Handicap Sweepstakes of 50 sovs. each, 10 ft., or 5 sovs. only if declared to the Secretary of the V.R.C., A.J.C., or C.J.C. before 4 P.M. on Monday, 5th August, with 5,000 sovs. and a trophy value 150 sovs. added. The handicap weight of the winner of the A.J.C. or V.R.C. Derby of 1889 to be not less than 7 st. 6 lb., and the winner of any handicap flat race of the value of 100 sovs., after declaration of the weights, to carry 3 lb. extra; of 200 sovs., 5 lb. extra; of 300 sovs. 7 lb. extra; of 500 sovs. or upwards, 14 lb. extra. The second horse to receive 1,000 and the third 500 sovs. out of the stake. Two miles. Entries, accompanied with 5 sovs. (the amount of first forfeit), to be made to the Secretary of the V.R.C. or A.J.C., before 4 P.M., or with the Secretary of the C.J.C., Christchurch, N.Z., before 12 noon on Monday, 3rd June. Weights to be declared at or before 12 noon on Monday, 24th June. Second forfeit (5 sovs.) to be declared and paid to the Secretary of the V.R.C., or A.J.C., or C.J.C. before 4 P.M. on Tuesday preceding the race, or the nominator will be liable for balance of sweepstakes, 45 sovs. (127 Subs.)"

The sums of **money** contended for at the meetings, and which are handled by the club, are enormous. The yearly sale of race-cards and of the race-book, which is a record of previous races, returns about £1,700 of profit. The annual **income of the club** is over £80,000 a year, and £37,000 of this had been set aside to go to the stakes of the current year in added money. At the English Derby there is no added money offered, the prize being simply the contents of the pool.

The amount annually expended up to the present may be seen from the following table :—

AMOUNT OF ADDED MONEY GIVEN BY THE V.R.C. AT THEIR MEETINGS.

From the Season 1864-65 *to Date.*

Season.	—	Spring.	New Year's Day.	Autumn.	Total.
	£	£	£	£	£
1864-5	..	1,350	..	830 1,025	3,205
1865-6	..	1,975	2,250	950	5,175
1866-7	..	2,100	1,750	850	4,700
1867-8	1,600*	2,150	1,800	625	6,175
1868-9	..	2,150	1,850	1,175	5,175
1869-70	..	3,025	750	1,525	5,300
1870-1	..	3,175	800	1,650	5,625
1871-2	..	3,475	1,000	1,600	6,075
1872-3	..	3,175	1,050	1,650	5,875
1873-4	..	3,675	1,050	2,150	6,875
1874-5	..	3,925	1,050	2,850	7,825
1875-6	..	4,250	2,450	3,400	10,100
1876-7	..	4,650	2,450	3,500	10,600
1877-8	..	4,650	2,450	3,600	10,700
1878-9	..	4,650	2,450	3,600	10,700
1879-80	..	4,900	2,050	3,850	10,800
1880-1	1,000†	5,000	2,050	3,900	11,950
1881-2	1,250‡	4,950	2,000	3,900	12,100
1882-3	1,250‡	5,000	2,000	4,700	12,950
1883-4	1,250‡	5,775	1,750	5,350	14,125
1884-5	1,250‡	6,325	2,100	5,825	15,500
1885-6	1,600‡	7,350	2,350	6,025	17,325
1886-7	1,600‡	8,875	2,350	6,225	19,050
1887-8	1,850‡	9,775	2,350	8,875	22,850
1888-9	3,200‡	11,200	2,450	10,050	§30,150
1889-90	4,700‡	14,900	2,550	11,550	33,700
			Grand Total . . .		£304,605

* Special meeting. † Complimentary meeting. ‡ Steeplechase Meeting.

§ Inclusive of April meeting, £1,450, and Queen's Birthday meeting, £1,800.

The amount of added money for 1889-90 is exclusive of the April and May meetings.

The entrance money and the forfeits go to the stakes. **All fines** are set aside to form a Distressed Jockeys' Fund, which has £3,000 in hand, to be devoted to the support of injured men and their families. **The annual expenses** for the keeping of the course amount to about £4,000; but a sum of £10,000 was being spent in 1889 on important improvements.

In all, £140,000 have been spent in making the race-course property what it is.

All the **vendors** of cigars, liquors, and eatables of various kinds are under the control of the ground committee, so that articles of inferior quality, proposed to be offered for sale, are at once objected to and forbidden. Had this rule been in force in connection with the sale of Colonial wines at the Colonial and Indian Exhibition in London, the impression left of the quality of the Colonial wine products would probably have been very different.

Temperance-bars are provided for the benefit of those who do not indulge in the use of alcoholic liquors.

The details of **fittings** on the course are of the most recent and improved kind. In the judge's box a wire is fixed perpendicularly about three feet from the judge's eye, and on the opposite side of the course a black-board is placed, with a perpendicular white line painted on it to enable him to determine to the greatest nicety when the first horse has come in.

Electric scratching-boards are erected at numerous points of the grounds. That beside the operator is the last on the circuit, so that should any disconnection of the current take place, the defect would be instantly recognised.

A staff of from twenty-five to thirty **telegraph clerks** is regularly required at the office on the course for the despatch of messages.

An ambulance waggon is sent out during each race in which there is jumping, and, when a rider is seriously injured, he is sent by special train to a hospital in town.

A surgeon's dresser is constantly on the ground, and two doctors receive honorary appointment and place their services at the disposal of the club.

Sunday, the 16th of June, was spent with **Dr. Dick,** Inspector of Asylums for the colony of Victoria and a relative of the author, at his temporary residence, a neat little cottage overlooking the Yarra River and the township of Heidelberg. Next day was spent at the **St. Hubert's** vineyards, the property of Messrs. Rowan and Castella ; but the results of this visit are hereafter dealt with.

The land passed through in the journey from Prince's Bridge Station, Melbourne to Yearing, was heavy clay and not of great agricultural value. Much rain had fallen, and the whole country was in a soaked condition. It was sad to see on all sides the remains of so much fine timber which had been burnt and destroyed.

On 19th June the author had the honour of being examined before the **Royal Commission on Vegetable Products** in Melbourne—the President, the Hon. J. F. Levien, in the chair. Among the subjects discussed at considerable length, was the necessity for the creation of an Agricultural Department, which would employ agricultural experts in its various important branches, and also travelling inspectors who would be able to impart information regarding the products and the customs of other countries, and at the same time collect and formulate information of a local description as a part of their duty—"men who should not be selected by chance or for expediency, but after a sufficient and thorough training both in science and practice."

It would have been well for the future of the agriculture of the colony had the above rule been adhered to with all, as it was in the cases of some of the experts who have since been appointed ; and it will, no doubt, prove to be more satisfactory in future if those in authority base their opinion as to the suitability of an expert upon the work which he has done, and which is duly attested by others who are capable of forming an accurate judgment, and not merely upon the opinion which a man, who may be a mere adventurer, may form or express of himself.

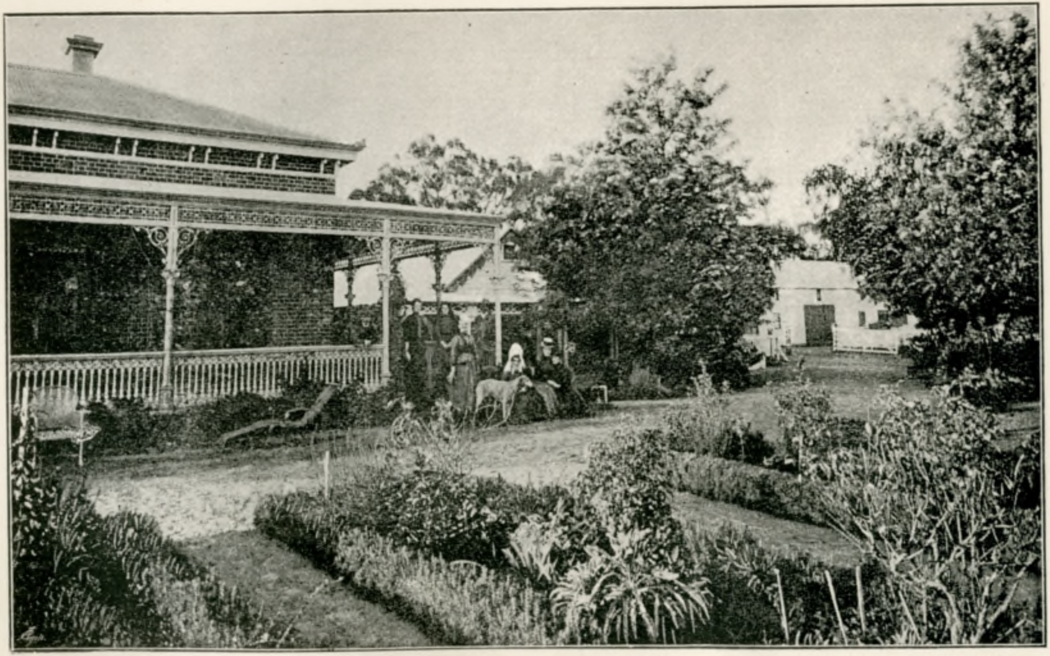
The suitability of the **system of ensilage** under colonial conditions was also shown to the Commission, and special attention was called to the benefits to be derived from the adoption of a system of **rotation of crops**, in which various legumes (as clover, vetches, or lucerne) should find an important place.

On 20th June the writer left Melbourne by the 6.50 A.M. train for **Deniliquin**, the capital of the Riverina, in New South Wales, about 200 miles to the north. After leaving the suburbs of Melbourne, the railway route lies through a flat, treeless country, and in about two hours enters upon rising ground with trees, passing through the gold-mining district of Mount Alexander, near Castlemain, where the deserted remains of extensive surface diggings are to be seen, with now and then a solitary digger at work. Time for lunch is allowed at Sandhurst at 11.15. As Rochester is approached, a beautiful rich red soil is entered. Sheep and cattle become numerous, and the green growth is, at the season referred to, much further forward than in the south of the colony.

Warbreccan, a station belonging to the Hon. William McCulloch, situated about three miles from Deniliquin on the banks of the Edward, a tributary of the Murray River, was reached in the afternoon.

This property cost about two guineas per acre three years before—viz., £150,000 for 64,000 acres with fixing and stock—50,000 sheep, including lambs. Five **boundary-riders** and an overseer are constantly employed, and in addition at shearing time, 32 **shearers** and about the same number of extra helps—"rouse-abouts," "markers," etc.

Sheep do not require to be dipped in this district, as there are no ticks, no foot-rot, and little fly-blowing. The



The Author.

VII.—HOUSE AND STABLE YARD, WARBRECCON STATION.

The property of the Hon. WM. McCULLOCH.

death-rate is also exceptionally low. The rams go to the ewes on 1st November or ten days later. The lambs consequently arrive in the Australian autumn, after the risks of drought are mostly past, and in time for the growth of natural herbage which springs rapidly after rain. Lamb-tailing and marking were on at this time—the end of June; and it was at a gathering of men, who had assembled for this purpose, that the writer was initiated into some of the peculiarities of **bush cooking.**

Bush tea is made with the best available water, which may be both thick and brown, boiled in a can. The tea is thrown into the water, and, as soon as the concoction comes to the boiling-point, it is removed from the fire and after a few minutes dealt out to each man in a pannikin.

The common **bread** of the bush is called "damper," and consists of unleavened wheaten-flour dough, slowly baked in the ashes of a dying wood fire. When well cooked by an old bush-hand, the resulting product is delightful, but when the work is done badly, the mass of dough remains heavy and wet, unpalatable and indigestible. The bread used on the occasion in question was named "brownie," and had been baked with brown sugar, a few currants, and a little dripping. A few of the plump tails of some of the larger lambs were, after removal, roasted in the wood ashes, and formed savoury morsels after the charred wood and skin had been scraped off.

A section of the **station-house** and the party of occupants are shown in Plate VII.

The great excitement of the occasion was a **kangaroo-hunt,** which was arranged for 22nd June, although the country was much too wet for all the pleasure to be derived that the sport is capable of affording.

Before contemplating the details of the hunt, it will be well to examine the accompanying **cut,** which exhibits in a life-like manner the form of the kangaroo and also the various attitudes it assumes while at rest or in motion.

The **kangaroo** is the best known representative of a very large group of animals—the *marsupials*—which are present in great variety in Australia. Their name was derived from the *marsupium* or pouch, on the inner surface of which the nipples of the mammary gland are. fixed, and into which the young are placed (as illustrated in the plate) at a very early stage of their existence.

The head is not unlike that of a large hare, and the upper part of the body is extremely small in comparison with the massive and muscular hind-quarters and lower

Kangaroo, genus *Macropus*. (Plate from 'Blackie's Modern Cyclopedia,' Glasgow.

back. The fore-legs are short and arm-like, and terminated by hands of five fingers or claws, which are only allowed to come to the ground while the animal feeds or lies at rest.

The method of progression is as unique as the form of the animal itself. It advances by repeated hops or springs (at times twelve to fifteen feet in length) from its powerful four-toed, posterior limbs, aided by a strong and muscular tail. The size varies much in the different species, from that of a hare or rabbit to that of a boy of twelve years of age. The remains of an extinct giant species have been found in excellent preservation.

Kangaroos are herbivorous, and where they exist in large numbers, as in the back country, they are looked upon as a serious pest, and are destroyed in large numbers as vermin.

The following figures, extracted from the report of Mr. P. R. Gordon, Chief Inspector of Stock for Queensland, showing **numbers of vermin killed** under the various headings, will indicate how the work of destruction is being carried on in that colony :—

—	Kangaroos.	Wallabies.	Kangaroo Rats.	Bandicoots.	Dingoes.	Total of all kinds.
1887	175,363	316,946	8,925	..	11,525	512,759
1888	275,729	445,080	24,282	95	19,552	764,738
1889	312,476	353,994	26,417	1,007	19,570	713,464
	Kangaroos and Wallaroos.	Wallabies and Paddamelons.				
Total number killed under Acts of 1877 and 1881.	3,698,757	4,454,240	74,944	1,102	60,554	8,289,597

N.B.—Kangaroos (*Macropus major*, Gould), and other species ; the largest marsupials.

Wallaroos (*Osphranter robustus*, etc., Gould), inhabiting mountains ; smaller in size yet as heavy as the Great Kangaroo.

Wallabies (*Halmaturus ruficollis*, etc., Gould), also called Bush Kangaroos ; much smaller than the Great Kangaroo.

Paddamelons (*Halmaturus Thetidis*, F. Cur. and Geoff.), a small species of Wallaby inhabiting brush country.

Bandicoots (*Perameles nasuta*, etc.), small burrowing marsupials with slender muzzle, which feed on bulbs and roots ; sometimes called Bandicoot Rats.

Kangaroo Rats, or more correctly, Rat Kangaroos (*Hypsiprymnus murinus*, etc., Gould) ; also called Potooros ; not larger than a rabbit in size.

Dingo (*Canis dingo*), the Australian native dog of wolf-like appearance and very fierce, remarkable as being the only mammal in Australia not belonging to the Marsupial group.

In the earlier settled districts, and where the land has been fully stocked with sheep or cattle, kangaroos have been exterminated. It is said that, on account of the increase in value of their skins, kangaroos would yield a greater profit than sheep, and that the day is not far distant when kangaroos will be bred like sheep in certain districts.

But to return to **the hunt.** The party consisted of ten individuals all told,* accompanied by a spaniel and five kangaroo dogs. The latter are usually either large and powerful greyhounds, Scotch greyhounds, or a cross between the two breeds, which secures a combination of speed and strength.

The kangaroos were only to be found in an unfrequented paddock at the distance of fourteen miles across country, and, owing to the wet and soft condition of the surface, the journey had to be made with a four-in-hand. The place selected was a level, open, almost treeless plain, surrounded by a wire fence, which was, however, not kangaroo proof, and more than 100 kangaroos were sighted during the day. The men who had come to drive the kangaroos, were despatched on horseback to the further and lower end of the paddock, a distance of about two miles, while the main body of the party, with the dogs and horses, got sufficiently concealed in a clump of scrub close to the fence along the side of which it was believed the game would come.

It was not long before little groups of kangaroos could be seen moving off in different directions at the approach of the outriders. They were at first only moving specks in the distance, but as those that came in the desired direction approached, it could be seen that there was considerable variety of size and colour—various shades of brown or red, according to the differences of age or sex.

* Two young ladies (Miss Osborne and Miss Katie McCulloch), Mr. McCulloch, two of his sons and a nephew, the author, and three men to ride in the kangaroos.

The Author.

VIII.—MURRAY RIVER IN FLOOD, AT PERRICOOTA.

Thirty feet above normal low water level.

The Author

IX.—MR. JOHN WAGNER AND FAMILY AT PERRICOOTA STATION, N.S.W.

When the leading group came within a distance of a few hundred yards of the party lying in ambush, the **dogs,** which had been held with difficulty, were slipped, and lost no time in reducing the space between them and the advancing quarry. As a rule the dogs keep together and single out one kangaroo ; but on this occasion they separated as the startled group of kangaroos divided and fled in all directions, and only one "kill" was made by an old dog that got away by himself.

The other dogs, after various exciting incidents, in a run which must have extended over three or four miles (the object of the chase having been repeatedly changed meanwhile), were completely winded and left behind, and were finally collected by the various members of the party on horseback, who had also been scattered in every direction.

The horses seemed to enjoy the sport quite as much as either the dogs or the riders. There was no urging necessary on their account. Though the country was flat, the riding was not of the safest kind, as the surface was closely pitted with crabhole-like water-hollows, of the Bay-of-Biscay type, which, after the heavy rains, were soft and sticky in the bottom. The horses, accustomed to pick their way, could do so admirably when moving at a moderate pace, but when at full gallop it was impossible to avoid all the pitfalls, and the rider was every now and then reminded, by an uncomfortable variation in the animal's motion, that one more danger had been successfully passed.

There were no casualties on this occasion, and the party gradually assembled at the starting-point for **lunch.** Chops were cooked in bush-fashion, and with them the eggs of swans and "native companions," that had been picked up by the way. The so-called "companions" are large, blue wading-birds, which are numerously represented in Australia. After lunch there were four "**kills,**" and two baby kangaroos, or "Joeys," about the size of a hare, were captured alive. One was carried home as a pet, but it refused to become domesticated, and ultimately died after a few weeks' confinement.

The sport of kangaroo-hunting is exciting and interesting, but the closing scene—the kill—is unusually disagreeable, owing to the victim continuing to stand erect while the dogs despatch it.

The doe which is carrying young in her pouch, is, owing to this handicap, more likely than the others to be overtaken by the dogs. She usually throws away the almost naked, helpless creatures at the last moment, no doubt for safety, when it is too late to save herself.

The first sportsman who comes up usually despatches the kangaroo held by the dogs, with his stirrup-iron, as the most ready and humane method of ending the creature's sufferings. The forepaws or feet are removed as trophies of the chase, and the tail is also cut off close to the rump and made into an excellent soup, which is not unlike ox-tail soup, but with a peculiar, characteristic, though not disagreeable, flavour. Kangaroo flesh is also roasted, and, when prepared in this way, it is equally palatable and nutritious.

After a day of sustained variety and interest the party retraced their steps, and arrived at the station-house as darkness was settling down, having covered a distance of forty to forty-five miles.

On 24th June train was taken at Deniliquin for Moama *en route* for **Perricoota Station,** the property of Messrs. Robertson and Wagner, the great Cob and Co. of Australia. The firm at one time, before the railway system of the country was developed, received from Government as much as £80,000 a year of subsidies for their mail coaches.

Now that colonial coaching is much reduced in extent and importance, the partners have developed new lines of business. They possess enormous tracts of grazing-land, and clip about 500,000 sheep annually. They are also the fortunate owners of one-sixteenth of the great Mount

The Author.

X.—A Riding and Driving Party at Perricoota.

The Author.

XI.—Grape Vines and Orange Trees—Perricoota Station.

Morgan Gold-Mine, which lies inland from Rockhampton in Queensland. It has been described as a "mountain of gold," and in 1889 the dividends paid to shareholders, after deducting working and all expenses from the total earnings, amounted to over £1,200,000.

Perricoota is beautifully situated on the north bank of the Murray River, about twelve miles west from Moama and Echuca.

The river was in high flood at the time, and flowed 30 ft. above its low water level, filling, but not overflowing to any great extent, its deep banks of rich alluvial soil, which have been deposited by the waters of the river during past ages. The view shown of the river is reproduced from a photograph taken by the author from the north bank, behind the Perricoota house.

The **group** taken on a garden-seat on the lawn in front of the house is that of Mr. John Wagner (the host on the occasion) and the members of his family who were on the station at the time. The riding and driving party—Plate X.—is composed of the same group differently arranged after a splendid gallop of fourteen miles to and from the the wool-shed—always a landmark and object of interest on a large station.

Plate XI. shows the back of the house, with a vineyard in the foreground, bounded by orange-trees laden with rapidly ripening fruit.

A ride was taken to the cultivation paddock, where 350 acres of excellent land are **irrigated** by the Murray River water raised by a steam pump, so that it flows by gravitation to various parts of the land in elevated supply channels. The soil was rich, and light enough to be mechanically suitable for irrigation, and the results were, in every respect except the important one of finance, pronounced to be a success. Twenty bushels of wheat per acre had been repeatedly grown without manure, but it is needless to add that even the rich alluvium of the Murray cannot be expected to continue to be so spontaneously bountiful.

At noon on June 27th, after three most instructive and enjoyable days, the **return journey** to Melbourne was begun, and was completed before twelve o'clock the same night, by way of Toolamba and Seymour.

Early next morning, the 28th of June, a run to the **Western District** was made with Mr. McCulloch, to see his property at Mertoun Park, three miles from Colac.

The **Mertoun Park** property extends to about 1,400 acres, and cost £15 per acre a few years ago. It is now probably worth £30 per acre. If broken up into small holdings for the purposes of potato growing and dairying, for which the district is admirably situated, it would easily let at £2 per acre.

The chief attractions in the matter of **live stock** were the Shorthorn and Ayrshire herds—to be described in a future chapter—a flock of 180 Lincoln ewes, twenty-five Hampshire Downs, and twelve Border Leicesters recently imported from the famous flock of Lord Polwarth at Mertoun, N.B.

The **fences** erected against cattle take the form of three sets of heavy rails and posts, of split timber from a bastard stringy-bark which possesses good powers of endurance.

The **Forest Scenery** of Australia is objected to on account of its leaden sameness of colour and form, but in this district the monotony is broken by the blackwood tree (*Acacia melanoxylon*, R. Br.), the wood of which is valued for the making of furniture. The leaves resemble those of the mistletoe, but are larger and broader, and the general appearance of the tree is not unlike that of the oak. The roots spread near to the surface, and the tree when grown as a standard is easily killed by the treading of stock or by the plough.

The **soil** is a beautiful rich black loam containing a good deal of sand, which makes it work freely.

The Author.

XII.—GROUP OF THE HON. WM. MCCULLOCH'S SHORTHORN CATTLE.

LADY OXFORD BLANCH. LADY OXFORD BLANCH 2ND. LADY NONSUCH 7TH. COWSLIP 47TH. MAY ROSE 20TH.

The ordinary **small farmer** grows wheat as often as he can; some go in for keeping a few sheep, which tend to restore fertility, and others resort to fallowing at intervals of a few years. The quality of the land may be gathered from the fact that eighty bushels of Cape (four-rowed) barley or bere (*Hordeum vulgare*) are at times reaped per acre.

The **wages** of ploughmen in this district are from 20*s*. to 25*s*. a week, with food and cottage found; cattle-men are in receipt of 30*s*., with extras.

The larvæ of a cockchafer were here doing much injury in

Common Cockchafer, larva and pupa.
Reprinted from Miss Ormerod's 'Manual of Injurious Insects.'

the pasture-fields. The species could not, in the stage at which it appeared, be determined, but it was probably nearly allied to the common May bug, (*Melolontha vulgaris*), sometimes called white grub and by the French *ver blanc*. In the Colonies it is familiarly known by the name of "take-all" on account of the injury it inflicts upon the roots of grass and crops. The grub is white with a brown head, and it is found in the soil at the depth of one or two inches, folded upon itself, so that the tail and head approach pretty closely together. It possesses the characteristic three pairs of legs of a true beetle-larva, placed on the three thoracic segments, and is a voracious feeder.

In Europe the cockchafer grubs exist as such for years before developing into the perfect insect, but it would appear in the colonies, that, owing to the unsuitable mechanical condition of the soil due to extreme changes of climate, the grub either does not so long remain a grub, or it becomes quiescent during much of the time.

The **cockchafer plague** seems to be most felt in France, where, during years when the insects are specially numerous, the annual damage done to crops and trees is estimated at a milliard francs or £40,000,000 sterling.

The attack, however, is not confined to one country on the continent of Europe, as no less than two hundred and thirty one millions of cockchafers were gathered in Würtemberg in 1872.

The mischief is done in **round spots** which extend from a centre like a fairy ring. The grass on the patches affected is completely destroyed in moist weather when the land is soft enough for the grubs to move about. One of the most effectual preventatives of further local destruction is the beating the ground round the outside of the ring till it is so hard that the grubs cannot penetrate it. The surest way to prevent a future attack is to turn in a herd of pigs to root them up and destroy them.

A cockchafer grub was repeatedly found in other parts of the Australian Colonies and in New Zealand, which destroyed not only grass but the roots of all sorts of crops except onions; even gooseberries and strawberries suffered.

The Swamp-hen or **Pukeko** (*Porphyrio melanotus,* Temm.), of New Zealand is in the habit of pulling up the affected grass to get at the grub, of which it is very fond.

Another formidable enemy of this grub in New Zealand is the **Wako**, a dark-brown bird like a landrail, which is almost wingless and contains a large amount of oil, used by bushmen to make into candles. These birds, which are very numerous, scrape the surface soil to get to the grubs.

Another **caterpillar**, hairy and grey in colour, was reported as liable to attack the grain crops, by cutting through the stalk below the head near harvest-time. They are thought in the western district to be the grubs of a small white butterfly, and they do most damage when the weather is slightly humid. The period of their destructive stage extends only over a fortnight.

As a warning to the Colonies to keep themselves alive to the importance of combating insect crop-pests, it may here be stated that the aggregate annual loss to American agriculture from insect injury is estimated at from three to four hundred millions of dollars.

A return to Melbourne was effected on Saturday evening, 29th June, and Monday was spent in making the acquaintance of a number of leading men who had made a special study of the agricultural resources of the colony, among others Mr. Frederick Search of the Yeoman department of *The Australasian*.

Now it was that the Author became fully impressed with the **difficulties of Colonial Agriculture**. It was pointed out that the area of really good cultivable land is comparatively small in the Colonies. The variation of the seasons is so great that no regularity as regards the most suitable time for sowing can be maintained. The first season may do very well ; in the second the seed may be rotted out with rain ; and during the third the vegetation may be scorched by hot winds.

Even New Zealand is not exempted from visitations of hot winds. The prospects of the grain harvest of 1890-91 have to a large extent been ruined by a drought of from six to eight weeks' duration, which has so seriously reduced the yield of grain crops that there will be little or no wheat, barley, or oats to export during 1891. This state of matters is certainly very exceptional in New Zealand, and probably does not occur more frequently than a somewhat similar period of drought in this country.

In Victoria, however, the **uncertainty of climate** is so great that a really good agricultural season does not recur oftener than about once in seven years, and much of the land capable of cultivation is consequently best under pasture, as will be more fully explained under irrigation, when speaking of the importance of lucerne as a grazing and forage crop in the Colonies.

The weekly **sheep-market** was seen on the morning of Tuesday, 2nd July. The selling of the best sheep is done privately on Monday night, and up till eight o'clock on Tuesday morning, when the remainder are disposed of at auction, mostly to graziers.

The numbers of sheep exposed for sale in this market run up at times in summer to thirty or thirty-five thousand.

The best dressed mutton at this time was selling at $2\frac{1}{2}$*d.* to $2\frac{3}{4}$*d.* per lb.

Later in the day the immense **Establishment** of **Goldsbrough, Mort & Co.**, consisting of a Bank and the largest wool, wheat, skin, and fur stores in Melbourne, was visited. The building stands five and six storeys high. Sales are made by auction, and much wool which at one time came direct from the grower to this country, now changes hands in this place.

Under the personal guidance of Mr. George Anderson, Master of the **Mint**, the complete process employed in making a sovereign was witnessed, from the separation of the gold from its natural impurity, silver, by passing chlorine gas through the molten mass. The chloride of silver being light in weight comes to the top and can be easily poured off.

The silver **alloy** was unpopular because it produced the peculiar pale colour which is well known to those who are accustomed to use the older Australian gold coins.

Copper is now the alloy employed, and the natural silver impurity requires to be removed.

On July 3rd a **departure** was made for Dookie by the early train. This proved to be the first fine, sunny day for a considerable time. The weather had been unsettled for some weeks and much colder than usual.

Wooded and more or less inferior **country** was traversed, until the splendid expanse of rich cultivable soil in the Goulburn valley was reached.

Dookie College and farm are described in a succeeding chapter dealing with Colonial agricultural colleges.

A drive of twenty-five miles along the Broken River valley brought the cross-country journey to a close at Benalla station. The well-wooded nature of the country indicated good quality of soil. The land was undergoing a process of clearing and much timber had been destroyed by ring-barking. There was little crop grown and the area of cultivation was gradually shrinking. Wheat did not yield nearly such a large crop as in former years, when as much as twenty-five bushels per acre was annually cut from virgin soil during three consecutive seasons.

The night express was caught at Benalla, and the journey to Sydney made by way of Albury.

CHAPTER III.

RÉSUMÉ OF ROUTE IN NEW SOUTH WALES.

Arrival at Sydney—Introductions—Sir Henry and Lady Parkes—Mineral Resources of New South Wales—Rookwood—Quack Doctors—South Coast Dairying District—Visit to Kiama—Character of the District—The Pasture—Butter-Making—The Co-operative Factory System—Berry and Sholehaven Districts—Return Journey to Sydney—Sydney Meat-Market—Ram Sales—Journey to the Hunter River District—Newcastle—Singleton—Archerfield—Baroona—Property of the Land Company of Australia at Ravensworth—Convicts in the Early Days—Houses in the Colonies—Schools—Crossing the New England Ranges—Arrival at Brisbane.

ON arrival at Redfern station, Sydney, about noon on 5th July, the author was met by Mr. F. B. Kyngdon and Mr. Philip H. Morton, M.L.A., prominent members of the Agricultural Society of New South Wales, and Mr. A. T. Pringle, viticultural expert, who rendered much assistance throughout the time spent in the colony of New South Wales.

Introductions were presented to the following gentlemen, to whom thanks for services rendered are now only imperfectly returned :—His Excellency the Governor (Lord Carrington), Sir Alfred Roberts, Dr. J. C. Cox, Mr. Alexander Bruce, Mr. Charles Moore, F.L.S., Hon. George Henry Cox, Mr. J. P. Dowling, Mr. G. M. Thompson, Dr. A. Philps and Mr. E. J. Sparke.

Visits were paid to the University, Randwick Race-Course, the new Jubilee Park undergoing construction, and the Botanical Gardens which were established in 1816, and are equally noted for their general picturesque appearance and for beauty of situation and of detail.

One of the most interesting social gatherings which it was the author's good fortune to take part in was a quiet Sunday luncheon-party given by **Sir Henry and Lady Parkes**, at the private residence in Balmain of the veteran statesman of Australia and Premier of the colony.

An interesting inspection was made of the unique collection of mementos and curios which Sir Henry had accumulated during a political career which has never been equalled in the Colonies, and which brought him into intimate personal relations with many of the most famous European statesmen of the last half-century.

The conversation turned at one time upon the photographs suspended on the walls, of the various Cabinets which Sir Henry had formed during the long years in which he had held office as Premier of New South Wales. Some of the members were dead, some were politically dead, and some were described in the dry humour of the worthy host, as worse than dead, one having attained to a superlative degree in this respect.

Sir Henry Parkes was born in the quiet country village of Stoneleigh, in Warwickshire, in 1815, and went out as a boy to the colony in the early days. Lady Parkes was born in Northumberland, in the village to which the heroine Grace Darling belonged.

Sir Henry has seen the colony of New South Wales grow, from a small beginning, to the position of a prominent unit in the internal economy of our Australasian Empire. Though great and important, the colony is only in its infancy. The capabilities of the land surface are only partially called into requisition, and there are few countries in the world where the **Mineral resources** are so vast, so varied, and so numerous.

New South Wales possesses gold, silver, copper, tin, lead, and coal, which are only waiting till the "knights of labour" gain experience and learn the elementary principles of economic laws by which labour is directed to take its proper place in the vast workshop of the world's production, where all men are equal according to the amount of work performed, and where the effort to artificially raise one corner higher than the rest in any other manner than by skill, inevitably ends in loss of employment and a diminution of trade, which on the appearance of difficulty immediately shifts its position to more congenial quarters.

In company with Mr. Kyngdon and Mr. W. S. Campbell, a visit was paid to **Rookwood** (an establishment about ten miles from Sydney), which was built three years before as a reformatory for boys. After a change of ministry, the idea was given up, and the buildings, which originally cost £12,000, remained as a white elephant on the hands of the Government. The payment of unemployed labour upon the land (which is of remarkably poor quality), and other expenses brought up the total expenditure during the three years to £18,000 or £20,000. The soil, even after trenching, is so stiff and poor, that, but for the fact that there exists in the county of Cumberland so much soil of similar character, it would have been hard to find land more unsuited to the requirements of an agricultural college farm —a purpose to which at the time it was proposed to turn it. There is in such a soil ample scope to show the benefits of green manure; but a college is not likely to be established there at present.

There is one stain upon the good sense of the governing powers in Sydney that cannot be passed over without mention. **Quack doctors,** men without any degree, diploma, or certificate, are permitted to practise in the colony in hundreds, and are even appointed to Government offices. No wonder then, when such a state of public feeling exists, that men without any sufficient knowledge of their subject are selected at times for appointments in other branches of science.

Mr. P. H. Morton, having arranged an excursion into the famous **dairying district** on the south coast of the colony, the author took train for Kiama on the morning of July 9th.

A member of either House of Parliament is allowed a free pass over the lines of railway in his own colony, under the idea that he will from time to time visit public works under course of construction.

For a time **the country** seen from the railway was well-wooded, though rugged and worthless, but the flat land opened out towards the south and also improved in quality as the dairying district was entered.

The following is extracted from a Sydney paper of the 13th July, 1889:—

"Professor Wallace arrived at Kiama on Tuesday, accompanied by Mr. P. H. Morton, M.L.A. At the railway station they were met by Messrs. Thomas Brown, Henry Fredericks, John Love, and G. Somerville, Js.P., Mr. John James, and others, and made a tour to Jamberoo, visiting the Pioneer, Waughope, and Woodstock butter factories, where they were met by Alderman M. King, Mr. G. F. Cole, Mr. Stewart, and Mr. Boyle, and shown round their institutions, after which they visited the dairy farms of Messrs. J. T. Cole and H. Dudgeon, two of the leading pastoralists in that district.

"In the evening Professor Wallace was given a complimentary dinner by the Kiama Agricultural Association at Evans's Hotel. There were between twenty and thirty gentlemen present, principally members of the Committee. The President, Mr. David Lindsay Dymock, occupied the chair, and the vice-chair was filled by Mr. Alexander Campbell, one of the vice-presidents. After the usual loyal toasts the Chairman proposed the health of Professor Wallace, to whom, on behalf of the Association and the district, he extended a hearty welcome.

"Professor Wallace, in responding, paid a high compliment to the judgment displayed by the gentlemen whose farms he had visited in the selection of their stock, which he described as something to be proud of and worth keeping. What surprised him most during his round amongst the factories was the excellent quality of the butter made at a temperature of sixty-eight degrees."

The **district of Kiama**—of special interest in connection with the recent advances in Colonial Dairying, but more especially in that of N. S. Wales—is situated on a flank or spur of the chain of mountains called the Great Dividing Range, which stretches for a distance of some 1,500 miles along the east coast of the Australian colonies.

These mountains intercept the moisture brought from the Pacific Ocean by the east winds. This accounts for the fact that the eastern coast region, throughout its entire length, is better supplied with rain than any other area in the island continent. No wonder then that dairying should be found to do best in that part of a country, somewhat famous for its want of moisture, where the supply of rain is most abundant.

The region referred to lies in a fertile portion of the rugged and hilly country which stretches along the sea-coast to the south of Sydney. Though the soil is of superior quality, the surface is, as a rule—though not invariably—too steep and uneven for cultivation; but, in addition to this, the facilities for successful dairying are great, as direct railway communication with Sydney exists, and the climate is such that, in most years, grass is abundant, and visitations of times of scarcity through drought are comparatively rare.

It will be admitted that, taken as a whole, the local advantages must be considerable, when at the time referred to the most recently sold land—and that in no way above the average quality—had been disposed of at £39 per acre, the value being estimated at what it was worth for dairying purposes. Even higher prices than this could be quoted in the cases of certain specially-favoured spots.

The holdings are small in this district. Many are only 50 acres in extent; but it was admitted that they could be managed with greater economy were they increased in size to 200 or 300 acres.

Indian dúb grass (*Cynodon dactylon*, Pers.) was seen to lend its help to form the **pastures**, along with British grasses and clover and the natural grasses and miscellaneous herbage of the country. One fact of special interest in connection with the formation of this superior permanent pasture was elicited—viz., that, during the process of formation from new into old "grass," white clover grew most abundantly. With the assumption of the character of old pastures, white clover has decreased and declined in its growth. This is one of the most striking instances of the important office which white clover occupies in the formation of good, permanent pasture—a function which has been attributed to it on more than one occasion by the results of the experiments at Rothamsted.

Butter is the great market product of the dairying of this quarter, the milk being conveyed to small factories, worked on the co-operative plan, and belonging to the farmers themselves. A special rate is fixed for the milk, and paid from time to time as the season goes on—usually one-third of the average price realised for one pound of butter, per gallon, with an addition of a penny per gallon. With butter at 1*s.* 4*d.* to 1*s.* 6*d.* per lb.—the rate ruling in the month of July 1889—the **price of milk** was 6½*d.* per gallon. The average price in 1888 was 7$\frac{3}{16}$*d.*; but the average during the last few years has been about 6*d.* per gallon. Should there be a balance on the credit side of the factory accounts at the end of the year, it is divided among the shareholders—who are also the local milk-producers—according to the shares they possess in the concern.

The **skimmed milk** is sold to the farmers, at ¼*d.* per gallon, to feed calves, or to a contractor who takes the surplus at the same price to fatten pigs—for which purpose it is admirably suited, provided it is not given in a sweet state, as then it is liable to bring on constipation.

The "Pioneer" factory, the first started in the district, was opened in 1883; but it is only within the last three years that the **co-operative factory system** has become general.

The machinery and dairy appliances are of the most approved pattern. Both the Laval and the Danish **separators** are found at work, but the former more frequently than the latter.

At one place a "Baby" (or hand power) Laval separator could not do its work, owing to the rich quality of the milk and the consequent thickness of the cream. The remedy in such a case is to add separated milk to the new milk to dilute it, and the separator will then work satisfactorily.

Owing to the difficulty of getting water cold enough to reduce the temperature of the cream, **churning** during summer is done at about 68 degs. Fahr.; yet the results are wonderfully satisfactory. Though half an hour is about the time for churning in cool weather, the butter comes in about fifteen minutes when the season is at its hottest. Great care is necessary in washing the minute granules—somewhat smaller than mustard seed—to prevent them going together until the buttermilk has been well removed from the butter. The churn, during the first washing, is consequently only rocked without being turned over. The cream goes fresh into the churn—usually the large revolving box or barrel churn—but is left till the following day to ripen.

The amount of milk required to make one pound of butter varies considerably according to the season of the year, and to the quality of the food the cows consume. At times 28 lbs. of milk are required to produce one pound of butter; but the amount frequently falls to 21 lbs., and 23 lbs. to 24 lbs. may be taken as a fair average.

Samples of the Kiama butter have found their way into the **London market**, where they sold readily, in 1888, at 120*s.* per cwt.; at the full "flush" of the grass season (about 25th November) it was reported to be "as good as the best Danish butter." Though this improvement may be said to have begun with the establishment of the first and so-called "Pioneer" factory in 1884, yet this part of the country has for a much longer period been famous for dairying, although it was not dairying of a first-rate order.

An experienced writer* on the subject points out that for many years the use of milk actually became unfashionable, and the man who could not drink his tea without milk or eat his damper (unleavened bread) without butter was thought effeminate, "and that even after fifty years had passed there were districts in which rum was much more plentiful than milk."

It was not till the colony was ninety years of age that butter-makers bestirred themselves to manufacture a superior article of uniform quality, but before this there was excellent butter made by individuals, who, on account of their isolated positions, were unable to realise full value for the results of their labour. This is the position of many small butter-makers in Great Britain and Ireland at the present moment, who might do themselves much good service by taking a leaf out of the colonial book, and adopting the co-operative plan in both manufacturing and marketing butter.

After doing full justice to the Kiama district and its dairying industry, the author was driven by Mr. Morton through a beautiful rugged and mountainous country, arriving about noon on the market-day at **Berry**, where he was entertained to lunch by the local agricultural society.

A further drive of fourteen miles brought the travellers to the residence of Mr. Henry Gordon Morton, agent for Mr. Berry † who owned 100,000 acres in the **Sholehaven district**.

* Mr. J. P. Dowling, the author of an excellent little book on 'Dairying in Australia,' Sydney, 1888.

† Mr. Berry, who was ninety-five years of age at the time referred to, has since died, and left, among other legacies for the public benefit, £100,000 to the University of St. Andrews, Scotland.

This property lies on a splendid alluvial plain which stretches from the base of the hills that had been crossed on the way from Kiama. About half of the estate is let to farmers, who number about 500, and on the liberal conditions under which they occupy their holdings they are contented to remain tenants rather than to take such land as can be secured as freehold property.

The return **journey to Sydney** was begun early on the morning of July 11th.

A beautiful drive of fifty-two miles over two high ridges of mountains and through the Kangaroo valley was much spoiled by a persistent drenching rain, and a close and impenetrable mist on the tops of the mountains. The distant scenery was completely lost, but the roadside beauties, including a waterfall of 600 feet in three falls or sections, were discernible.

The time occupied by the way was from 7 a.m. to 1.50 p.m. Owing to the roads being soft and muddy after the rain the last four-and-a-half miles had to be covered at a hand-gallop to catch the only train of the day at Moss Vale, for Sydney. The effort was successful but without a minute to spare, and Sydney was reached at 5.30 the same evening.

In Sydney visits were paid, in company with Mr. Bruce, the Chief Inspector of Stock, to the **Meat-market** at Darling Harbour, referred to in another place, and to the **Ram sales** at Messrs. Goldsbrough Mort & Co.'s rooms. The highest-priced sheep, bought by Mr. F. B. Suttor, brought £300, and was an excellent specimen of a Merino with a dense even coat of wool, great breadth of shoulder and well-developed hind-quarters.

Starting at 9 a.m. on July 13th, a run was made into the **Hunter River district**, under the guidance of Mr. Kyngdon, Secretary of the Royal Society, Sydney.

The railway running north from Sydney traverses for a considerable distance the top of a rugged ridge with deep

XIII.—CHARACTERISTIC BUSH ROAD, NEW SOUTH WALES.

ravines on each side, which have probably been formed by the surface falling in after great eruptions of lava had been discharged, at a time when that part of the country was in an active volcanic condition.

The magnificent **Harbour at Sydney** was no doubt formed in a similar manner by the sinking of a portion of the surface crust into a subterranean hollow. This is the most reasonable explanation of the unique phenomena which make the harbour so safe and so valuable ; viz :—the abrupt descent of the shore and the great depth of water close to the land.

The surface formation is of Hawkesbury sandstones overlying the carboniferous coal-measures, which are here found at a depth of about 1,500 feet, but further north gradually come to the surface.

The Hawkesbury River was crossed about 10.30 A.M. An arm of the sea was spanned by a bank and an iron open **Tressel bridge**—the finest in the southern hemisphere, and possessing the deepest foundations in the world, viz :— 120 feet below high-water mark.

The surface of the country is still in a state of nature, growing the natural sombre forest of eucalyptus, with here and there a fringe of wattle-trees where the clearing necessary for the railway had made a gap, or the dense bush with the cabbage-tree-palm (*Seaforthia elegans*) towering above it. The common bracken is to be found wherever there is an air-space for it to occupy.

Seams of **coal** from a few inches to even a few feet thick crop out from time to time in the railway cuttings.

Newcastle, the largest seaport in the colony reckoned from the point of view of tonnage of traffic, was reached about noon.

The work of loading and unloading is done by means of powerful hydraulic cranes—the necessary pressure being given to the hydraulic machinery by an immense iron cylinder 50 feet high filled with 100 tons of gravel.

The night was passed at **Singleton**, and next morning **Archerfield**, the property of Mrs. Bowman, was reached, after a drive of nine miles. The journey involved the crossing by boat of the Hunter River, then in high flood. A day was agreeably occupied in viewing the property and the breeding and grazing stock of cattle and horses.

Time did not permit of an inspection being made of the important **dairying industry** of the Hunter River district; but, as it is being largely developed by settlers who have come from the south-coast dairy district already referred to, the systems employed are practically the same.

July 15th was spent in returning to Singleton and in visiting the vineyard of Mr. Alexander Munro, and the Shorthorn herd and Suffolk Punch stud of Mr. A. A. Dangar of **Baroona**.

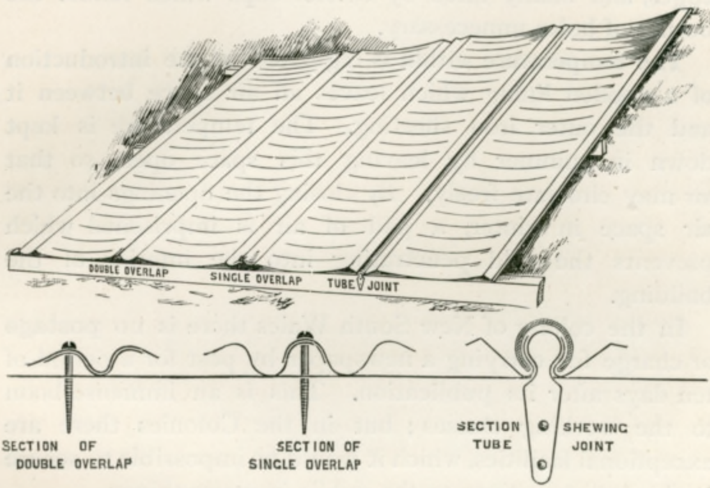
Next morning, after being joined by Mr. J. G. Edwards, one of the three managing Directors of the **Land Company of Australia**, the train was taken to **Ravensworth**, and a visit paid to one of the numerous estates of that company. The object of the company is to purchase large estates and cut them up in areas to suit small occupiers.

The low-lying flat land on the estate proved to be an excellent loam which could be turned to good account, either under ordinary cultivation or under fruit, but the rising ground was an inferior dense clay which would probably tax the patience of the best class of settler.

The houses, of solid masonry, had been built in the early days of the "thirties" by the **convicts**, who worked under the old regulations, by which a land-owner could secure the services of a gang of prisoners under the direction and control of a gang-master or prison-keeper.

A murder had been committed on the place by the prisoners. A relative of a brutal gang-master had been drowned in a pool and the perpetrators of the deed had never been discovered. In fact it was a question whether the death was not the result of an accident. A touching incident occurred in connection with this affair a little while before the time of the author's visit. A letter which narrated the details of the murder after the incident had been all but forgotten, and after the property had repeatedly changed owners, arrived from Melbourne from an old convict on his death-bed. The old man said he had witnessed the deed, and that he could not die happy till he had revealed his secret.

Houses in the country districts are now made of



New Patent Galvanised "Arc" Sheets and Cross Sections, showing Methods of joining them.

corrugated galvanised iron, and in towns also the roofs are usually of this material. Where such a quantity of this material is used one would expect to find the most recent improvements both as regards appearance and durability in course of adoption, but in this the interested visitor is disappointed. The ordinary corrugated iron sheet, which is fastened by means of nails driven through it so that it in time becomes weakened and corroded at the joinings, is the common roofing employed.

The "arc" sheets shown in the accompanying figure * are actually less expensive and would have a much better appearance than corrugated sheets. If tube-joints were used in place of nails (as above illustrated by cross sections of the joints of both systems) the work would also be more efficient and more permanent. The tube-joint is most simple. The edges of the iron sheets are turned up as shown in the section referred to, and a tube which has an opening along one side is fitted on to the two upturned edges, and finally fixed by twister clips which render the boring of holes unnecessary.

The temperature within is regulated by the introduction of a wooden lining which leaves an air space between it and the outer iron sheeting. The temperature is kept down in summer by leaving this space open, so that air may circulate freely. By closing the openings into the air space in winter, a pad of air is imprisoned which prevents the cold penetrating into the interior of the building.

In the colony of New South Wales there is no **postage** or charge for carrying a newspaper by post for a period of ten days after its publication. This is an immense boon to the working classes; but in the Colonies there are exceptional facilities, which it would be impossible to secure in this country, given to the public in many things.

School children are permitted to travel free by rail and by tram. Attendance is compulsory between the ages of six and fourteen years if the children are located within two miles of a school or can come by rail. For each child 3*d.* per week is paid up to the number of four or five children; all over that number go free. A premium is thus offered for large families.

If a man is too poor to pay and can secure a certificate

* The Iron and Steel Fencing and Building Company, Limited, St. Vincent Street, Glasgow.

to that effect from a J.P. or a clergyman, he is permitted to send his children to school free of charge.

Government high schools occupy an intermediate position between the Public Schools and the University.

Private schools have been shut up owing to the reduction of the fees necessary to compete with state schools.

Grammar schools which existed before the new education schemes came into force, are also being emptied on account of the lower standard of fees in the Government schools.

Roman Catholics attempt to educate their own children, and do not permit them to go to the public schools.

The night express **train for Brisbane** was taken at 2 A.M. on July 17th.

In passing through the tableland of the **New England Ranges**, much poor land was traversed before a halt was made at Armadale (a cathedral city) for lunch at eleven o'clock.

In some parts there are patches of good land, and the country is dotted with neat little homesteads. **Wheat** grows well at this elevation. The **rust** was reported not to have been so bad as usual for the previous three years.

Maize produces a good crop, except on the rare occurrence of a wet, cold season; and while it lies in bulk it is not liable to be attacked by weevils, like Indian corn grown in other parts.

At **Ben Lomond**, a rough mountainous country of granite rock with large surface boulders, the railway rises to a height of 4,500 feet, but it rapidly descends towards the north.

The train passed into Queensland at Wallangarra, and arrived at **Brisbane** on the evening of July 18th.

CHAPTER IV.

RÉSUMÉ OF THE RETURN JOURNEY FROM BRISBANE TO MELBOURNE.

Introductions in Brisbane—The City—Toowoomba and the surrounding Country—Crops and Climate—Warwick—Mr. Thomas Macansh—Wages of Ploughmen—Colonial Expressions—Canning Downs Station—Burnett Downs—Return to Sydney—Run to the Blue Mountains—Visit to Winbourn—Prickly Pear—Sweet Brier—House Sparrows—White Ants—Homebush Market, Sydney—Fresh Food and Ice Company—Country Milk Company—Orange-Growing on the Parramatta River—Richmond—Middlemen—Railway Rates—Railways as a Means of Developing Distant Parts of a Country—Distribution of Wealth—Railways run at a Loss—Return to Melbourne—Visit to Ballarat and District—Departure for Hobart.

Introductions were presented to the following leading men in Brisbane:—Sir Henry W. Norman, G.C.B., G.C.M.G., C.I.E., (the Governor), Sir Thomas McIlwraith, K.C.M.G., Sir Arthur Palmer, Mr. B. D. Morehead, M.L.A., (the Premier), Mr. P. R. Gordon (Chief Inspector of Stock), Mr. Peter McLean (Agricultural Under Secretary), Mr. W. K. Rose, and Mr. A. D. Walsh.

The **Botanical Gardens** under the curatorship of Mr. Philip MacMahon, form an interesting feature in the city of Brisbane. At the time referred to they were not in show condition, but seemed to possess qualities which would prove attractive at the proper season.

The notice which occupied a conspicuous position at the entrance of the gardens—"The gardens belong to the public, and the public are requested to protect their own property!"—was more remarkable for its sense than its suavity.

A magnificent **view** of the city and the river, then in flood, was had from the top of One Tree Hill or Mount Coot-tha, to which Mr. Walsh was guide.

Many of the houses in the hollows—for Brisbane is built on a series of irregular rugged ridges with deep and low-lying hollows between—were standing deep in water, and a horse in a baker's van was actually drowned in the street.

The author left **Brisbane** by the morning train on 22nd July after spending three most interesting and instructive days, in which a vast amount of information was collected and recorded.

The next halt was made at **Toowoomba** the chief town of the important pastoral district of the Darling Downs, which stands at an elevation of 1921 feet on the tableland above the mountain ridge of the great Dividing Range. These mountains form as it were the inner bulwarks of the country running parallel with the coast-line and rising abruptly from the low-lying belt of scrub-land on the edge of which Brisbane rests. All information desired was freely supplied by Mr. G. G. Corrie and Dr. Roberts, sons-in-law of the Hon. James Taylor, the chief landowner in the district, who was also visited.

The character of the immediate surroundings of Toowoomba was learned by driving to a number of typical settlers occupying various descriptions of holdings, and hearing from the occupiers themselves what they had done and what could yet be done by immigrants.

One of the most interesting places seen was that of **Mr. Wm. Crawford** of Crawfordsburn, a descendant of an Irish branch of the old Crawford family of Kilbirnie in Ayrshire, Scotland. Mr. Crawford has been a most successful settler. He believes strongly in a holding of 640 acres for a man with a moderate capital (say equivalent to £1 in the bank for every acre in the holding), or if near town a 320 acres holding.

For the poor man the Queensland **Homestead Act** is one of the best land acts that could possibly be passed. By it a man can secure 160 acres by paying a survey fee of £4, and *6d.* per acre of annual rent for five years, at the end of which time he receives his deed of ownership. All that he wants to enable him to start work is six months' food, a few cows, two horses, a cart, a plough, and a drag harrow.

Maize grows remarkably well in this district; one settler had only lost one crop in twenty-five years. Planting is done by ploughing in the seed-corn every fifth furrow.

Four inches is the usual depth of soil turned over in preparation for a crop of maize, wheat, oats, or potatoes, but the regulation furrow slice in ploughing competitions is eight inches broad by five deep.

Wheat is so liable to suffer from rust that a crop can only be depended on to ripen in a year now and then, viz., about once in seven years. It is usually cut green and made into hay.

Certain varieties of wheat are said to be **rust-proof** and are distributed as such by Government. No doubt it is the fact that some varieties resist disease better than others under certain conditions, but unfortunately a change of conditions may prove fatal to the rust-resisting power.

A sample of rust-resisting wheat from Queensland was last season sown in the nurseries of Messrs. Dicksons & Co., Edinburgh, along with square-head and a few other common Scotch varieties; and in this climate the so-called rust-proof wheat was more seriously injured by rust than any of the home varieties.

It is the impression of the oldest colonists that the **climate** of this part of Queensland is becoming drier and more uncertain than it was in the early days. They say that thirty years ago rain could be depended upon to come by Christmas, but now there is no such certainty.

The **return journey** was resumed on the afternoon of July 23rd, and **Warwick,** a municipal town on the Condamine River, about fifty miles north of the New South Wales border, was reached the same evening. The surrounding agricultural district is one of the richest in Queensland.

Under the guidance of **Mr. Thomas Macansh,** son of the Hon. J. D. Macansh of Canning Downs, the district was seen to the best advantage.

The **soil** has been formed to a great extent from disintegrated blue trap-rock, and is dark in colour. The best soils are found on the hillsides, which present the "corduroy" surface features already referred to in connection with the Bay of Biscay country in South Australia. This land is exceptionally rich, and is said by the farmers of the district to be inexhaustible.

Ploughmen receive as **wages** 17*s.* to 20*s.* a week, with "tucker." **Tucker** is the common name for food, and is one of a series of expressive words in use among the rural population in the country.

The corresponding name for a pack of clothes is "**swag.**" The expression, "humping the swag," or "going on the wallaby track," is used when a man is reduced to walking and carrying his baggage on his shoulder. This is generally indicative of reduced circumstances, as all Australians ride if they can afford to do so. "**Humping bluey**" is for a workman to walk in search of work.

In some parts the wandering population in search of work, or on the way to some other part of the country, forms a serious tax upon the sparsely scattered resident community. In conformity with an unwritten law "swagmen" or "sundowners" who arrive at a station must be fed and accommodated for at least one night. They expect a gratuitous allowance of tea, sugar and bread, and in some places butchers' meat. The owner of a grazing property cannot resist this demand, as during the dry season he is at the mercy of those who for spite might set fire to the run and destroy in a few hours the entire season's food of his stock. Any one caught firing a run is severely punished by law, but the chances of escape are so great in a country of such an immense area that an irate and resolute bushman does not hesitate to run the comparatively slight risk of being found out.

The **Canning Downs Station** contains 65,000 acres. It was offered for sale a few years ago at £3 10*s*. per acre, but fortunately a purchaser was not forthcoming at that figure, which is considerably below its present value.

During a **ride** of nearly forty miles, the chief characteristics of the country and the points of greatest interest on the property were passed in review.

The colonial **saddle** is made with pads in front of the knees, to prevent the rider slipping forward should the horse buck. Saddles without pads are called "Britishers."

Favourite horses are here **sheeted** when they are turned out during winter—a practice fully described in a future chapter dealing with the custom in New Zealand.

The country referred to is excellent for the growth of **lucerne,** and **maize** thrives equally well. One field of eighty acres was pointed out which had produced forty bushels of maize per acre. The straw is left standing in the field, and horses or cattle are turned in to consume it. One great drawback to the extensive cultivation of maize in a country where labour is dear, is the necessity for hand-labour in removing the sheath which encloses the corn-spike. This is work which cannot be done by machinery, and it adds an additional 2*d*. per bushel to the cost of separating the grain from the cobs.

Wild turkeys, or bustards, as they are called, are still fairly abundant in these quarters.

XIV.—CAMEL-TEAM WAGGON.

In use in the far North of South Australia.

The native **curlew**, although somewhat like our own bird of that name in form and in cry, has a short bill, and is rather blind and stupid in the sunlight, as it is a bird of nocturnal habits.

Burnette Downs, an immense out-lying property in the Northern Territory of South Australia, belongs to Messrs. Macansh, Smith, and others. It lies on the waters of the Playford and Buchanan Rivers in Lat. 18° to 20° south, or about the same as Townsville on the Queensland coast—Long. 135° to 137° E. It extends to 8,000 square miles (5,120,000 acres). The annual **rent** paid to the South Australian Government is 2*s.* 6*d.* per mile, or in all £1,000 a year. The number of stock now on the place is 20,000 cattle (short-horns) and 300 horses.

It costs about £2 10*s.* per head to drive 400 fat **bullocks** from this station to Sydney, where they realised a few years ago £7 10*s.* each, and they take seven months on the journey, even when put on rail at Bourke; but the cost of driving, say 1,500 lean bullocks the same distance, is only 15*s.* to 20*s.* per head, and they bring £4 to £4 4*s.* each. Hitherto New South Wales has been the **market** for stock from that part of the country, but it is believed that Port Darwin on the Victoria River will become the great outlet of the future for the Northern Territory of South Australia.

The **land** in this colony lying to the north of Lat. 17° S., is poor, as a whole, and has in many places been abandoned. The soil in the country in which Burnette Downs is situated is a beautiful rich black loam, capable of carrying a large amount of stock if provided with a sufficient supply of water.

Sheep require permanent water in dams, wells, or creeks, at distances of six miles; and cattle require water to be within a range of ten to fifteen miles. On land of this quality fifty head of cattle can be kept to the square mile.

The salt-bush and cotton-bush do not grow on this tableland, which is 1,100 to 1,300 feet high; but there are numerous **saline herbs** which take their place in fattening stock.

The inland fresh-water **lakes or lagoons** into which the rivers and creeks empty themselves, have a rich and luxuriant grass growing through the water, which is locally known as lake-grass. Animals are ravenously fond of it, and get fat upon it in a short time.

The water-holes being **puddled** by cattle are enabled, in a black- oil country, to hold out much longer during periods of prolonged drought.

The watercourses are usually wide and shallow, owing to the level nature of the surface, and large areas are consequently liable to be flooded after heavy rains.

After the surface of the pasture-land becomes trodden down by stock, the moderate rainfall has more effect in producing the growth of grass.

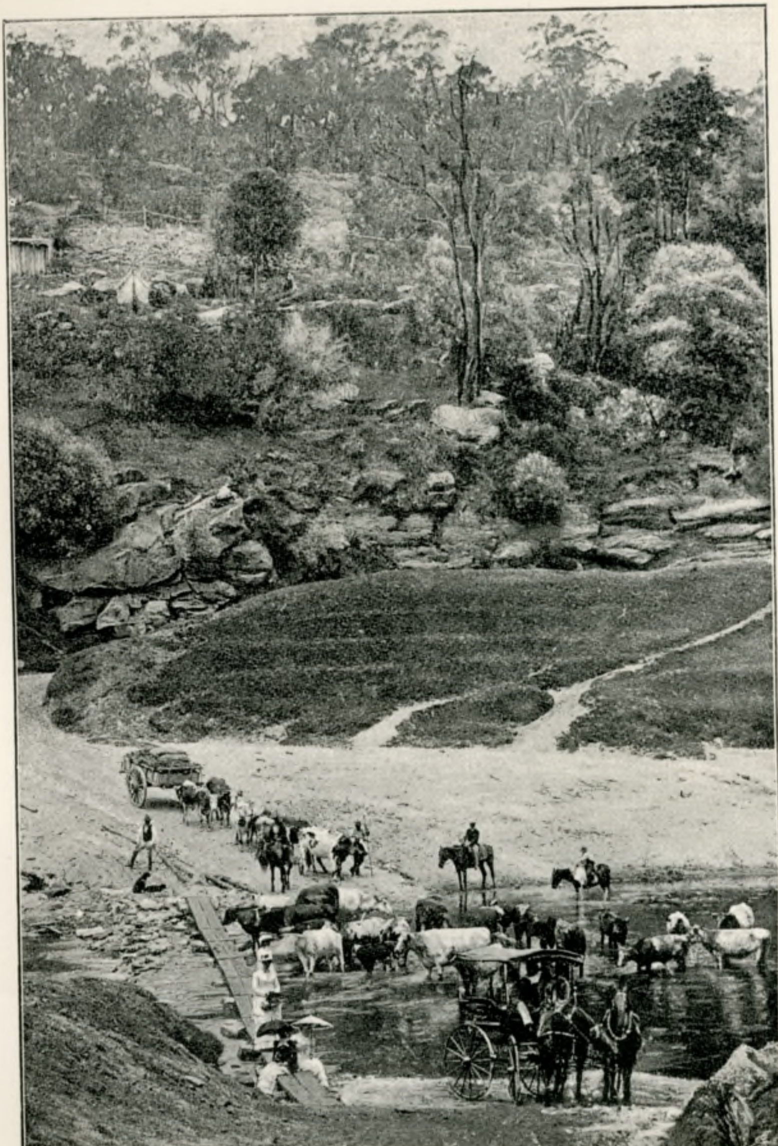
Much of the soil of the inland country possesses a large amount of **lime,** in particles which vary in size from those like grains of sand up to others the size of a pea; and at times they are even as big as a cricket-ball.

There is a great want of solid rocks on the surface, though the lime nodules lie exposed, more particularly on flooded ground.

Wells must ultimately supersede tanks or dams. The latter have been constructed on the Burnette property, each large enough to carry 5,000 head of cattle through a season of drought. They cost about £2,000 apiece, and stand about 21 feet deep when full.

Wells, even far into the interior, can now be made with American boring plant, and fitted with pumping machinery at a cost of £500 when the water is found at from 300 to 400 ft. deep.

The **total cost** of the development of Burnette Downs station amounts to £120,000, and, owing to the death of



XV.—Cattle Crossing Nepean Towers, New South Wales.

one of the partners, the estate may be put in the market and sold to a company that will extend the water-supply and put on a full complement of stock.

From Canning Downs the early morning train was caught at **Warwick for Sydney,** and the borders of New South Wales were reached at breakfast-time.

In the afternoon the famous **Peel River Estate,** with a river frontage of 46 miles of about the finest land in the colony, was seen to the left. The company which secured it from Government undertook to spend a million pounds sterling in improvements, and the question naturally arises: "How long will it take to spend this amount?"

Sydney was reached by the 6 A.M. train on July 26th, and again left at 10 o'clock on a short run to the **Blue Mountains** as far as Mount Victoria. The time in the outward journey was agreeably spent in the company of the Hon. W. H. Suttor, Vice-President of the Executive of the Legislative Council of New South Wales, the Hon. Geo. H. Cox, and Mr. W. C. Abeckett. Mr. Suttor's grandfather went out to the colony with Sir Joseph Banks in 1801, and was entrusted with the introduction of hops, oranges, and various other fruit-trees and crop-plants.

Before reaching the first zigzag, the railway passes through the magnificent alluvial valley of the Nepean, which at its lower reaches is named the Hawkesbury.

The valley seems to have sunk in the same way as the bottom of the harbour, leaving the mountains so steep and abrupt that the railway could not be constructed except in the form of a zigzag.

The railway cuttings expose the *débris* left by an ancient dried-up river, the bed of which is indicated by the presence of water-worn stones. Lapstone Hill derived its name from its flat rounded stones, which resemble those which shoemakers placed upon their knees in the olden days to beat their shoe-leather upon.

The **purple hue** which rests upon the Blue Mountains, and has given rise to their name, is not unlike that to be seen in autumn in the West Highlands of Scotland, though the colouring is more sombre and heavy.

After an elevation of from 800 to 900 feet was reached, **Mount Loma** and **Mount Wilson** were seen to the right. These eminences, rising to over 3,000 feet above sea-level, are of volcanic origin, and protrude through the sandstone of the district.

On the **return journey** an interesting visit was paid to the **Hon. Geo. H. Cox,** at his property of Winbourn in the Mulgoa district, located at the foot-hills of the Blue Mountains, only a few miles distant from the Western Railway line.

A most complete **system of irrigation** was undergoing construction; but, as the cost of erecting the head-works and laying iron pipes under ground would reach £3,000 for thirty acres of land, the experiment was not one which could ever be followed by the ordinary cultivator.

The **prickly pear** plant grows to the dimensions of a tree in this part of the country, but does not spread as it tends to do in the Upper Hunter. It appears as if something more than is done at present might be accomplished with the fleshy and succulent leaves of the prickly pear during seasons of drought, as they make excellent green food when relieved of the spines which have given them the name of "prickly."

In some parts of America the spines are burnt off before the leaves are given to stock, and in Mexico the mules prepare the plant for food by kicking it to pieces.

The **sweet-brier** is one of the most objectionable weeds in the colder parts of the country, as in Bathurst and in Tasmania.

The *Lantana mixta* is also pushing its way in the Colonies, as it is doing in Ceylon and in the hill-country of Southern India. It was also found asserting its vitality in the rich vegetable growth at Honolulu, where it takes advantage of every opportunity to establish itself among the natural herbage.

House-sparrows have also displayed their most destructive habits in the Colonies. They appeared in the district in question about six or eight years ago, but they have within the last four years (the first two of which were exceptionally dry) developed a taste for fruit. They are rapidly driving out many of the native song-birds.

White ants are most destructive to wooden structures to which they have access. They have greater difficulty with the hard wood of certain trees than with the majority of common timbers. It is said that they have become much more numerous since so many trees have been killed by ring-barking and left to rot on the ground.

It might be a useful expedient to introduce some of the Indian species of the true ant, which prey upon the so-called white ant, and thus aid in the restoration of the balance of nature which has been disturbed by the rough and ready methods of land reclamation.

Sydney was again reached on 28th July, and on the following day in company with Mr. Bruce, the Chief Inspector of Stock, the Homebush sheep and cattle-yards were inspected.

The **market** is held on Monday and Thursday. From 20,000 to 30,000 sheep and 2,000 head of cattle are sold weekly by auction.

The premises of the **N.S.W. Fresh Food and Ice Company** were also visited. This company has now assumed colossal dimensions. It disposes of over 3,000 gallons of milk per day with between four and five tons of butter and 120 tons of ice a week.

Milk, heated to 204° Fahr., then cooled to 56° to 60° Fahr., and finally frozen into blocks, is supplied by this company, for the P. & O. and Orient Royal Mail Steamers.

The **Country Milk Co.** also does a large business in distributing milk, as much being sold in Sydney as 1,500 and 1,600 gallons per day in summer, and 1,000 gallons in winter. The price has usually been about 1*s.* per gallon during winter, but in 1889 it came down to 9*d.*

The cost of carriage of milk per gallon is 1*d.* for thirty-eight miles, 1½*d.* up to sixty miles, and 2*d.* for 120 miles—the furthest point from which it comes.

A flying visit, in the company of Dr. George O'Neill, was paid by boat on 30th July to the **Orange-growing district** up the Parramatta River. Orchards are not nearly so successful on the south as on the north side of the river.

At **Fairmount**, Field of Mars—the first district settled in the colony—an interesting experiment, for the prevention of the attack of the American blight, which seemed so far to be successful, was witnessed. A hole was bored in the stem of the tree, and mercury was poured into it and shut in with a plug, with the intention of causing the tree to be permeated with mercury.

A hasty inspection of the works of the **Sydney Preserving Meat Co.** at Auburn, was made under the guidance of the manager, Mr. Alban Gee, and a visit was paid to the late Mr. Andrew Towne at **Richmond.**

The **land** in this part of the colony is excellent, though undoubtedly too highly **rented.** It ranged from 25*s.* up to £3 and even £3 8*s.* of yearly rent per acre, the growing of straw for the Sydney market having created keen competition for land.

Wheat cannot now be ripened in this part of the country on account of rust, and the great uncertainty of the climate makes agriculture even more difficult than in our own country.

One of the serious drawbacks to colonial advancement is the extortionate charges of the **middlemen,** a numerous and formidable class of social parasites who sprang into existence, at a time when the large land-owners or squatters were making so much money that they did not care to trouble about doing their own business in town, but left it to agents, who have increased in numbers and have grown in power and importance. Now that the squatter has difficulty in meeting his engagements, and would be very glad to do much more of his own business if he were permitted, he cannot throw off the incubus which clings to him like the "old man of the sea."

Squatters cannot, any more than farmers in this country, form an effective combination to maintain their rights; they are located too far apart, their prominent interests seem to be individual interests, and there are jealousies and distrust of each other which make combination impossible until they are driven to extremities. The consequence is that they are deliberately robbed of their property by agents who living in towns band themselves together and pass regulations and resolutions against which the unfortunate producer is powerless.

The agents' expenses on wool amount to $11\frac{1}{4}$ per cent., and there is a charge of *6d.* for commission on a pig worth *4s. 6d.*

The consigner has not only the carriage to market to pay, but also the cost of delivery of the goods; and the amount sold is determined by the carter who carries out the delivery, irrespective of the amount despatched to market, no matter how well that may be attested. An open door, which is said to be much used, is thus left for petty pilfering by the carters and their friends.

Empty bags are not allowed to be returned—their collection would cost the agents too much trouble.

One of the most inexcusable encroachments upon the liberty of the subject, brought about by a combination of middlemen, took place when the government of New South Wales instituted a 1*d.* contract stamp duty. The agents met and agreed to charge each client *6d.* for stamp duty on each transaction, which meant that they would charge five hundred per cent. more than the actual duty without doing any extra work.

The position complained of is graphically described in a little book entitled '*Colonial Couplets*,' and published by Simpson & Williams, Christchurch, N.Z.

"There's a man who plays a paying game,
Whatever he may say—
Whose name is a great and mighty name
Over the world to-day.
Who stands at ease where others fall,
Where others sink can swim;
While those who toil and spin—yes, all
Work, sweat, live, die for him:
He's an absolute ruler, deny it who can,
Our modern monarch, King Middleman.

* * * * * *

There's a trick to swell each big account,
And every little bill,
Each item in the grand amount
Insensibly to fill;
For they charge to buy and then to sell,
They charge for charging, too,
And then charge you for me as well,
Then me for charging you.
'Tis a marvellous science, deny it who can,
The double game of the Middleman.

The cost of **railway-carriage** is another item which is likely to retard the development of the Colonies—the distances up country are so great that an ordinary rate of charges would be prohibitive to inland traffic.

Railways which are built by the colony at the colony's expense ought to be run purely for the benefit of the colony, and not in the first instance to pay a certain rate of interest on the outlay; and the freight charges for long distances should be so reduced that distant parts would not be handicapped to the extent they are at present in the matter of placing their produce in the market.

By the injudicious charge of a high rate for traffic, a country may be kept down to less than half the value it would rise to were it possessed of the market facilities it requires.

There is a natural tendency to an increase in the **value**

of land near large centres of population, to the detriment of the more distant parts of the country. This tendency to a divergence in value of different parts of a country on account of locality may be said in one sense to be natural, but it is in an important and more fundamental sense purely artificial ; or to put it plainly, it is the natural effect of a given artificial cause.

Increase of population means in a prosperous country increase of **wealth.** Wealth increases the value of the natural resources of a community merely by its presence. It also tends to draw people into close contact and to congregate them in dense communities. Within limits, no harm, but good, results from this state of things ; but carried to extremes it leads to social evils of the worst description, which undermine both the mental and physical energies of a nation.

The **railway** is the most ready means by which in a new country wealth and population can best be decentralised for the common good. This cannot be accomplished by insisting upon the pound of flesh in the shape of interest on money, expended not merely for the benefit of those who live on the land and send their produce to market, but also for the benefit of the receivers of the produce in towns and all the various classes of the community which live upon the profits earned by these receivers. If the interest on the borrowed capital expended on the construction of a railway is nearly all paid by the producers up-country in the shape of carriage on goods exported and of necessities imported, the burden is not fairly adjusted, because a large section of the community must materially profit by the increased volume of trade to the country, due to the opening up of a new source of production.

Railways in the up-country districts of the Colonies should consequently be **run at a loss** so far as the traffic receipts are concerned, and the balance should be made up out of the common purse of the community—the proceeds of taxation—to equalise the responsibility and to give a chance for the rapid and perfect development of those parts which are geographically distant from the great centres of commercial and industrial activity.

The evening express from **Sydney to Melbourne** was taken at 5.15, and Melbourne was reached at 11.15 A.M. the next day, the 1st of August.

Two visits immediately afterwards paid, one to the Ballarat district, and another to the famous Thoroughbred Stud of Mr. Samuel Gardiner near Heidelberg, will be found referred to in another part of this book.

Under examination, before the **Vegetable Products Commission** in Melbourne on **5th August,** the author dis cussed a scheme for the development of the agricultural education of the colony. He spent the evening as a guest at the inaugural dinner of the Edinburgh University Graduates' Association, and next day sailed for Hobart, Tasmania, in the Union Co.'s S.S. Manapouri.

CHAPTER V.

AGRICULTURE NEAR BALLARAT.

Sir William Clarke's Estate—Points of Interest by the way—The Lake—Gardens—Statuary—Industrial School—Lake Learmonth—Ercildoun—Aspect of the Country—Hills and Soil—The Best Centres—The Management of Sir William Clarke's Estate—The Results of Moderate and High Renting — Houses —Fallowing Land—Number of Horses and Method of Yoking—Capital—Profits—Implements — Yield of Crops per Acre —Prices—The Influence of Rainfall on the Value of Soil.

One of the most instructive and interesting little dètours or excursions from the main route was that to **Dowling Forest,** the estate of Sir William Clarke, extending to about 16,000 acres, and lying within the range of a comfortable drive from Ballarat, Victoria. The visit was made in company with Mr. G. G. Morton, agent on the estate and also proprietor of Labona, the first residence built in the Learmonth district.

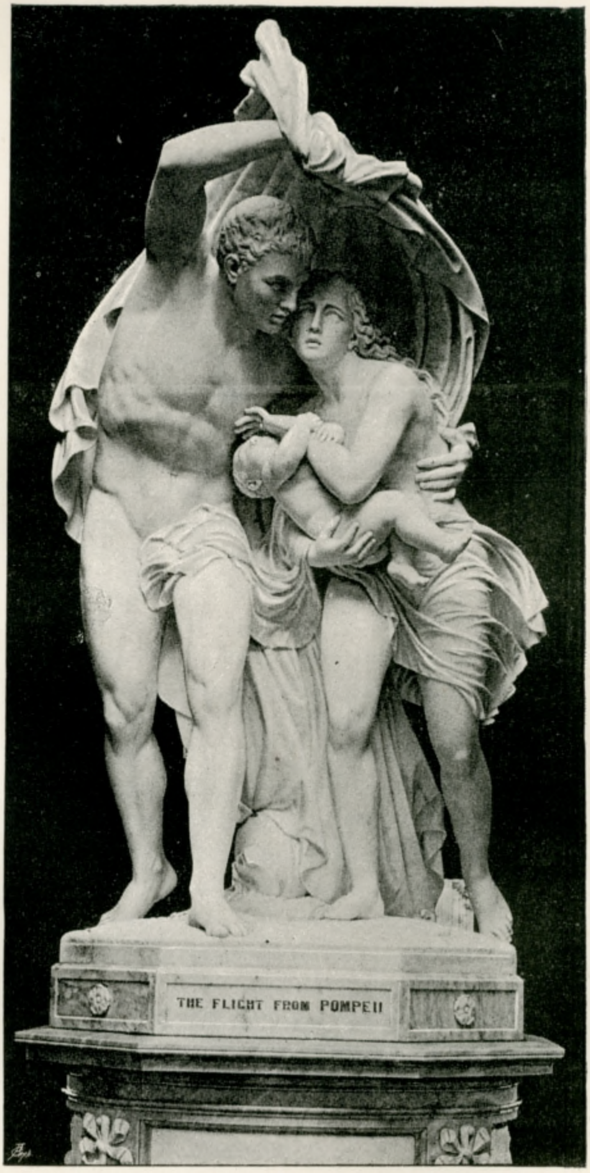
On leaving Ballarat one of the first objects of interest passed was an artificial lake named Wendouree, where there is good fishing and an abundance of water-fowl—ducks, and black as well as white swans. It is a great resort for the people of Ballarat during summer, and over a dozen little passenger-steamers and hundreds of small boats ply on it.

In the Ballarat public gardens, on the shore of the lake, stands an immense and well-stocked fernery, and near by, protected under glass, some most exquisitely beautiful statuary in white marble, presented by Mr. Russell

Thompson, and representing in full life-size figures The Flight from Pompeii, Ruth, Modesty, Susannah, and Rebekah.

Still further west rises the Industrial School, where needy boys are maintained and taught trades. On their leaving at about sixteen or seventeen years of age, employment is found for them in much the same way as similar philanthropic work is so admirably done in connection with our own Dr. Barnardo's homes in London. A few miles out into the country is **Lake Learmonth,** named after Mr. Thos. Learmonth, the first owner of Ercildoun, which property was sold to Sir Samuel Wilson for a quarter of a million sterling, when the former owner migrated into the Riverina country. The lake is now four miles in circumference. The surface level was raised at a cost of about £1,200, by admitting the storm waters of Ercildoun and Mount Bolton. This was to cover the swampy banks and prevent malaria, which was the cause of the death of the wife and five children of the Rev. Geo. Mackie, the first Presbyterian minister stationed at Learmonth some twenty-seven years ago. The shores of the lake are now perfectly healthy and are a fashionable picnic or holiday resort in the proper season. To the west of the lake lies the beautiful estate of Ercildoun. The climate of the district must be favourably influenced during hot weather by the presence of a sheet of water of this extent. The level only falls about eighteen inches by evaporation during the hot season. The land on the banks, although not heavy, is of such a nature that water does not escape by soakage.

The country around opens out into a flat, rich plain of dark chocolate volcanic soil, while numerous low, rounded, bald hills of volcanic origin rise abruptly without any apparent regularity. There are about twenty of these hills in the district, but Mt. Cavern is the only one which shows the form of an old crater. The soil is rich all the way to



A. Flegeltaub, Ballarat.

XVI.—STATUARY IN BALLARAT GARDENS.

the top, and a number of them—Mt. Blowhard, Mt. Hollowback, and Mt. Coghill, are cultivated. Racecourse Hill is another which was specially noticed, as the railway to Wabra (also a beautiful agricultural district about ten miles off) runs along its base.

The chocolate soil covers by far the most fertile areas of the colony in this, its western part, viz., Colac, Wanlabul, Dowling, Wabra, Smeaton, &c. The area of the patch in the neighbourhood of Ballarat is fully thirty-five miles long by thirty wide. Sir Samuel Wilson owns the largest estate of this soil extending to 26,000 acres.

The Smeaton property, 36,000 acres, which belonged to the late Captain Hepborne (a Scotchman), was sold a few years ago, for about £9 per acre, to a company who split it up into farms of from 80 to 240 acres and sold it on the deferred payment system. The company made a handsome profit out of it, while the occupiers are now prosperous.

Sir Wm. Clarke's property is an excellent example of what can be accomplished in a district under a truly liberal and broad-minded policy of estate management, which is not only theoretically good in itself—taking into full consideration the interests of the country and of the population supported by the estate—but practically good and worthy of imitation in the method of its execution. The great secret of success seemed to be that the land was moderately rented at about 10*s.* 6*d.* per acre on an average, with an abatement when it was found necessary to throw any part into grass, to rest, and consequently, to put it out of cultivation for a few years. The estate has been well managed for some considerable time, and that shy plant "prosperity" has had an opportunity to develop and grow in the case of almost every one of the fifty-three tenants among whom the land was divided in holdings of various dimensions to suit the means of the occupiers. The results are to be seen in the contentment and independent position of the tenantry, and the evidences of mutual interest shown by owner and occupier.

The land would no doubt, if thrown open to competition in the market, let at a higher rent, but the natural result when this is done on an estate which has gained a reputation for broad and liberal covenants, is for outsiders to offer more than the land is worth, to gain as they think a footing, while they live in the hope of securing a reduction of rent in the future.

One of the most difficult duties which a landlord has to perform to himself and to his estate is to refuse the tempting offer of a larger income than he has any right to or than the produce of the land can afford as fair rent. Should he give way to the temptation often laid in his way in the form of private, irresponsible, and badly-matured offers of an increase of rent, by neighbours who are jealous of the prosperity of the occupants, a life-long trouble begins. An owner may secure a good tenant now and then from among strangers, but he cannot "plant" an estate with new men and hope to do so satisfactorily at whatever rent he may fix.

The houses on this property are wooden frame houses, and on this account look smaller than a house possessing similar accommodation but built of stone and lime, owing to the extra thickness of the walls in the latter instance. A typical house, consisting of seven apartments, costs about £250, and is suitable for a farm of 320 acres—200 acres under crop.

Arable land is here fallowed every third year to get quit of iron-weed (*Lithospermum arvense*, L.), sorrel, and other weeds. It is necessary at times to lay land down in grass to rest, and then the rent is reduced from 10*s*. per acre to 4*s*., the normal rent of grass-land. The land quickly recovers fertility when allowed to fall out of cultivation in either way.

On a holding of 260 acres three teams of three horses each are required. In ploughing with the usual double furrow plough, they are yoked three abreast, but in unicorn fashion in the waggon, which is the common farm vehicle of the colony. The capital required for such a farm is about £2 per acre; and the returns during the ten years previous to the time referred to in this volume, fluctuated between a gain of £500 and the loss one season of £100. Larger returns were mentioned in a few instances, but these were exceptional.

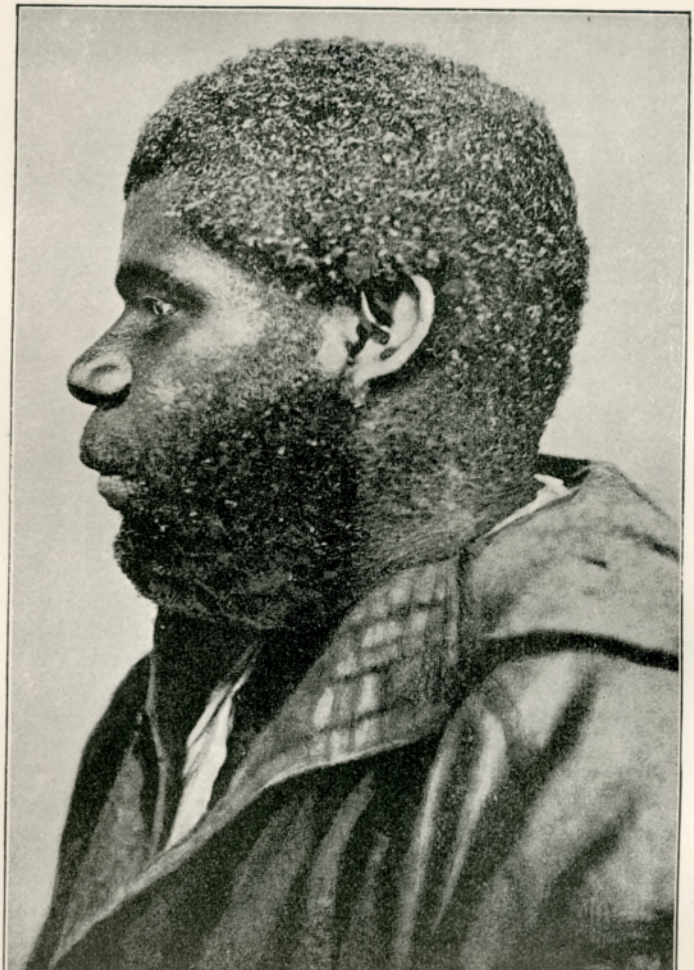
Implements are considerably more expensive than in this country. A two-furrow plough with disc coulters, for work of ordinary depths of six or seven inches, costs £25; waggons £45 to £55; string binding reapers £70.* The common makers being Hornsby, McCormick, Harris, Howard, Wood, and Massey. The last machine has only recently come into favour.

The quality of the dark chocolate volcanic **soil** of the districts may be judged of by the **returns** got of the various crops per acre without manure, worked under the system already explained. Oats give thirty to fifty, and sometimes ninety bushels; wheat twenty-five to thirty-five bushels; and grass two to three tons of hay, per acre. One paddock was pointed out which had been continuously under cultivation for forty-five years; although the yield was not now above an average, in the time of Mr. W. J. T. Clarke it grew sixty bushels of wheat per acre. This shows the wonderfully rich character of the soil, but it is at the same time a distinct indication that fertility declines with too close cropping, and that even on the best land the various means of restoration practised in Europe must sooner or later be resorted to.

The prices which had ruled during the two or three years previous to 1889 were most satisfactory to the farmer, and

* This seems an enormous price when the light steel binder, made by A. Harris, Sons, & Co., Brantford, Canada, is produced wholesale in a protectionist country for £28 each.

were to some extent accounted for by proximity to a large market and by the preceding seasons of drought. This district is favoured by a more liberal supply of rain than some others, and no doubt the lighter coloured chocolate volcanic soil to the north-east of Melbourne, and traversed by the railway on the way to Sydney, would, but for the deficiency of rain-fall, be almost if not quite as good as this darker variety.



XVII.—WILLIAM LANNE ("KING BILLY").
The Last Man (Aboriginal) in Tasmania. Died 1869.

CHAPTER VI.

RÉSUMÉ OF ROUTE IN TASMANIA AND NEW ZEALAND.

Australia left—Tasmania and its Climate—Products and Inhabitants—Arrival at The Bluff—Visit to Morton Mains—Mr. John Hunter Brown—Edendale Estate—Dairying at Edendale and Gore—The Waimea Plains—Sail from Kingstown to Queenstown—Drive from Queenstown to Arrowton—Sewhoy's Gold Dredging Operations—Scotch Churches in the Colonies—By Coach from Arrowtown to Roxburgh—Frosty Weather—General Reid's Relatives—The Reid Concert and its Consequences—Journey from Roxburgh to Lawrence—Gold—Mr. Wm. McCaw—Dunedin—Railways in New Zealand—Taieri Plain—Mosgiel Woollen Factory—Prices of Land—Departure from Dunedin—Visit to Totara, Elderslie, and Windsor Park—Oamaru—Visit to Springfield—Wages of Agricultural Labourers—Crops—Stock—Water-Supply—Christchurch—School of Agriculture, Lincoln—Wellington—Leading Men—Journey, Wellington to Masterton—Inspectors of Stock—Te Ore Ore—Journey to Eketahuna and Woodville—Napier and the Surrounding Country—A Hop Garden—Artesian Water—Journey to the West Coast with Captain Russell—Crops Grown—Manawatu Gorge—Agriculture on the West Coast—Arrival at New Plymouth and Departure from Auckland.

Australia was left at 2 P.M. on August 6th, and the harbour at Hobart made, after a run of 443 miles, before daylight on the morning of 8th August.

The island of **Tasmania**, which is but a little smaller than Ireland, is specially favoured with exceptional and profuse natural beauty, and enjoys one of the finest climates in the world.

The mean **temperature** in summer—December, January, and February—is 62° Fahr.; and in winter—June, July, and August—47° Fahr., while that for the whole year is little over 55° Fahr. The climate of the spring and autumn months is said to be as near perfection as possible. The resident population is healthy and long-lived.

The surface of **the country** is rugged and irregular, and extremely varied in quality and character. The **soil** varies from one of extreme worthlessness to the richest alluvium of volcanic origin, laid down by the many mountain streams which have done their work upon the rocks and stones of the uplands.

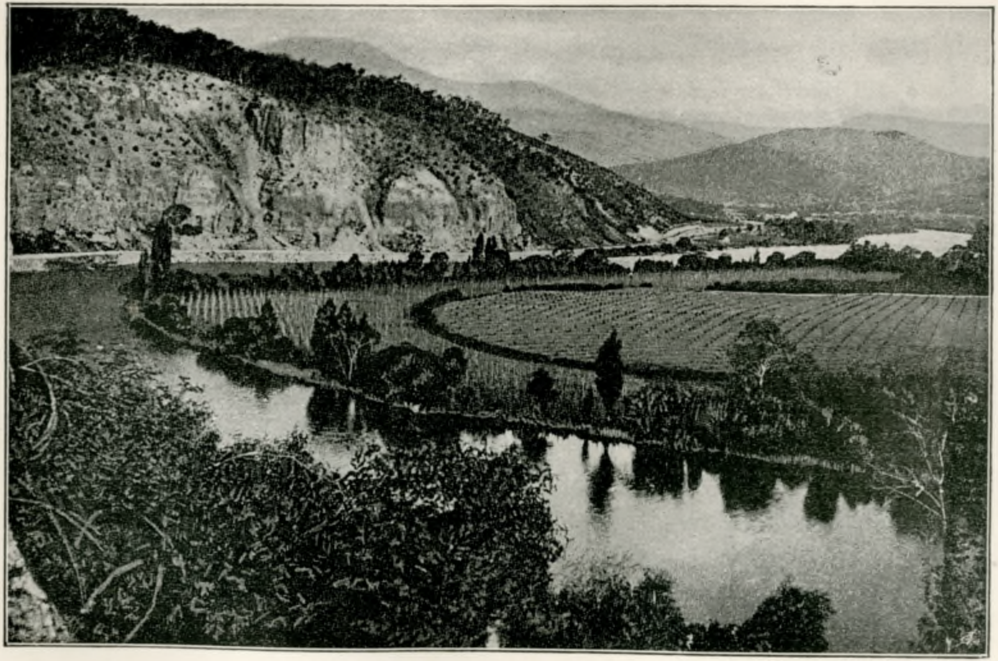
Great profusion and variety of **vegetation** are conspicuous features of the island scenery, the rugged and mountainous character of the country materially intensifying these characteristics.

Tasmania, as will be more fully pointed out in a later chapter, is a famous centre for **sheep-breeding,** more especially for the breeding of Merino rams for the Australian market. The management, no doubt, is good as regards attaining the object in view (so far as the individual sheep are concerned), whatever may be the ultimate result upon the constitutions of the descendants of the sheep in question. The holdings are smaller than in Australia, and more personal attention can be devoted to the breeding flocks than where the numbers are very large. But, in addition to management, there is no reasonable ground to doubt that both soil and climate combine to further the efforts of careful breeders.

Though **Europeans** and domesticated animals thrive remarkably well, their presence ended disastrously for the **aboriginal black population.** At the beginning of this century the race, which was quite distinct from that of the Australian aborigines, or from the Maoris of New Zealand, is supposed to have numbered four or five thousand. It may be said to have died out, as only one half-caste is believed to remain. Two plates are here given of the last specimens of this race, which became extinct in 1876.

XVIII.—TRUGANINI OR LALLA ROOKH.

The Last Aboriginal Tasmanian Woman. Died 1876.



Anson Bros., Hobart

XIX.—The River Derwent and Hop Gardens.

From Pulpit Rock, New Norfolk, Tasmania.

Hobart, the Capital, is beautifully situated at the foot of Mount Wellington (4,166 ft.), on the banks of the River Derwent, which there expands into a magnificent harbour.

The **crops** grown are chiefly oats, barley, peas, potatoes, and hay. As in Australia, wheat suffers from the attacks of rust.

Hops (shown in the accompanying plate) and **European fruits** of nearly every description do remarkably well. One of the most important industries of the island is the preserving and tinning of fruits.

There are general complaints that national improvements in Tasmania do not progress at the rapid rate which is the rule in the main centres of population in Australia, but the **mineral resources** of Tasmania have not yet been properly developed ; when that occurs, trade will expand at a very different rate.

It is surmised that there is a vast amount of **silver** in the mountain regions, which is only waiting the judicious investment of capital to secure it.

There is a considerable part of the country which has not yet been explored, but all indications for the present seem to point to Tasmania being one of the world's most fashionable and favoured spots in the future, and, like Ceylon, one of the fairest gems in Her Most Gracious Majesty's Imperial Crown.

Only one day was spent in Hobart. The remaining 1,050 miles (English) to **the Bluff** in the south of the South Island of New Zealand were steamed across in rather less than four days, the Bluff being reached on the forenoon of Monday, 12th August.

The train was taken to **Invercargill**, and, subsequently, the same evening to **Edendale**, one of the stations of the New Zealand and Australian Land Company, where the time was usefully spent with the Company's manager, Mr. Donald McDonald, who came originally from Campbeltown, Scotland.

The wages of ploughmen were there £1 per week with food, and a few shillings extra in harvest-time, but as much work as possible was let by contract—a valuable expedient where there is so much wet weather and broken time as there is in the South Island, and where it is necessary to utilise the available working hours.

A visit was paid to Mr. A. R. Wallis at **Morton Mains,** distant from Edendale about half an hour's journey by train to the south. The acreage of this estate, which was named after Mr. Morton of Glasgow City Bank notoriety, extends to 35,700 acres, and the **stock** amounted to 25,000 sheep and 1,200 head of cattle. The former included two pure stud flocks, viz.: Border Leicester and Romney Marsh, and the latter the largest pure-bred Polled Angus herd in the islands.

The property was bought by Mr. Wallis not quite four years ago, from the New Zealand and Australian Land Company, at £2 per acre.

The **soil** of the southern part of the island is not of first-rate quality. It consists largely of a clay subsoil and a friable loam which stands in need of liming and good treatment.

During the day spent at Morton Mains **Mr. John Hunter Brown** of Whakaki arrived, and returned with the author to Edendale.

Mr. Brown acted as guide and companion during the whole of the tour through New Zealand until the final departure from Napier for the West Coast on September 4th.

On the Edendale estate is located the largest and the oldest New Zealand **dairy factory.** The **cheeses** are made on the Canadian cheddar plan, and are shipped to London. The produce of the previous year had been sold in London at 56*s*. per cwt. The **milk** is bought under contract from the Company's tenants at 3½*d*. per gallon all the year round; cheese is manufactured for nine months out of twelve, and when the supply of milk is reduced below 300 gallons, butter is the chief product.

In summer the amount of milk rises to nearly 3,000 gallons per day; then work is carried on day and night, and is sufficient to keep about eight men employed. The cheese-room is kept up to a temperature of 65° Fahr. in the cold weather by means of steam pipes.

The **management** is let by contract to a trained English expert, who receives, for accomplishing all work connected with the factory, $\frac{3}{4}$*d.* per lb. for the cheese delivered when about six or eight weeks old.

The cost of carriage to England of 1*d.* per lb., and sundry additional expenses of $\frac{1}{2}$*d.* per lb., reduce the sum received by the Colonial producer to 4$\frac{1}{2}$*d.* per lb. The cheeses weigh about 37 lbs. each, and four of them fit into an octagonal wooden case for shipment.

Pigs are kept to consume the whey, which is valued at $\frac{1}{8}$*d.* per gallon; and the pork produced is sold as "green" pork at 3$\frac{1}{2}$*d.* to 4$\frac{1}{2}$*d.* per lb., or, when cured, at 6$\frac{1}{2}$*d.* to 7$\frac{1}{2}$*d.* per lb. The profits of pig-feeding ought to be good at these figures, but it requires great skill and care to keep a large number of pigs together in a healthy condition.

Churning was there done at 64° Fahr. during winter in churns about three-quarters full.

The **Gore dairy factory** was visited under the guidance of Mr. T. Green on the same day after leaving Edendale. The management was under the direction of an American, who was thoroughly conversant with the most recent improvements in cheese manufacture, and performed the kind of work which ought to be made universal among the New Zealand dairymen.

The **cheese** at this factory had been sold at 5$\frac{1}{2}$*d.* and 6*d.* per lb. cash.

In the part of the country referred to, the **milk** secreted in spring yields 9 to 10 and even 12 per cent. of cream; in summer 14 and 15 per cent. In autumn the cream does not improve in percentage of butter as at home, but goes down in quality, owing to want of shelter for the cows.

The amount paid in this factory to cover all work and management was 7*s.* per 100 lbs. of cheese packed in cases.

The shipment of **New Zealand butter** to England has not proved so successful as the corresponding trade from Australia, but the New Zealand Government has been persuaded to grant £250 to pay the expenses of an expert to travel home with a consignment of butter, and investigate by the way the weak points in the management on shipboard.

The afternoon train from **Gore to Kingstown** was taken, and before darkness set in we had crossed the **Waimea Plains**—where the New Zealand Agricultural Company spent beyond recovery a large sum of money belonging to widows and others in Edinburgh.

An agreeable sail of twenty-four miles from **Kingstown** to **Queenstown**, on Lake Wakatipu, 1,000 ft. above the sea-level, brought the evening of 14th August to a close.

The next day a détour was made, during the course of a twelve miles' **drive** through a rugged and mountainous country from Queenstown to Arrowtown, to see the successful dredging operations which had been started by **Sewhoy**, the great Chinese speculator, in the bed of the River Shotover at Arthur's Point.

The **dredger** cost £2,200 to place it at work. It was then lifting and washing fifty tons of gravel per hour, and the return for the week had been 100 ozs. of gold.

A set of powerful iron buckets on an endless chain lifted and emptied the gravel from the river-bed on to the upper end of an inclined shoot with a double bottom. The upper bottom was constructed of perforated iron through which the gold and sand dropped on to the second bottom placed one inch below it at the lower end, but at a greater distance at other points further up. The lower bottom was lined with coco-nut matting to retain the gold, and was three inches shorter than the upper bottom, to enable the water (with which the shoot was copiously flooded) and the sand to pass.

The upper perforated bottom or coarse screen was lifted every second day to remove the larger pieces of gold found resting upon the coco-nut lining of the lower bottom.

A return shoot or trows placed below the first, inclined in the opposite direction and possessed a coco-nut lining which held the finer particles of gold and allowed the sand to go with the water.

The gold and other residue was next washed in a plush-lined trows to remove the last traces of sand and mud, and the cloth bottoms were lifted and the gold washed off into a tub or barrel in which **mercury** was then poured, for the purpose of forming an amalgam with the fine gold dust. The free mercury present was got quit of by pressing through a chamois-leather skin. The amalgam left in a ball within was heated in a crucible, to drive off the mercury. It required also to be refined to get rid of the other metals taken hold of by the mercury.

A 15 H.P. engine kept the work going night and day with the exception of Sundays.

It is strangely interesting to a Scotchman who appreciates the nicety of distinction with which the **Free Church** is separated in its ways and actions from the **Established Church of Scotland**, to see that the representatives of the two churches are one and the same people in the Colonies.

A little **girl**, in service at the Royal Oak Hotel, Arrowtown, who had never been away from her native village, put the whole matter of sectarian distinctions in a nutshell when she pointed out that "Although there's lots of things they differ in, they all agree in being frightened for the same place!"

An early start was made from **Arrowtown**, as eighty-four miles had to be covered in the day by coach, before reaching **Roxburgh.** The **road** lay down the valley of the Molyneux River, a deep and rapid-flowing stream accredited in Sir Julius Vogel's 'Anno Domini 2000' with vast stores of gold.

Protracted **frost,** which was still hard and keen, had so bound up the supply waters that the river had fallen lower than it had been for many years.

The Chinamen in large numbers, taking advantage of the circumstances, were washing the gravel by the water's edge in hand-rocking or cradle-washers.

Gold is thrown to the sides in a strong-flowing river, so that unless held by a stone or boulder, it is not, as might be expected, found in the bottom of the channel.

The drive from Roxburgh to Lawrence occupied six hours—from eight till two o'clock.

Moa-flats were passed, where the bones of the **extinct Moa** (*Dinornis*) were discovered in large quantities by Sir Julius Von Haast.

The coach-driver for part of the journey from Arrowtown claimed to be a lineal descendant of **General Reid,** who left a large sum of money in the hands of trustees to support the Chair of Music in Edinburgh University and to defray the expenses of a great annual memorial concert —the well-known Reid Concert. Had General Reid not utterly neglected the claims of his near relatives in favour of schemes which, however good in themselves, ought to have had a secondary place in his consideration, the energy displayed by various interested parties in wrangling over the spoil might have been expended in a better cause.

We look with a natural feeling of resentment upon the action of a man who robs his nearest relatives and heirs of the wealth which fate placed in his keeping, not merely as an individual but as a leading member of his family or clan, in the vain effort to perpetuate the remembrance of his name by building a church, or erecting some less sacred or even vulgar monument, or, forsooth, by endowing a concert fund, so that what he is pleased to called a symphony * may be repeated annually to his memory. A man has no moral (in contradistinction to legal) right to lower the chances of success of his relatives or his descendants in the next generation by sacrificing the products of his superior good luck or good fortune and possibly superior brain power, merely to gratify a whim of his fancy.

Men do not succeed by their own unaided individual powers, but by the good-will of their fellows and by the assistance rendered by others as well as by their own efforts. It is the **duty of each successful member** of a family to aid its honest, but unsuccessful and poverty-stricken members. Probably the great man of the future, if means be supplied for his development, may be descended from the man whose luck is down for the present.

The struggle for existence is now so keen that the members of each family are bound to stand shoulder to shoulder and fight for their common interests. A man who becomes, in his personal estimate of himself, superior to his own "kith and kin," and who claims for his individual qualities alone the credit of his success, is **an Egotist** to be regarded with contempt.

The **action of the law** through the instrumentality of Royal Commissions, has recently shown how futile is the effort of an individual to perpetuate his name by a charity or a bequest. The sacred rights of a will which places property in trust for a public object, are now in certain instances reduced by law to twenty years—to something considerably short of one generation. At the end of this time the capital may, in a vast number of cases, be devoted to

* By the will of the late General Reid a symphony composed by him, in which General Reid's March, "The Garb of Old Gaul," occurs as one of the movements, is bound to be played annually at the Reid Memorial Concert given in Edinburgh.

some object with which the testator had even less sympathy than with the natural heirs whom he so short-sightedly and shamefully disinherited.

Possibly if **the shade of General Reid** were able to contemplate his descendant in the position of a coach-driver and at the same time to hear the wrangling over the property which was dedicated by him to what he imagined was the cause of classical music, it would be thoroughly ashamed of the action of the testator.

Returning to the journey from Queenstown by coach, it was made all the way in a bright, hard frost; as keen as the frost of a Scottish winter. To the right and left the steep and comparatively barren, micaceous hills were rich in gold; samples had been washed from their original position in the quartz-veins of the rocks and were to be found in almost every mountain stream.

Gold dredgers were frequently passed, moored in the current of the River Molyneux, with in each case an undershot water-wheel placed on each side as the sources of power.

Lawrence was left by train at 2.50, and Dunedin reached at 7 p.m.

At Glenore Station the author and his friend (Mr. Brown) met by appointment a remarkable man in his own quiet way, viz., **Mr. William McCaw,** the author of a much-prized, small theological book, named 'Truth frae 'mang the Heather.' This man was for forty years a shepherd in the wilds of Dumfriesshire, in the native parish of the two travellers.

Mr. McCaw went out to New Zealand about ten years ago, and, while farming is his means of livelihood, he spends much time in the conducting of public religious services; for which work he displayed much aptitude among his countrymen before he left Scotland.

By a happy coincidence the Rev. **Principal Rainy** from Edinburgh, the leading diplomate of the Free Church of Scotland, who was doing a kind of triumphal procession through New Zealand at the time, was in the train with the author.

Only Mr. McCaw was introduced to the Principal. It seemed like a special dispensation of Providence, as a reward for faithful services in the great cause, that the old shepherd, somewhat attenuated by advancing years, with his Scotch plaid of genuine homespun shepherd's tartan over his shoulder, should have been selected to be presented to the distinguished Churchman out of the crowd of elders and enthusiasts in church matters who had assembled at the station to get a glimpse of the Principal as he passed.

While at **Dunedin** Mr. Brown and the author were driven by Mr. Thomas Brydone, the Manager of the New Zealand and Australian Land Company, round The Peninsula by way of Portobello, a distance of about thirty miles.

The Peninsula is a famous **dairying district,** and the cows—mostly of the Ayrshire breed, with, in some instances, a dash of Alderney and Short-horn—are light and small, to suit the steep and rugged nature of the pasture.

The **railways** in New Zealand (all on the narrow 3 ft. 6 in. gauge) are not managed with a view to develop the resources of the country so much as to secure interest for the money invested in their construction ; for example the carriage of one ton of oats or other produce, from some parts of the interior of the country to the nearest port where there is no competition by steamer, costs 30*s*. per ton, or more than an additional rent upon the land.

What a difference it would be to the country if the greatest possible facilities were offered for the shipment of the natural products of the soil,—how wealth would flow into the islands through an increase of foreign trade, and how the crowded population of the towns would be drawn to fill up the country districts !

Another drive was taken under the guidance of Mr. John Hardy Morrison along the south road—the main road into the interior—in a south-westerly direction, to the **Taieri Plain,** a distance of nine miles from Dunedin.

The township of **Mosgiel** (the word originally meant, according to Burns, "red-soil" or "red-land") was visited. Here a most successful **woollen mill** had been erected by a grand-nephew of the poet in 1870.

The company under which the factory is now worked possesses a paid-up capital of £56,000. It employs about 400 hands—mostly young women. Girls are taken in at fourteen years of age and receive 10*s*. per week. The wages of women vary from 16*s*. to 25*s*., or even more when they work by the piece. Skilled men receive £3 and unskilled workmen 36*s*. to 40*s*. per week—sums which are distinctly above the average of the wages in the colony. There has been no urgent call to reduce the wages during the depression of trade, as the business had realised 10 per cent. on the capital up till 1887, and had since paid a dividend of 8 per cent. per annum.

Land in this township sold in one-acre blocks at £58 for building purposes. Agricultural land near the township is worth £25 per acre to purchase or 30*s*. per acre to rent, but the quality is excellent. Exceptional crops of as much as 110 bushels of oats and 70 to 80 bushels of wheat per acre, have been reaped at times.

Dairy farmers receive 5*d*. to 6*d*. per gallon for **milk** put on rail. The middleman here steps in and secures a substantial profit by retailing it in Dunedin at 4*d*. per quart.

The **plain,** at one time a swamp, was reclaimed by drainage. It is one of a series of straths running up between the ridges of hills in the surrounding country.

Dunedin was left on 20th August by the early train for Totara, and the morning being beautiful a magnificent view was had of **Port Chalmers*** and the scenery of the rugged and precipitous coast, as the train wound round the curves cut far up in the face of the Blueskin Cliffs which command the entrance to the harbour.

From Totara, one of the stations of the New Zealand and Australian Land Company, which will be described in a future chapter, the party were driven by Mr. John MacPherson, the Manager, to **Elderslie**, the property of Mr. John Reid, extending to 37,000 acres of freehold, which had been taken up twenty-six years before, and reclaimed from tussock grass.

The annual area of grain crop amounted to 4,000 acres, and of turnips 2,500 to 3,000 acres—the work being mostly let by contract.

Mr. Reid secured thirteen prizes (six being firsts) from fifteen entries at Melbourne Exhibition.

The chief **stock** seen were short-horn cattle and stud flocks of from 500 to 700 ewes of each of the three most fashionable long-wool breeds of sheep in New Zealand—the Lincoln, the Leicester, and the Romney.

A flying visit was paid to Mr. Edward Menlove at **Windsor Park,** where a choice herd of Short-horns was shown, among which were the 5th Duke of Alvay, which was champion at Melbourne Exhibition, and Oxford Roan Duke, a bull which turned the scale at 2,800 lbs. (25 cwts.).

The train was joined at **Oamaru,** a town of over 5,000 inhabitants, and a break in the journey to Christchurch was made at Ashburton railway station to pay a visit to Mr. Duncan Cameron, whose property of **Springfield** lay at a distance of fifteen miles from the station.

* Port Chalmers was named in honour of Dr. Chalmers, the Free Church (of Scotland) Divine, who did the early settlers of this part of the country the good service of suggesting that their town should be called Dunedin, the ancient name of the Scottish capital, in place of Edinburgh, its earlier name. It is fair to state that the same suggestion was made about the same time by Mr. Robert Chambers of the well-known publishing firm.

The area, divided into paddocks of 200 to 300 acres each, extended to over 16,000 acres of freehold (besides 4,000 acres of leasehold), consisting of a beautiful rich brown alluvium, resting on a stiff clay sub-soil, and situated near the base of the Southern Alps at the upper end of the Canterbury plain.

This was the largest arable farm visited in the colony. Ninety horses were kept at work in addition to those belonging to men who contracted for ploughing by piece-work—done at the rate of 5*s.* 6*d.* per acre, six inches deep and ten or eleven inches wide.

The **wages** of the regular workmen were £1 per week with food, and a bonus of £8 extra in harvest.

Swagmen, who come round to ask for employment, get 8*s.* to 12*s.* a week and food for doing light work; but even at this low nominal rate the labour is unsatisfactory, as many "loose" men, who wander about the country, spend their wages upon alcoholic liquor and keep themselves in an unsettled mental and an unfit physical condition.

Wheat and other grain crops are drilled to protect the seed at planting time from the increasing pest of small birds, and sixty bushels per acre of wheat have been harvested in favourable seasons. Although larks do not eat grain, they are almost as destructive as house-sparrows, pulling up the young wheat-plant as it germinates.

Rye and Cape-barley (Bere) are grown for spring forage for sheep, and come forward for use after the turnip crop is consumed and before the grass is ready. **Turnips** are sown on the flat in rows with only 1 cwt. of artificial manures per acre, and as much as 34 tons per acre has been thus produced.

The **sheep flock** numbered 25,000, and about 5,000 or 6,000 carcasses are annually shipped as frozen mutton to England.

One of the most interesting improvements was the complete system of **water-supply**, not for irrigation purposes but for the use of stock. Each paddock had its open watercourse, of which there were about sixty miles in extent on the property.

Christchurch was reached on the evening of 22nd August. It was clearly noticeable by the way that the soil of the Canterbury Plain is very varied in quality; bands of shingle or the *débris* from some dried-up river cropping out frequently.

The greater part of the following day was spent in visiting the **School of Agriculture** at Lincoln, in company with Mr. Thos. Acland, who made the time occupied by the drive of fourteen miles both instructive and interesting by communicating information on popular topics, and by the interest he displayed in the efforts being made to improve the agriculture of the Island.

The same evening the boat of the Union Steamship Company was taken at Lyttelton, and the passage from the South to the North Island accomplished during the night.

Wellington was reached at 9 A.M. on Saturday, 24th August. This town, the political capital of New Zealand, is built on a most unsuitable site, in a desolate corner of the southern portion of the North Island; the only redeeming feature, and that from a strategic point of view, being the magnificent harbour formed by a land-locked bay of deep water and elevated shore-line.

Among the **leading men** whom the author met, and to whom he was indebted for information and assistance of the kind he stood in need of, may be mentioned His Excellency the Earl of Onslow, G.C.M.G. (the Governor), Sir H. A. Atkinson, K.C.M.G. (Prime Minister), Sir James Hector, M.D., K.C.M.G., F.R.S.; the Hon. G. F. Richardson (the Minister of Lands, Mines, and Irrigation); the Hon. G. McLean, the Hon. E. C. J. Stevens, the Hon. Matthew Holmes, Mr. Lewis (Under Secretary for Native Affairs), Mr. W. M. Maskell, Mr. Miles, and Mr. F. W. Frankland.

An interesting visit was paid to Mr. Harry Crawford, a former pupil of the author, who owns the greater part of the peninsula upon which the harbour defence fortifications are placed.

Wellington was left on the afternoon of August 26th by train for Masterton. The author's companion on the journey was Mr. E. Clifton, one of the six **Inspectors of Stock** of the six sheep districts into which New Zealand is divided—three of these being in the North and three in the South Island. Although the districts are termed Sheep Districts for convenience, cattle, horses, and rabbits are all under the jurisdiction of the inspectors.

The head of the department is a political head, an arrangement which decidedly interferes with uniformity and efficiency of work.

In addition to the six district inspectors there are 28 **sub-inspectors** of stock in New Zealand. No special qualification is demanded of these men and it would be an enormous improvement if it were made imperative that each sub-inspector before entering upon his duties should pass through the curriculum of the Canterbury College. By this means much information of value to settlers who have not had the advantage of a scientific training would be disseminated.

As a result of the system of inspection **scab in sheep** has been almost stamped out in New Zealand, except in the Kaikoura district of Marlborough where 9,800 wild sheep, mostly suffering from the affection, were shot within two years.

Owing to the wild and broken nature of the district there was great difficulty in getting at these sheep, the men employed to do the work having to camp out on the ground.

The **railway** after leaving Wellington, rises rapidly over a poor, rugged, and wooded country called the Rimutaka Range. The gradient is supposed to be 1 : 14

but in some parts it is 1 : 12. A heavy Fell-engine accomplishes the ascent by gripping a central rail by means of two wheels working horizontally so that one presses on each side of the rail.

At **Masterton** under the guidance of Mr. Daniel Guild, manager of Te Ore-Ore, that property (of about 2,000 acres) was examined, and an ascent made to a rounded green limestone-hill of 4,000 feet, affording excellent views.

Many of the **holdings** in this district are about 2,000 to 3,000 acres in extent. The low land, which has been reclaimed from heavy timber and is capable of cultivation, is worth about 15*s.* of annual rent per acre. The best description of green hill-land will carry three sheep and their increase per acre, the annual return of produce per sheep being about 8*s.*

Eketahuna was reached by train at 1 P.M. on 27th August, and a four-and-a-half-hour's journey by coach to **Woodville** completed the day.

Next morning the Woodville Cheese Factory and a number of small holdings of 100 acres or less were examined in company with Mr. Wm. W. Carlyle of **Broomfields.**

This property extends to about 800 acres freehold, and 500 acres under lease, and carries a stock of 2,500 sheep and 300 cattle. Early lambs by Shropshire rams are produced, and bring about 5*s.* each ; viz. 3*s.* 6*d.* for the carcass and 1*s.* 6*d.* for the skin.

Napier was reached in the afternoon of August 28th.

Six days were devoted to **Napier** and the surrounding country, which included Mr. Brown's property of Whakaki, described in a future chapter.

The time was profitably spent, much information being derived from the following gentlemen :—Bishop Stuart of Waiapu, the Rev. W. J. Habens (Inspector General of Schools and Under Secretary for Education), Mr. P. S. McLean, and others.

Close to Napier there is a wonderfully rich tract of alluvial land, variously termed the Heretanuga or Ahuriri Plains, extending to about 80,000 acres on the banks of the river Ngaruroro.

Three paddocks in the possession of Maoris were pointed out which had grown crops of wheat, maize, and potatoes for thirty-seven years and still produced 60 bushels of wheat per acre in a favourable season. Sweet potatoes or **coomras** are extensively grown for food on shingly land by the Maori population.

A **hop-garden** of 23 acres was managed on the East Kent plan. The rent paid amounted to £250, and a crop of 30 cwts. of hops was gathered from a portion of the ground in the previous year.

The manures used (named in the order in which they were most highly appreciated) were, farm-yard, bone-meal, guano, and superphosphate.

Great difficulties were experienced with fungoid and insect **pests**, but the remedies available for their destruction will be dealt with in the chapter on Implements and Machines.

A drive through the plain was enjoyed on a visit to Mr. John Chambers at **Te Mata**, a property of about 30,000 acres, and the return journey was made through the estate of **Riversdale**, which had been bought at £20 per acre by a syndicate of five gentlemen from Napier, who cut it up into small lots to suit purchasers, and sold it for £30 per acre.

Artesian water could be obtained in abundance by sinking a few feet in the plain. It is supposed to come from the river, finding its way under an impervious stratum at a higher level, and being held imprisoned until a surface opening is found for its escape.

Napier and the East Coast were left on Wednesday, 4th September, and the train taken to Woodville, *en route* for the Manawatu Gorge and the West Coast.

XX.—MANAWATU GORGE, NEW ZEALAND,

WITH A GLIMPSE OF THE COACH ROAD TO THE RIGHT.

The first day's journey was agreeably spent with Captain **Russell** of Flaxmere, Hastings, an enthusiastic Agriculturalist and breeder of thoroughbred horses as well as a politician of distinction.

On the cultivated land south of New Plymouth on the West Coast, and south of Napier on the East, green and purple-top **turnips** are most extensively grown on account of Swedes being so liable to suffer from the American blight. **Mangels** grow remarkably well and are in many places even more certain than turnips.

Roots or rape are now required for the three hardest months of winter, to prevent sheep feeding close to the ground and picking up lung-worms, which in New Zealand, as in Australia, form an increasing source of loss to flock-owners.

The **houses** in the part of the country referred to are almost universally built of wood—on account of the danger of their being shaken or twisted by earthquakes.

Manawatu Gorge was traversed by a four-in-hand coach during a drive of sixteen miles from Woodville to Palmerston—two points which were at the time expected to be united by rail within twelve months.

The early train for the North was taken, and a short visit paid to Mr. J. P. Lethbridge at **Bonny Glen.**

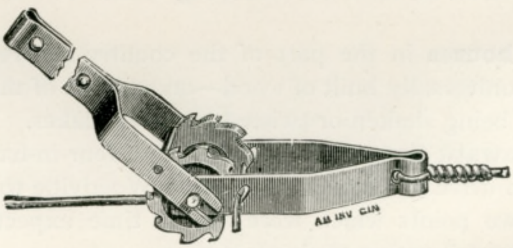
The **soil** and sub-soil in this part of the country are of a heavy clay deficient in lime, the true soil being only about six to eight inches deep. When lying out in grass the land is able to carry two Lincoln sheep per acre, but when turnips are grown, an acre will keep ten sheep for four months.

Finger and toe is unknown in this soil, and the third turnip crop in succession is usually the best.

Lambs fed on newly reclaimed bush-country can be got up to 40 lbs. weight about Christmas time, but such results are only expected for a few years after breaking-in until the wood ashes left after burning the bush become exhausted.

On the property of Mr. J. P. Lethbridge a most ingenious **method of straining fence-wire** was exhibited, viz., that belonging to Reid's * patent "Triplex Permanent Wire Stretcher," which is equally applicable to the straining of wire in fences, in vineyards, or in hop-gardens. The contrivance is so simple and so useful that its existence should be more widely known in such a region of wire fences as the Australasian Colonies. A strainer costs *9d.* and will tighten a wire 60 to 80 roods (or 15 to 20 chains) in length if placed, as it ought to be, midway between the straining posts. The accompanying figure shows the mode of fixing the wire and of applying the tension.†

The next visit was made to Mr. Arkwright at **Overton**



Reid's "Triplex Permanent Wire Stretcher," showing mode of using permanent Stretcher between panels in fences or vineyards.

House, a beautiful English-looking framework mansion, which, with stable and offices, must have cost over £3,000.

* Manufactured and sold by Mr. J. Stewart Reid, Dunedin, and by Messrs. William Bain & Co., Lochlin Iron Works, Coatbridge, Glasgow.

† The right-hand wire is passed through a hole for the purpose at the double end of the hoop-band forming the sides of the mechanism. The end of the left-hand wire is threaded into a hole in the axle of the double ratchet wheel, which acts as a reel on which the surplus wire is wound by the application of pressure to the lever-key, shown in working position in the figure. Motion is given through turning round the ratchet wheel by pulling on the ratchet teeth with the cross bar which passes between the arms of the lever-key. A fresh hold may be taken without fear of slipping if the stretcher is held sufficiently upright to allow the pawl-pin to drop by its own weight to the bottom of the obliquely placed slot in which it works.

A fair value for the land in this quarter was £10 or £11 per acre.

On arrival at New Plymouth it was found that the "Gairloch," which should have carried the passengers for Auckland who had come by train, had left only a few hours before, and that there was no other steamer for three days. It transpired that this was the method of persuasion used by the Steamship Company to induce Government to subsidise the boats on this line.

The remainder of the way to **Auckland** was made in the "Rotorua." Little of the place or its interesting and historical surroundings could be seen ere the departure on the same afternoon, the 9th September, of the "**Alameda,**" the American mail steamer for San Francisco *viâ* Honolulu, and Tutuila in the Samoan group of islands.

CHAPTER VII.

WINE PRODUCTION.

Climate—Emigration to a Wine-Growing Country—General Ignorance of the Processes of Wine-Making—Importance of Practical Experience and Scientific Knowledge—Effect of Climate and Soil on Wine—Early Failure—Wine a Product of Alcoholic Fermentation—Pasteur's Germ Theory—Acid Fermentation—History of Australian Wine—Where exhibited—Distribution of Full-bodied and Light Wines—Wine Districts in the Various Colonies—Rowan and Castella's Vineyard at St. Hubert's—Wine made on a Small Scale—£800 prize—Area and Site of St. Hubert's—Soil—Varieties of Grapes Grown—Preparation of Soil for Planting—Manuring—Conservation of Natural Soil Fertility—Loss to the Soil—Planting the Vines—Pruning—Lime Whitewash—Roots—Maintenance of Vigour by a Vine—Usual Cultivation and Cleaning of Soil—Labour and Wages—Yield per Acre—Difference of Conditions in Different Places—Time and Condition of Picking—Sweet Wines and Light Wines—The Phylloxera—Diseases and Insect Injuries—Remedies; Flowers of Sulphur—Sulphate of Copper and Ammonia Wash—Drainage—Frost—A Typical Wine-Cellar—White Wine—Milling—Pressing—Fermentation—Red Wine—Open Vats—Must and Marc—Colouring-Matter—Racking Off—Storage of Wine in Casks—Fining—Cask Crusts of Cream of Tartar—Acidity and Means of Removal—Comparison between Light and Heavy Wines in Sugar, Specific Gravity, and Alcohol—Silent Spirit Distilled from Marc—Means of Reducing Wines—Fortified Wine—Adulteration by Cane Sugar—Qualities of the Finest Varieties of Australian Wines—Earthy Flavour—Books of Reference.

The Culture of the Vine, and the manufacture from its ripe fruit of that wholesome and invigorating beverage, wine, is usually associated in the imagination of a resident in the British Isles with the natural charms of the "sunny South," with the climate he would wish to call his own, provided he could secure along with it the many advantages, real and imaginary, which naturally rank so high in the minds of most men fondly brooding on the charms of their native land. **While we fully sympathise** with the sentiment, so beautifully expressed by the American poet, "There's no place like home," and, along with a regret that the poem is not British but American, feel, especially in a foreign land, the enthusiasm created by its utterance, yet a stronger feeling of pity for the ignorant poor who misread its meaning, immediately overpowers one. To him who knows the real position of the home-life of the wretched Irish cottier or the crofter of the Highlands of Scotland, who knows the extremely limited sphere, under any possible circumstances, of his power of self-help or ability to contribute to the advancement or well-being of the community, and who at the same time knows by experience what a world of hopeful prospects is being sacrificed by his remaining in that place where unlucky chance or stern fate has thrown him, the significance of the sentiment changes from one of pleasing contemplation to that of profound compassion for the benighted being. The expression was never meant to be descriptive of an unhappy home. It was written on behalf of a home which was new and which had been found by those who had gone in search of it from our own country.

But to return to the subject under consideration, the wine industry of Australia. Though most people are aware that wine is, or ought to be, the juice of the grape, few, not in the trade, have much if any idea how it is produced from the raw material ; and no doubt many will be surprised to learn that the manipulation in the manufacture of good wine is not only difficult, but involves a highly scientific and intricate process which is liable to go wrong at any stage of its development. Excellent wine has been made without the operator knowing anything of the principles involved, or the reasons why certain changes take place. **Long personal experience** and the result of early instruction by those who possess a stock of valuable knowledge derived from the experience of generations in certain professions, have often triumphed over the teachings of science ; but most frequently this has been the case only where science has not been combined with a sufficiency of practical experience to ensure its best effect. **The necessity for a scientific explanation** of all parts of a process of wine-making, whether working well or doing badly, is specially noticed in a new country where new families of operators are taking to it. It is even necessary in the case of experienced operators, because of the change of external conditions and surroundings. Not only does the difference of climate affect the various processes, but the original material, even when grown from the same variety of grape, differs in its character in one country or in one district as compared with another.

Though the wine industry of Australia now bids fair to become one of increasing magnitude and importance, during the period of its early history, its reputation suffered seriously from the want of uniformity of method and from the inferior products which found their way into the market as Australian wine.

Wine is the most important product of the alcoholic fermentation, which takes place in the juice of the grape under certain given conditions, through the agency of myriads of minute vegetable organisms which freely reproduce their species in the liquid and live upon the sugary portions of the juice. By the vital action of these germs, the spirituous principle or alcohol present in all pure wines is produced and left in the liquor, and carbonic acid gas is given off into the air. **Pasteur**, the great French chemist and father of the germ theory of fermentation and disease was the first to point out in his work on beer, the importance of microbes in such processes of fermentation. In the instance of vinous fermentation, he showed that the germs were derived from the surface of the stalks and skins of the grapes, where they aided, along with an accumulation of dust, in forming what is termed the "bloom." This was proved by experiment, by showing that fermentation did not take place in the juice if care were taken that it did not come in contact with the deposits on the exterior surface of the skin; if, for instance, all loosely adhering particles were washed or rubbed off before the grapes were crushed.

The great difficulty of the wine-maker lies in the fact that with defective management deleterious products, such as acetic acid and butyric acid, are formed, or other injurious fermentations take place, and the resulting product is acid or bitter to taste, the bouquet or aroma of good wine being lost.

Australian wine has only recently come to the front as an article of superior quality in the European market. Although it was favourably noticed at the Paris Exhibition in 1864, the amount of wine of an inferior quality which found its way into the market seriously injured its reputation for a time, and brought about the reduction of the area under vine cultivation.

The International Exhibition at Melbourne in 1881 revived the Industry, and since that time it has been growing in extent and importance in such a manner that it is certain to assume the position of one of the most important sources of national wealth to the Colonies. With the steady improvement of the average quality of colonial wine (through those makers who knew least about its production going to the wall most quickly), and with the spread of the knowledge of the real character of the good samples, came the ravages of the dread enemy of viticulture, the Phylloxera, which so seriously diminished the wine production of France that, to meet the demands that she, previously to 1884, was able to supply, the wine-growing resources of all parts of the world were called upon to show what they could produce, and to contribute what they could towards making good the deficiency. In this fashion Australian wines were made better known to the consumer. Great things were expected in this respect of the Colonial Exhibition in London in 1886. Although the wines of Australia fully stood the test of the judges and connoisseurs, yet the general public were deprived of the possibility of becoming familiar with them, owing to an unfortunate want of provision in the liquor contract for the separate supply of the wines of each colony by persons specially interested in maintaining their reputation by exposing none but wines of acknowledged good quality and character.

In the Paris International Exhibition of 1889, the wines from most of our Colonies, in a manner which must have been gratifying to their producers, more than maintained their already high reputation. A grand-prix—one of the seven presented to individual wine-growers who were thought to be the most worthy of all the exhibitors from various parts of the world—was allotted to a Victorian, and this awakened a considerable amount of attention and curiosity in connection with Australian wines.

The interest in colonial viticulture was also shown by the election of an Australian wine-grower as Vice-President of the viticultural section of the International Agricultural Congress held in Paris during the same great Exhibition.

Although wines of considerable strength and body are produced in the Colonies, especially in the more northern and warmer wine-producing parts of them, yet the wine of the southern and cooler regions belongs essentially to the class of light and neutral wines now recommending themselves so favourably to the middle and well-to-do classes of the community. These wines must come into competition with the lighter varieties of

French and Californian wines, and in virtue of their lightness and freshness of flavour are likely to secure for themselves a steadily increasing consumption.

It is now generally admitted by all, save teetotal enthusiasts (whose extreme views not infrequently do injury to their own admirable objects), that the extension of the use of light wines at meals is one of the best means for the prevention of the excessive use of strong liquors so injurious to the constitution.

It is well known that only certain favoured districts combine all the **natural qualities of soil and climate** capable of producing, under any circumstances of management, a grape yielding a wine of superior quality. The resources of the Colonies have already been sufficiently tested in this respect to show that the area of wine production is capable of wide extension. **In Victoria** it has been ascertained that all the "northern territory between the River Murray and the Dividing Ranges," is capable of producing excellent wine. In the Rutherglen district, over 5,000 acres are now under vines, or about one third of the grape-growing area in the colony *—a gratifying increase from 700 acres, the area in 1881. **Gipsland and**

* INCREASE IN ACREAGE OF LAND UNDER THE VINE IN THE AUSTRALASIAN COLONIES.

Year.	1878.	1883.	1889.
New South Wales	4,237	4,478	7,867
Victoria	4,434	7,326	15,662
South Australia	4,297	4,280	7,352
Queensland	605	1,198	1,763
Western Australia	614	725	1,088
Tasmania	—	—	30
Total Acreage	14,187	18,007	33,762

the **Valley of the Yarra** are equally suitable in this respect, and many thousands of acres in the southern parts of Victoria in a similar climate are sure, in time, to gain a similar reputation. **In South Australia** vine-culture is possible as far north as Davenport.

In New South Wales we hear of the favoured regions of the **Hunter River**, and of the capacity of the lower slopes and base of the Blue Mountains for successful wine-growing.

Wine from the Toowoomba district of **Queensland** was favourably noticed in London in 1887, and again at the Melbourne Exhibition of 1888.

Although it was the writer's privilege to see vine-growing and wine-making in all the various Colonies, and at many points by the way, yet the greatest facilities for the study of the details of the processes were offered during a visit of about two days to **St. Hubert's**, the vineyard of Messrs Castella and Rowan, in the immediate vicinity of Yering, on the Yarra, and within thirty miles, north-east, of Melbourne.

In the absence of Mr. Hubert De Castella,* one of the owners, who, at the time, June 1889, was acting as the representative of the colony at the Paris Exhibition, the information on which the following remarks are largely based, was supplied by his son, Mr. François De Castella,† who had made a special study of viticulture in Europe, and who was fully conversant with the details of the work and took a special interest in associating, with the descriptive outlines of the operation, the most accurate reasons for success or failure in carrying it out.

* Mr. De Castella published one of the earliest French books on Australia, 'Les Squatters Australiens,' Hachette, 1861 ; also an interesting little work, 'John Bull's Vineyard,' Sands and McDougall, Limited, Melbourne, which has been referred to with advantage. Since the time of the author's visit Mr. De Castella has sold his share in St. Hubert's Vineyard to his partner, Mr. Rowan, and retired to Fribourg in Switzerland, his native country.

† Mr. François de Castella has since been appointed viticulture expert to the Victorian Government.

The methods employed at St. Hubert's vineyard are described as being typical of the best practices of the manufacture on a large scale of that description of light wine, for which the conditions of the Colonies are in a great measure specially suited.*

It must be admitted that wine made on a small scale with ordinary appliances necessitating much hard working at a slow rate, and exposure to the air in the bruising and preparation of the grapes, is as good if not actually finer than that made on a large scale and worked chiefly by machinery. But small samples, however excellent, are not easily marketed, and the small grower does not reap the full benefit which the excellence of his article ought to confer upon him.

While treating the practices adopted at St. Hubert's as a guide for further explanation, it is proposed to discourse as occasion offers, upon the general principles of viticulture, and the conditions of other parts of the Colonies suitable for its successful practice.

The vineyard of St. Hubert's, extending to 260 acres, is situated on a slope or rising ground stretching up from an expanse of low-lying alluvial land on the banks of the Yarra, and liable, during wet seasons, to become a temporary lake. The vineyards of Yering, and Yeringberg in the same neighbourhood, are similarly situated as to elevation and exposure. They produce the same delicate wine which has gained the foremost place in every great contest. It was the owner of Yering vineyard, Mr. Paul De Castella,

* The best proof of the claims of the choice to the position ascribed to it is the fact that, at the Melbourne International Exhibition, in 1881, the wine made at St. Hubert's secured the prize, valued at £800, presented by the Emperor of Germany, and offered "To an exhibitor of one of the Australian Colonies as an acknowledgment of the efforts in promoting art and industry shown by the high qualities of the goods manufactured by such exhibitor." The competition was thus open not only to wine-growers, but to producers of all sorts of materials in the Colonies. St. Hubert's wine also won a gold medal at the Bordeaux Exhibition of 1882.

one of the earliest Australian wine-growers, who won the Grand Prix at the Paris Exhibition of 1889. **The soil** is fertile, not too heavy, and rests upon a solid clay—conditions admirably suited to the health and successful growth of the grape in Australia.*

The varieties of grapes grown are :—Of Red, Cabernet Sauvignon (imported direct from Château Lafitte), Syra de l'Hérmitage, Pinôt noir of Burgundy ; of White, White Hermitage, Riesling (from the Rhine), Tokay, Chasselas (Swiss variety, *Fondant of Cton. de Vaud*). **Table grapes** are larger and contain more water than wine grapes, but it is a question if they have more sugar.

The land is prepared before planting by ploughing and subsoil-stirring to the depth if possible of about two feet. This is less expensive than and preferable to trenching, as the subsoil, being heavy, cakes into hard lumps if brought to the surface and exposed to the sun one ploughing ten inches deep, is frequently all the deep cultivation the land gets or requires.

Wine is of best quality when the soil is not very rich, and, **manuring** is only practised to a limited extent. Farmyard manure may be applied where it is to be had, perhaps, every eighth or tenth year. Ammonia water from gas-works, absorbed by sawdust, which is spread upon the surface, destroys weeds and has nutritive properties, but it ought to be used with caution to prevent injury to the roots of the vines.

There is no universal rule or line of conduct either for or against manuring. It depends upon the soil, the variety of grape to be grown, and the purpose for which

* Castella says yellow, red, and brown soil, especially if it be a mixture of clay, sand, and gravel, or rotten stones, is the most productive, the colours mentioned indicating the presence of some peroxide of iron. White sandy and stony soil produces much less, but gives fine wine. Of all, the best is a a grey soil, loam and gravel on a sandy clay ; it secures both quantity and quality.

it is to be used. For example, manure is applied in Burgundy, but in Bordeaux* it is not used in red-wine vineyards, as it spoils the flavour. On the other hand, in the same district, white-wine grapes are extensively manured without evil consequences. It is possible that raw bone manure, for which the roots of the vine have a special affinity will in time be found more serviceable than farm-yard manure, which produces a greater tendency than bone to woody development. An effort is made to conserve as much as possible of the natural fertility of the soil, and for this end the **prunings** are burnt and their ashes spread on the land. In some instances, where drainage is necessary, prunings are buried in the bottoms of drains cut two feet deep, to form channels (as in the case of a brush drain in this country), where they may remain effective for ten years. On decaying they return their remaining substance to the body of the soil. **The "marc"** or residue left in the press, consisting of the solid refuse, skins, stalks, and pips, is also put back on the land, so that, with careful management under favourable circumstances, little of value is lost to the soil except traces of phosphoric acid, and a moderate quantity of cream of tartar—bitartrate of potash.

The marvellous success of the **compound manure** sold by Messrs. William Thomson and Sons, Clovenfords, Scotland—the most successful hot-house table-grape growers in the United Kingdom—demonstrates the importance of, and necessity for, a thorough and complete **system of experiments** to be carried out under the direction of viticultural experts, to test the results of various manures in various proportions under colonial conditions. Mr. Thomson has shown that farm-yard manure is unsuitable as a manure for vines on all but light, gravelly

* The soil near Bordeaux is very thin, containing quantities of rounded quartz pebbles.

soils, as it encourages the growth of fungi and sours the land. A concentrated or, so-called, "artificial" manure gives much better results.* Such a manure ought to contain a sufficient quantity of potash to supply that material for the growth of the young wood and leaves. When raw bone is the source of the necessary phosphate of lime it should be in the form of bone-meal or bone-flour, as rough bones are too slow in their action.

Vines are planted in straight rows, so that the heavy part of the work of cultivation may be conveniently done by horse labour. In the southern or humid districts, the **distance apart** in the parallel rows (the plants in which do not zigzag) is about five feet. In the wine-growing regions of the north of the colony the width between the rows which secures the best results is about twelve feet. It is thought that the greater number of vines in the former case are required to throw off from the soil the superabundant moisture by means of evaporation from their leaves.

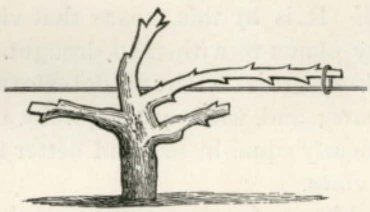
Planting is usually done by setting in the newly prepared ground a scion of the growth of the last season, which possesses at least one bud, in much the same manner as the gooseberry is propagated in this country. In some varieties of vines a portion of the old wood of the penultimate year's growth may be left adhering to the set, but to leave wood of any earlier year's growth may be fatal to the success of the young plant. **The vine** may also be **propagated by layers**, or by bending a young selected bough and inserting it in the earth. When the **training of a vine** is done "gooseberry" fashion, the young shoots are pinched or snipped off while growing by a knife such as could be made out of a discarded scythe blade. **Winter pruning** is done from about the middle of May till the middle of August. Some kinds, as Sauvignon and

* It is not uncommon to find that the Clovenfords's Mixture trebles the weight of grapes within three years after the first application.

XXI.—Grape Vine Trained to a Pole.

St. Hubert's Vineyard, Victoria.

Riesling, require to be "long pruned," as regards at least one leader, which is bent over or tied down to a wire, and carries the greatest portion of the crop. Two buds are left on each of the other truncated horns, so as to provide for a sufficiency of new wood ; these branches also produce from one to three bunches of grapes. As a rule there is a greater liability to leave too little wood than too much in the case of the ordinary vigneron. The shoots growing out of the current year's wood bear no fruit. The branches with fruit always spring out of a bud



Examples of Long and of Short Pruning.

on the wood grown the previous year. The accompanying figure shows a vine six or seven years old which has been winter-pruned. All the buds left might bear fruit, and the yield might be twenty-four bunches on the leader tied to the training wire, by each of the eight buds left developing into a branch with three bunches. The three short arms bearing six buds might give an average of two bunches on each of the six branches produced, making in all thirty-six bunches. The number would be greater if more than three short arms remained, or an extra bud were left to each arm, as would be the case with an older vine. The excision of old and strong boughs requires a saw, but the removal of young wood is most conveniently accomplished by *Averruncators* or *Sécateurs*, which in working act like snippers or short and

Sécateurs.

powerful hooked scissors, but with a spring additional to reopen the clipping blades after each excision. When a twig has to be removed the cut should be made close to the old wood, but where a bud is left the wound should be as far away from the bud as possible to reduce the chances of injury which might result to it from bleeding or escape of sap. To whitewash all that remains of the wood after pruning, destroys any germs lodging in or on the bark and thus aids in the prevention of disease.

Root pruning is unnecessary and is not practical. Roots of vines, an inch in diameter, go down eight or nine feet in light, open soil. It is by this means that vines are better able than many plants to withstand drought.

Healthy vines grow without deteriorating for over twenty-five years; and, while yet vigorous, old vines grow fruit which is nearly equal in size and better in quality than that of young vines.

The vineyard has to be kept **clean** and the soil open by ploughing and frequent scarifying.

The land is ploughed up after the leaves fall, and an open furrow is left between the rows of vines for surface drainage. The furrow slice is not cut deeper than two and a half inches, to avoid the injury, which would result from deep ploughing, to the roots that are located near the surface in great abundance. **Thirty men** are constantly employed at St. Hubert's (which, it should be remembered, possesses an area of 260 acres under vines), in receipt of wages at 15*s.* per week, with food and house accommodation in addition.* The number of hands is increased to 120 for about three or four weeks † at picking-time, when as mixed a multitude of the unemployed from the large centres of population turn out, as may be seen in the hop-

* Bedding is not included in this.

† In 1889 the grape picking at St. Hubert's lasted from 11th March till the end of the second week of April. In the more northern and warmer district of Rutherglen the grapes are ripe a month earlier.

growing districts of England, during the hop harvest. Young vagabonds, old paupers, and indigent shopkeepers who are unable to secure a holiday in any other way, compete for the favour of being allowed to pick grapes.

The average yield per acre is about 250 gallons or roughly one and a half tons of ripe grapes, though in rare instances the produce may run up to four and a half tons. **In the southern**, and consequently colder wine-growing districts of the Colonies, the vine takes longer to **mature** than in the warmer and more northern parts. On the river Yarra, for example, a vineyard takes four years to come into full fruit, though it may yield a small return during the third year. At Rutherglen a crop may be looked for a year sooner.

For the manufacture of Australian wines, such as are likely to be most sought after for exportation, the proper stage at which to **pick** the grapes is when they are in full bloom but not over-ripe. If left till the full amount of the natural sugar of the grape forms, the wine is produced sweet and with an excess of alcohol, too strong for a typical light wine. If grapes are pulled before they are ripe, acetic and tartaric acids will form in the wine.

When a vineyard suffers from a severe drought, the fruit is liable to be small and to contain an excess of sugar. *

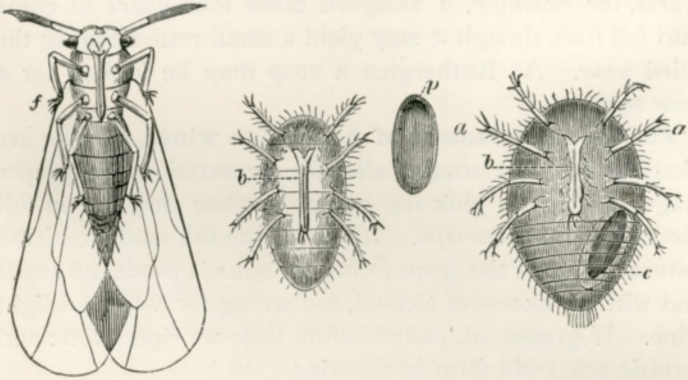
The most destructive insect enemy in Victoria is a small green caterpillar, the larva of the *Pyralis vitana*, which in spring eats the buds when they begin to show fruit, and lodging in autumn in the bunches, destroys the vitality of the fruit.

Though the phylloxera has made its appearance in the Colonies, it has not as yet done serious damage to the wine industry. It was immediately destroyed in Victoria, and vigorous means are now being employed for its extirpation

* In 'John Bull's Vineyard' the composition of the juice of a ripe grape is given as eighty per cent. of water, nineteen per cent. of sugar, and one part in the hundred of tartar, tannin, colouring-matter, resin, and oil combined.

in the Camden district of New South Wales, where it has secured a footing.

To destroy the phylloxera it is essential to root up all vines that have been attacked and to plant some other crop upon the land for a year or two until it is quite certain that no vine roots remain in the soil. As the insect cannot live upon the roots of other plants, the total eradication of vine roots means the total destruction of the pest, after which the land may again be planted with healthy vines.



Phylloxera vastatrix (J. E. Planchon). Female specimens and their eggs. *a* and *a* antennæ; *b* and *b* horns or suckers; *c* egg plainly visible in the body of the insect; *p* the egg; *f* winged form of the insect. All greatly magnified.

[Plate borrowed from Mr. Wm. Thomson's 'Treatise on Grape Vine,' 10th ed.]

To prevent its reappearance, scions of the choice and favoured varieties should be inarched or grafted upon **stocks of the American grape vines**, as some of these are strong rooted and defy the attacks of the insect. The foreign stock does not affect the fruit to any appreciable extent in the matter of quality although the quantity of crop in the case of a delicate and shy yielding variety has been immensely increased by grafting on a vigorous stock. The varieties recommended for stocks by Mr. Wm. Thomson are the "Isabella," a popular American grape-vine of great vigour and hardiness and the "Catamba" which is also commonly grown in America. The grapes have a peculiar foxy or musky flavour, but are widely used as dessert and also for making wine.

One of the most general scourges to which the vigneron is liable is that produced by the *Oidium Tuckeri*, sometimes called the "take-all," of the vineyard. This is a minute fungus which, growing upon the leaves and grapes, induces a hard and unhealthy condition of surface and interferes with their development and with the ripening process.

The wine bug appears when the grapes are almost ripe and when it is dangerous to employ anything which might adhere to the grape and injure the flavour of the wine.

The application of **flowers of sulphur** effectually prevents the attack and in the early stages of the growth of the parasite will even destroy it. No less than five tons of sulphur are used annually in the vineyard at St. Hubert's.

Another fungus, *Sphaceloma ampelinum*, produces black patches on the bark, and the vine and leaves shrivel up. In French this disease is called *Anthracnose;* in German, *Schwartzer Fresser*. Injury from this cause is aggravated when there is too much moisture in the soil. **Drainage** is consequently a useful means of prevention. The remedy for the disease is a spray of sulphate of copper dissolved in ammonia.

The Strawsonizer is the most perfect implement used on a large scale for distributing liquid over the surfaces of plant-leaves.

The best and most simple instruments for the application of dry powders to the leaves of trees and vines is **a pair of hand-bellows** invented by Alfred Langlois, and sold along with the necessary et-cæteras by Limozin Brothers and Co., Place Bresson, Algiers, at the moderate cost of half a guinea. The nozzle of the bellows is a pulveriser for reducing the powder to a fine state of division.

The great advantage of this instrument is that it can be worked easily by one man, who places the nozzle under the leaves of the trees or vines so that the cloud of dust which is emitted, settles on the bark and on the upper and under surfaces of the leaves, where it destroys the adult insect-

Insect-Powder Distributer.

pests and their young, as well as the fungoid or vegetable parasites. The dressing-powder is carried by the labourer in a canvas bag slung over his shoulder.

The ammonium copper-sulphate solution is adopted almost universally by grape-growers, and it is even made obligatory in countries—such as Switzerland—where government rightly interferes with individual neglect which might lead to the undue increase of insects or fungoid pests. It is the means now used in Europe to combat the recently introduced invader, which is almost as destructive as the *Phylloxera*, viz., the mildew, *Peronospora*, which was introduced with American grape-plants, and now seems to have established itself permanently.

Spring frost, which may occur, is perhaps the worst enemy of the grape-grower. In some parts where the vineyards lie near to marsh-land, a canopy of **mist** rises during night from the low-lying humid ground and protects the tender shoots of the vines sufficiently to prevent the destruction of the tender growth until the air is warmed by the direct rays of the sun.*

The typical wine-cellar, or block of buildings in which the juice of the grape is manipulated, consists of **vaults** usually sunk completely or partially in the ground, and, if the foundation material on which the building is erected is not adhesive clay or rocky substance, the walls require to be faced with masonry. The great object in having the vaults under-ground is that an equable temperature of about 68° F. can then be more easily maintained. Above the vaulted chambers are located the **press-room** and the **fermentation-room**, floored with concrete, and furnished with the necessary implements.

Active operations in the cellar last only for about six weeks.

As the process involved in the making of white wine differs considerably from that adopted in the case of red wine, the details will be, so far, discussed separately.

White wine grapes are taken from the baskets of six or seven pickers and packed into a **wooden drum,** strapped

* See 'John Bull's Vineyard' for a description of this and of the artificial means used to afford protection against frost.

on the back of one man, in which they are carried to a one-horse dray, where they are packed into boxes that contain about 170 lbs. each. From these they are transferred to the **grape-mill** or crusher, (*fouloir*) which possesses two grooved or **fluted iron rollers** (one moving more quickly than the other) between which the grapes are bruised and then passed on into a large flat-bottomed tub. **The broken grapes** are then shovelled into two presses at opposite sides of the tub. The part of the crushing process, which at one time involved **treading with the naked feet** after the grapes passed through the mill, is now dispensed with in most large cellars.

Considerable pressure is applied, and the juice (now technically called the "must") is run off from the solid matter, by much the same method as that by which whey is pressed out of curd in cheese-making. This stage of the work may occupy sixteen to twenty-four hours before the "marc" or solid matter is dry, but it is always best when it can be accomplished in the short space of eight hours. To expedite the process, the pressure has to be removed and the marc repeatedly stirred up to admit air, so necessary at this stage in the manufacture of white wines, and to induce the flow of juice. This juice with that which came directly from the broken grapes, before they entered the press, is passed by a tube into the **cask,** in which it **ferments** for a month, more or less, and in which it is afterwards stored. Casks are left covered, but with a bung-hole open to allow of the escape of carbonic acid which comes off in large quantities. **Fermentation** dies out naturally and then the cask may be filled up, although some wine-makers prefer to let it remain without being disturbed until racking-off time. **The only object to be gained in filling up** the empty space is the exclusion of air from the wine; but the layer of carbonic acid gas which, in virtue of its density being greater than that of air, rests as a lid upon the surface of the liquid, is generally sufficient for this purpose, unless in the case of wine of extreme weakness which is liable to develop acidity.

Red wine was at one time fermented in open vats,* but now these are closed in, and each has a syphon with one end inserted into the lid, while the lower end opens under water so that carbonic acid gas can escape, but no air can pass up in return. **Open vats** have a tarpaulin thrown over them to keep the surface of the must bathed in carbonic acid. It has to be racked off sooner than in the case of the closed vats, to avoid the danger of acetic acid fermentation. **A moderate amount of fermentation** then goes on quietly in the cask ; carbonic acid escapes into the vault, so that it is unsafe to enter without a light, which serves to indicate if the atmosphere is unable to support life.

Red wine is most commonly made by a lengthened process of fermentation of the entire grape in a vat—solid and liquid parts together, and at times the stalks also. The capacity should not exceed 1000 to 1500 gallons. If vats are too large the temperature rises unnaturally, and other products are manufactured in place of alcohol.

The must is left in the vat for five to seven days, when weather and must are perfect and when fermentation begins at once ; but with less favourable conditions it may have to remain for twenty to twenty-four days before being racked off from the marc or solid portion, which does not often contain the stalks, as these are taken out by a toothed crusher when the grapes are first broken.

When the stalks are left in the must, they retard the ripening of the wine, although, by virtue of the adhering germs, they hasten the development of the fermentation.

The marc is pressed after the removal of the fermented juice. **The skins** are not only a vehicle for the germs present in the bloom, which encourage fermentation, but they contain **tannic acid**, which is useful in precipitating

* Burgundy is made in open vats to mellow the strong flavour of the grape.

albuminous substances that may come from injurious fermentations arising in the wine after the alcoholic fermentation is over.

The red colouring-matter of the skin of the grape is not soluble in the juice, but dissolves in the spirit formed as fermentation proceeds. It is thus necessary for making red wine, to include the skins of the grapes in the fermentation vat during the fermentation of must.

Both red and white wines require to be **racked off** about once every three months during the first two years. No wine ought to be drunk till it is more than **two years old.** Australian wine, if well-made, continues to improve for many years after it is this age.

It is still a moot point whether wines keep better **stored in small** than in **large casks**—say one of 360 gallons capacity as compared with one of 1,500 gallons. A 500 gallon cask is of a convenient and useful size.*

Brandy casks are often used for wine, as they can be secured at a cheaper rate than new casks. The excess of tannin of the oak staves of a new cask is removed by steaming, to prevent it darkening the colour of the wine. The smell of new oak is not objected to; it is even considered *recherché* in Bordeaux wines.

During the first year, the new wines are racked off in the cellar two or three times, from one cask to another, to eliminate the lees, and thus to secure clarification, because the lees are apt to ascend in the liquid through the fermenting influences of a rise of temperature.

Fining is done just before bottling, by adding the white of eggs (eight per hogshead of sixty gallons) or some albuminous mucilage. This combines with the **tannin**, and forms an insoluble network, which falls to the bottom, and carries with it the impurities met with in its descent, mostly

* These cost between 6*d.* and 7*d.* per gallon of capacity. Hogsheads of about sixty gallons cost £1, or 4*d.* per gallon. The Burgundy hogshead is fifty-four gallons.

the remains of ferments. The alcohol also aids in the production of the albuminous network by hardening the albuminous material.

In France, bullock's blood is used by some for fining. **Isinglass** also serves the purpose well.

The hydrated oxide of aluminium ($Al_2O_3 3 H_2O$) is used occasionally. **Alum** is dissolved and treated with a solution of soda or ammonia. When washed it becomes gelatinous.*

A wholesale fining (independent of that before bottling) is effected in many great European wine establishments during the first year, at the time of the first or second racking off (transvasage) above referred to.

While wine stands in the vaults a **crust** of tartrate of potash, or cream of tartar, settles, or rather crystalises out, and forms an inner lining in the casks. It is picked off after it has accumulated for a few years, and sold under the name of **Argol** for about *8d.* per lb.

Acidity can be removed from wine by the use of chalk, or of the neutral tartrate of potash. For example, if the acid in sour claret is tartaric, as occurs when wine is made from green grapes, the common tartrate of potash on being added becomes the bitartrate, and is precipitated as cream of tartar.

Though similar processes of manufacture are adopted in the case of **light and heavy** colonial wines, yet the products differ materially. The Murray wines, for example, are much richer in sugar, owing to the nature of the climate, than the Yarra wines. The specific gravity of the grape juice in the former is 1·15, and in the latter 1·09. While the Murray wine runs up to about 20 per cent. of absolute alcohol, the usual percentage of the Yarra wine is about 10 to 12½, rising sometimes to 14. Bordeaux

* One kilogram of alum dissolved in twenty litres of water and one kilogram of carbonate of soda in ten litres of water are sufficient for a hogshead of wine.

wine contains about 10 per cent. By the British method of classification, which adopts Sykes's hydrometer, the percentages are quite different.*

A silent spirit is manufactured from the **lees and marc**, containing about 60 over proof, or about 91 per cent. of absolute alcohol. This contains at least some fusel oil.

To reduce the percentage of alcohol in a wine, and to transform it into a light wine, water may be added to the must before fermentation sets in. Heavy manuring or long pruning will produce a larger crop, and one possessing less sugar.

Fortified wines, on the other hand, have alcohol added to the natural wine. This gives wine greater keeping power, but makes it liable to a heavy import duty on coming into this country, and renders it unsuitable for the purposes for which light wines are in demand.

Wines are sometimes adulterated in another way, viz., by using a solution of cane sugar to maintain the activity of the grape ferments remaining in the marc, and thereby to increase the amount of alcohol and so-called wine manufactured from a given quantity of grapes.

The finer varieties of light Australian wine are now largely and increasingly prescribed by doctors for certain classes of patients, not only as a mild alcoholic stimulant, but on account of their alimentary qualities. In the latter quality, red wine is considered superior to white. Mr. Hubert De Castella describes a good wine as "brilliant, sound, free from any sweetness, rich in aroma, full and vigorous, but not strong." Of a sample of white wine, he

* Mr. Castella points out in 'John Bull's Vineyard' that "all pure wines made from grapes gathered *at proper times* will be found to range under the limit of twenty-eight degrees of proof spirit." And again, that it has been ascertained "that the average strength of the wines of Western Australia was twenty three degrees, of South Australia twenty-two degrees, of New South Wales twenty-two degrees, and of Victoria twenty-one degrees."

says it ought to be "in taste a perfect unity of aromas, free from sugar, from alcoholic smell—a rich wine, but sound, soft, and mellow, like fresh milk." The distinctive characteristic of Australian wine, a peculiarity which is present in some of the best as well as the worst samples, is spoken of by wine experts as an "earthy" flavour or the flavour peculiar to the wine made from the produce of a newly planted vineyard. If it turns out to be something connected with the breaking in of new ground, it will soon disappear. If it proves to be a peculiarity specially Australian, time and habit or experience will undo the prejudice against it.

The following are a few of the best books of reference on the subject of wine and the vine:

'La Vigne,' par le Comte Odart, an old book, but a classical one, which will continue to remain one of the best and most interesting (3rd Edition, 1861).

'Le Vin,' par Vergnette Lamotte.

'La Vigne et le Vin,' by Chaverondier, an excellent book on wine manufacture (1872).

The 'Cours Complet de Viticulture,' by G. Foex, Director of the École d'Agriculture of Montpellier, is the most complete and useful book as a guide for cultivation, and many of its pages may be read with interest by those who are in no way practically connected with the growth or manufacture of the grape.

'Les Maladies de la Vigne,' par Pierre Viala (1885).

There is one excellent book in English which ought to be in the possession of every one who grows grapes under glass, viz.: 'A Practical Treatise on the Cultivation of the Grape Vine,' by William Thomson, of Clovenfords. Published by Blackwood and Sons, Edinburgh and London. The first edition was issued in 1862, and the tenth edition in 1890.

CHAPTER VIII.

A STATE DEPARTMENT OF AGRICULTURE AND A SYSTEM OF EDUCATION IN AGRICULTURE.

Memorandum by the Author—Enthusiasm in the Colonies regarding aid to the Agricultural Interest—Expression of Opinion by Sir Henry Parkes—Banquet given to the Author by the Agricultural Society of New South Wales—Extract from the Speech by the Guest of the Evening Relating to a System of Agricultural Education—Professor Anderson Stuart's Remarks—A State Department of Agriculture for New South Wales—An Expression of Opinion by the *Sydney Mail*—Agricultural College, Ham Common.

In Sydney, the author had the honour of being asked to prepare a **Memorandum** for the use of Government, setting forth a scheme for the establishment of a State Department of Agriculture in the Colony of New South Wales, and at the same time a scheme for the development of the teaching of Agriculture in the various branches—higher, intermediate, and lower.

Agricultural representation in the Government and Agricultural Education may be said to have been experiencing a "boom" in nearly all of the Australian Colonies about the time referred to. This was stimulated from within by the necessities of the case in each colony, and from without by a modicum of healthy rivalry, at least in the case of the leading Colonies, which were not to be left behind in the race.

The following quotation from the Sydney *Daily Telegraph* of 30th August, 1889, will show with what enthusiasm the movement was urged forward. It is extracted from the account of an interview which the Prime Minister had with a Deputation to him from the Free Trade and Liberal Conference.

"Sir Henry Parkes said that the question of founding a Department of Agriculture had of late received considerable attention from the Cabinet, and it had been decided to take steps towards its accomplishment as soon as possible. . . . He could promise that in a very short time, perhaps within three months, such a department as the deputation recommended would be in existence, probably in connection with the Department of Mines. The announcement that their wishes would be so readily complied with had such an effect upon the deputation, that the chamber, sacred to the solemn deliberations of the Executive Council, rang with three hearty cheers."

The author feels impelled to express his thanks to the veteran statesman of Australia for the all too flattering remarks to which he was pleased to give expression at that meeting regarding the services rendered by him (the author) in this matter. And it is also a matter of profound gratification to him that the movements made have been, so far as it was possible at this early date to be, so much in the direction indicated in the Memorandum presented on the subject.

The Agricultural Society of New South Wales was graciously pleased to entertain the writer of these pages to a banquet given in Sydney on 12th July, Sir John Robertson, K.C.M.G., President of the Society, and ex-Premier of the Colony, in the chair. **It may be mentioned** in passing that the **wines** * presented upon

* WINE CARD.

CHOICEST AUSTRALIAN WINES FROM NOTED VINEYARDS IN THE COLONY OF NEW SOUTH WALES.

Albury Wines.

J. T. Fallon's—Burgundy, vintage 1883; Reisling, vintage 1885; Tokay, vintage 1883; Carbinet, vintage 1883.

Harbottle, Alsop & Co.'s—Ettamogah Red, vintage 1885; Ettamogah White, vintage 1884; Ettamogah Reisling, vintage 1883.

that occasion were exclusively of Colonial production, and that for excellence they would have astonished many a connoisseur of the old world.

The following extract from the speech of the guest of the evening, reported by the *Sydney Morning Herald*, may indicate the outline of the complete scheme of Agricultural Education for the Colony, in his mind at the time. The remarks by Professor Anderson Stuart which follow, show clearly that the authorities in Sydney University are fully alive to the comprehensive functions of that important educational body, and are ready, when the necessary means are provided, to give effect to that portion of the scheme which naturally comes within its sphere as the highest educational corporation in the Colony.

"Professor Wallace . . . . returned thanks to the gentleman who had proposed his health, and cordially and heartily thanked the Agricultural Society of New South Wales for inviting him to the banquet. He felt that the honour they had done him was in a measure personal; but at the same time he could not but notice, and he was proud of it, that they honoured him in a large measure from his connection with the University of Edinburgh, of which he was at present the humble representative. He had been two months in the Colonies, and might perhaps be excused for saying a few words with respect to his general impressions of the country as a whole. He would make no invidious comparisons either here or when he returned to the old country. It afforded him pleasure to notice in this great empire of Australia the enormous advancement that had been made in such a comparatively short time. He might say that he was astonished when he looked at their railways and great cities, and saw what had been done on that continent. They read a great deal about Australia in the old land, but

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Hunter River Wines.

H. J, Lindeman's—Cawarra Hock, vintage 1884; Cawarra Hock, vintage 1876; Cawarra Claret, vintage 1884; Cawarra Burgundy, vintage 1884; Cawarra Shiraz, vintage 1883; Cawarra Muscat, vintage 1884.

John A. Wilkinson's—Coolalta Hock, vintage 1880; Coolalta Hock, vintage 1886; Coolalta Claret, vintage 1886; Coolalta Burgundy, vintage 1886; Coolalta Extra Hermitage, 1880.

no man could understand that country until he came out here and saw that their ways were not only the ways of England, but if anything, an improvement upon them. With regard to the subject with which he was most intimately acquainted, he was afraid he could not use such words of flattery. They in England had long gone past the stage when they had exhausted the natural resources of the soil which were stored up by nature during those pre-historic periods when the wild beasts alone inhabited the earth ; and they had taken to other means for keeping up the standard of their crops to what they considered a good yield. This country had followed their example, so far, in exhausting those natural resources, and he did not blame the people ; but he wished them to try to turn over a new leaf in this direction, and endeavour, by means of improved practice, to get better yields in the future. By education he meant that people here should have the benefit of the experience of the old world, and if they added that to what they already possessed great good would undoubtedly result therefrom. He would divide the system of education into three great branches, lower, middle, and higher. In speaking of the system of education, he would like to make it plain that he did not wish to interfere in the least degree with the teaching already established in connection with the Board of Technology. This was a branch separate altogether from the system he was about to sketch, and one which did an enormous amount of good. Let him begin with the **education of the lower grade**—the education of the masses. The system of government in this colony was one which involved the principle of the greatest good to the greatest number, and in this instance they must begin with that part of education which extended all its various ramifications to the country districts, and to the great masses which were unable to come into the greater centres of population for educational purposes. He then gave an outline of what had been done in the way of spreading a knowledge of agriculture among the masses in Scotland, saying that there they had enlisted the rural schoolmasters in this work. These rural teachers were restricted purely to the teaching of the science of agriculture, not to the art. They preached the principles, and left the practice to men better able to carry it out. By means of this division of labour they were enabled to prevent the different parts of their system clashing. They in England were in the throes of a great change in matters connected with agriculture. England now found that it was really necessary to do something for agricultural education, and last year the Government gave £5,000 to this end. The University of Edinburgh held special classes for schoolmasters. These came and studied agriculture, and went back to the rural districts, where they taught not less than 1,500, including men and boys, with great success.* He would propose something like this for this Colony. Let them make agriculture one of the science subjects in the ordinary school curriculum, and they would then have, he believed, one of the best means for spreading a knowledge of the science throughout the country. If agriculture were added to the sciences taught in the training of young schoolmasters they would be able to keep up the supply of teachers. He would speak next of the **highest grade of education**, that which should be given in their own university as at present established. He did so for two reasons. He believed that they would hear that evening something of this from his friend, Professor Anderson Stuart, who represented the Sydney University. And again, he did not think this part of his proposal was ready to be carried out at once, but could be left to those who were guiding university matters. They would look forward to its being established in the course of about two years, when the other parts of his proposal were carried out. With regard to the university's part of it, they must have a man who had been brought up as a practical farmer, and one who had shown proficiency in the best teaching institutions at home. When they had got this man and established their teaching curriculum, let him be associated with the examining board. It was quite absurd to think that they could get a thoroughly trained man to come out here who would willingly allow his students to be examined by some one who had no practical knowledge of agricultural education. With regard to the third part of the proposal, namely, **intermediate education**, that should be given in a series of farm schools associated with ordinary farms. The Dookie Farm in Victoria was a good one, and he would like to see a farm established on similar lines in connection with the teaching institutions of this Colony. They had not that hereditary knowledge of farming pursuits which was possessed by the farmers in England, consequently in this Colony they needed a series of schools where a study of practical agriculture might be carried on as the first object; the next being the pursuit of scientific agriculture. He would suggest that two school farms should be established, one in the immediate neighbourhood of Sydney, where a thoroughly well qualified man might be placed, whose services might be employed in teaching schoolmasters. Rookwood might form a centre, and a good school-farm might be established on the Hawkesbury River, where there was much better soil. If the Government were to establish such school-

* The members of the Institute of Scottish Teachers of Agriculture that sprang from the classes referred to, now number 230, and the pupils they have under instruction exceed 3,000.

farms, he felt confident that the benefit would be great. He hoped to be able to congratulate them in the immediate future on the establishment of a Department of Agriculture. With the development and teaching of agriculture such as he proposed, it was absolutely necessary that such a department should be called into existence.

"In conclusion, he said it was the duty of the Colonists to be up and doing, so that they might not only maintain their position, but make better use of the great resources of the land in which they lived. He assured them that they in the old country were proud of the Colonies, and looked forward to their development as being the development of their own country."

"Professor Anderson Stuart, in the course of his remarks, alluded to the growth of the university during recent years, and acknowledged the assistance it had received from the Government and the Legislature. In his opinion, a university scheme of education should include teaching fitted to furnish the community with competent advisers in all professional matters, for on the wise counsels of such men depended very greatly the material prosperity and general happiness of the people. While during the first forty years of its existence the University of Sydney did as much good as its limited means permitted, yet only since its teaching was extended so as to include the professional schools had it taken that firm hold on the good opinion of the people that was making it one of our most popular institutions. At this moment there were schools of literature, philosophy, mathematics, science, medicine, and engineering. A school of law would commence with the new year. A school of military engineering and a school of architecture would, he trusted, be established very shortly, and a complete school of mines or mining-engineering would most likely be established in a few days at a comparatively trifling cost to the Challis Fund. This was the cheapest way for the Colony to have such a school, and only one was needed. A separate school of mines elsewhere, were it to offer the same quality of teaching, as good accommodation, and as complete teaching appliances and apparatus, would cost £10,000 a year. A highest school of agriculture could be established at the university for only £1,000 a year, the cost of the one special chair needed in addition to those which they had. To have the highest agricultural teaching at the university would be best for the agricultural school and best for the students, both of which would profit by the connection."

A State Department of Agriculture.—Simultaneous with the movement for the better technical education of those directly interested in agriculture was that for the creation of a State Department of Agriculture, which should direct and control the special teaching-machinery to be called into existence, and watch over the general interests of the agriculture of the Colony. It was found expedient at first, as a tentative measure, to associate the new department with an existing department—the interests of which were more or less associated with, or akin to, the interests of agriculture. **Though the Education Department** no doubt had a claim to be associated with the new office, owing to the importance of the purely educational work which it was intended to carry out, still there were many points of interest besides those of education, and it was found that the Department of Mines, from the practical nature of its associations, had a prior claim. **The Minister of Mines**, the Hon. Sydney Smith, as a matter of fact, ultimately became (in 1890) Minister of Mines and Agriculture. Profiting, however, by the experience of the unsatisfactory results of attempting to work the two Departments by the same machinery,—as exhibited by the working of the Department of Land Records and Agriculture in India, and of the now defunct Department of Agriculture in Great Britain,—it was determined to make the special work of each of the two great branches of the double Department of Mines and Agriculture as distinct as possible. This, so far as it is possible, is now being carried out under a separate Agricultural Secretary, Mr. H. C. L. Anderson, who came from the Education Department.

The fact that the Education Department was not chosen as the one best suited to undertake the whole responsibility of union with the new department does not relieve the Education Department from the duty, which naturally falls to it, as a purely educational department, of providing for a proper system of education in the principles of agriculture as a science subject in country schools.

Almost simultaneously with the establishment in Great Britain of a Board of Agriculture, with its President a Cabinet Minister, the **Scotch Education Department,** in consideration of the importance of agriculture as a subject of general education, specially recognised it in the Scotch Code for 1890.

It was felt in New South Wales that, in addition to the Education Department undertaking the responsibility of directing the necessary instruction in the elementary principles of agriculture through the medium of the country schoolmasters, it was necessary, for the guidance of the Board or Council of the Minister of Agriculture, that the Under-Secretary for Education should be a member of it.

It was suggested that the Council should ultimately, in the fulness of time, consist of six members.

1st. The Under-Secretary for Agriculture, who should possess some knowledge of the subject in addition to office routine.

2nd. The Under-Secretary for Education, whose function has already been explained.

3rd. The Professor of Agriculture and Rural Economy in the University of Sydney.

4th. The President or Superintendent of the leading Farm School, forming one of a series of schools located in various representative districts of the Colony.

The 5th and 6th. Two members elected by the various Agricultural Societies throughout the Colony acting conjointly.

It was also, further, strongly pressed that the composition of the Council should be made as permanent as possible, so that it could take up, after due consideration, certain works that would be carried through by those who conceived and planned them, and be able to act independently of any change of government or political party.

When there is popular representation and all offices are held subject to the will of the leaders of the successful party after each political strife, little satisfactory work can be done in any branch of the civil service. This remark applies equally to the United States of America and to our various Colonies. **It is a pleasing feature** of the recent tendencies of popular representation in the great American Republic that, at last, merit and special qualifications for special objects are beginning to assert themselves as against political intrigue and political influence. The assurance of permanency attracts better men to official specialists' positions, and value for the money expended can be both given and received. **Nothing can be more unsatisfactory** or more costly to the community, than the **political method** of filling scientific appointments. In such a subject as agriculture the harm does not end there, because ground is actually lost by the inefficiency of those in authority. The possibilities of improvement are discredited, and a heavy handicap is thus placed upon the right men when they do ultimately struggle to the front.

There is one grand principle in connection with the establishment of a new department and in the appointment of scientific experts which the Colonies have not altogether and on all occasions recognised or embraced, and that is to secure the best man in a given subject, from any quarter of the world, who is willing to come and give his entire services for the remuneration offered. Although many of those in authority fully appreciate the principle promulgated and act upon it, yet more than one example could be given of appointments conferred within the last few years upon men who have dabbled as amateurs in certain subjects, and maintained a judicious system of personal advertising, but whose knowledge as experts, as evidenced by their official productions, is a laughing-stock to the authorities of Europe and America. The reference is made to no one Colony or no one department, but is perfectly general, and is given in the full assurance that no one who has done good work will feel himself condemned.

The following quotation from the *Sydney Mail* of July 29th, 1889, may be taken as an indication of the interest with which the proposals for the creation of a **State Department of Agriculture** and a System of Agricultural Education were received.

"A few words of explanation will enable our readers to understand the merits of Professor Wallace's scheme. He proposes utilising the existing admirable system of State Education by engrafting into its curriculum primary instruction in the rudiments of agriculture, so that every child attending the public schools shall be taught the reasons why plants grow, how the economy of animal life is sustained, and the nature of the common things of the country. The reasoning faculties of the child will thereby be exercised by understanding something about the nature of the plant and animal worlds, of which he himself is an integral part, and such knowledge will never be found unprofitable in whatever after-walk of life his lot may lead him into.

"For the more special education of the rural population, Professor Wallace lays great stress upon farm schools for practical work and technical tuition, The youth, who otherwise learns by rough rule of thumb and unthinking drudgery his future means of livelihood, will, in these farm schools, be taught to expend in the field or homestead his labour to the best possible advantage, and will receive during a third of his school hours instruction in the class-room. Boys thus educated will ripen into valuable and practical men, advancing their employers' interests by their skilful labour directed by a knowledge of the laws of nature with which their occupation will bring them so much face to face.

"Of higher grade than the farm school will be the High School of Agriculture, where a youth, already instructed in the practical work of the farm, will receive more advanced instruction in scientific agriculture, as well as be required to undertake the higher branches of outdoor farm and horticultural work. Having passed through such a course of "Practice with Science" the young man will be able to enter upon pioneer settlement, or farm with advantage in the settled districts. Should, however, he desire to proceed to higher knowledge of his profession, the University of Sydney stands with open doors to receive, educate, and furnish him with a degree of recognised merit and of such inherent worth as to be a pass-word of success. Such is a mere outline of a scheme that may be passed by the present Parliament. Its scope is statesmanlike and widely comprehensive, and, if accepted, will prove worthy of the reputation of the mother Colony of Australian settlement. To complete this noble ideal, the question will necessarily arise as to the control of so great a scheme. We say unhesitatingly that if this new departure be bound like an Egyptian mummy in the grave-clothes of red-tape officialism, then inefficiency and failure will speedily ensue. A living scheme of agricultural education will require a living and responsible board of control under the immediate supervision of the Minister. The public have, and not without reason, associated the somewhat anomalous Department of Mines with the agriculture of the Colony. Let the Minister be who he may, there will be requisite, as the Professor suggests, a board of control—the board of agriculture—composed of men of approved ability, one to superintend the educational portion of the work, another for the supervision of the many farm schools and high schools of agriculture, associated with the representative agriculturists and both the professors of agriculture, those of State and of the University, in order to act as scientific advisers to the Government. These six gentlemen, together with the Minister, will compose the board.

"An adjunct to the work of the board will be the special training of the schoolmasters of the State in order to prepare them for their duties of teaching the rudiments of agriculture, and as a still further development of Professor Wallace's scheme, the establishment of a State College of Agriculture, by preference near to the metropolis. An institution of this nature will afford a more advanced course of scientific instruction and an extended period of study to youths of promising talent who have passed through the intermediate establishments, the sons of parents willing to pay for higher education, and men of private means."

"The proximity of the college to Sydney, whereby it would permit of the closest supervision of the State Professor of Agriculture, as well as of other scientific men, would be a matter for desirable consideration.

"It must not be supposed that the existing Technical College course of agricultural education would be interfered with. On the contrary, the establishment of the new and complete scheme would give additional scope to the present technical classes and itinerary lecturers, who would give most valuable service in stirring up an enthusiasm for agricultural education amongst a class remarkable all the world over for an intense conservatism. The Technical College has its own special sphere of action, and from this it should not be disturbed."

Ham Common, near Windsor, the recently selected site of the proposed **Agricultural College**, was seen by the writer when on a visit to the late Mr. Andrew

Towne, whose stud of horses—Thoroughbreds, Trotters, and Clydesdales—is referred to in another chapter. The details of the proposed scheme here alluded to were published in the Sydney papers about the end of June 1890. The College, sufficient to accommodate 50 to 60 students, is to be a brick building which will cost about £12,000, erected on an elevated portion of Ham Common, about two thirds of which, or 4,000 acres, are to be set apart as the college farm. The locality is convenient, being forty miles distant from Sydney and within one mile of the Richmond railway station. **The land** is very various in character, from the lightest sandy soil to heavy clay and the richest alluvium; and, for the benefit of instruction, a great variety of crops will be cultivated. The *Telegraph* says—

> "It is proposed to allot 10 acres of the common for vines, 20 acres for orchards, 10 acres for orangeries, 500 acres for general cultivation, and 2,000 acres for grazing. The cultivation will include cereals, lucerne, sorghum, maize, fruit-trees, experiments with the best indigenous and other grasses."

The one drawback to the common for the purposes referred to is that a large area of it lies below high-water mark. In the great floods of 1867 and 1869 about 2,000 of the 4,000 acres were under water, but the remainder, though all low and flat, is thought to be sufficiently high to prevent it being swamped. The Colony is indebted to the forethought of the recently appointed first Secretary for Agriculture, Mr. Sydney Smith, for the judicious selection of the College site, which, as it already belongs to Government, will entail no initial cost.

CHAPTER IX.

AGRICULTURAL COLLEGES.

Agricultural Education in Victoria—Its Council—Land Endowment—University of Agriculture—Vegetable Products' Commission—Dookie Agricultural College and Details of Work and Management—The Merit of the System — Longernong Agricultural College — The Farm and Experimental Station—Roseworthy Agricultural College—Professor Lowrie's Advice to Farmers in South Australia—Lincoln Agricultural College—Its Misfortunes and Improved Position—Suggestions for Further Improvement—Schoolmasters to Teach the Principles of Agriculture—A Degree in Agriculture in the University—Scholarships in Agriculture—Difficulty of Establishing an Agriculture Department in the University of New Zealand.

Agricultural Education in the Colony of Victoria is under the direction of a **Council of Agricultural Education**, established in virtue of the Agricultural Colleges' Act of 1884. It consists of eleven members, viz., (*a*) The Secretary for Agriculture ; (*b*) Five members nominated by the Governor in Council, three of whom are the trustees in whom the land set apart for the purposes of agricultural education is vested ; (*c*) Five members elected by the Agricultural Societies throughout the Colony, which is divided for convenience into five agricultural districts.

The Act requires that there be a roll of members each paying a 10*s.* subscription per annum, of every Agricultural Society taking part in the election. Any member of any Society complying with the Act may nominate a candidate by a specified method, and in the event of more than one nomination for the election, which is now triennial, the decision of the constituency, consisting of eligible members of the various societies, is given through schedules addressed to a returning officer appointed by the Governor in Council.

The land set apart and placed under the direction of the trustees already mentioned, exclusively for the advancement of agricultural education, amounts to 25,000 acres and yields at present an income of about £10,000 a year. The property consists largely of exceptionally rich islands in the Murray River, and it is estimated that in a few years the value should amount to £50,000 annually.

Looking to the realisation of this handsome sum of money, **the programme** of the Agricultural Department of Government embraced the completion of a series of five Agricultural Colleges—two of which, Dookie and Longernong, already exist, and a sum of £25,000 was put in the estimates of 1889 to build the others; one to be located in each of the five agricultural districts. The scheme also contemplated the future establishment in Melbourne of a **University of Agriculture.** After paying a visit to the Longernong College on 10th June, and to Dookie College on 4th and 5th July, and satisfying himself of the satisfactory basis upon which these Agricultural Colleges are established, the author was able to give his unqualified support to the proposals of the agricultural department, in evidence before the Vegetable Products' Commission * at Melbourne on 5th August, 1889. **Support** was given to the establishment of an Agricultural **University,** because

* The Progress reports and minutes of evidence of this Commission, the first published in 1886 and the eighth in 1890, form a vast store of valuable and interesting information collected from all sorts of people. The weak point in the scheme is that there is no sufficient safeguard to exclude men who have no claim to be regarded as authorities on special subjects, from giving evidence which might mislead the uninitiated. All kinds of opinions are taken, and the public are left to determine who is right and who is wrong. The commission was appointed on 7th September, 1885, "For the purpose of enquiring

the amount of money expected to be realised for the purpose was amply sufficient to do so on a sound University basis.

With the growth of population which will take place in the Colony within a few years, the Melbourne University will require extension.

There appeared to be no reason why, in view of these facts, an Agricultural University should not occupy a separate, suitable building, and be equipped with a separate staff of specialists. The great objection to an Agricultural University in nearly every other country or Colony, is the want of money to make the institution good enough to be worthy of the name of a University. A half-measure in a case of this kind is worse than ruinous; and an institution with only the name of University without means to exercise University functions is a discredit and a detriment to education. It is for these reasons that, as a rule, the best results are obtained when the higher branches of Agricultural Education are associated with a department in an established University which is not purely agricultural.

All the advantages to be derived from a General University connection can be secured to the New Agricultural University by **affiliating it to the Melbourne University**, in the same manner as certain outside schools and colleges in Scotland, that give instruction of a sufficiently high standard, will, probably by the schemes of the Scottish Universities' Commission, be affiliated to the old Universities. Corresponding instruction in Melbourne

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and reporting respecting the vegetable products, other than wheat, for the growth of which the climate of Victoria is suitable, both with and without irrigation." The members of the commission at the time of the author's visit were, Messrs. J. F. Levien (President), Walter Madden (Vice-President), Charles Yeo, James Buchanan, James McIntosh, Joseph Knight, Andrew Plummer, T. K. Dow, John West, and D. E. Martin; the Secretary, then as now, was Mr. John J. Shillinglaw.

University and in the Agricultural University would then be accepted by either institution as qualifying a student for examination for a degree. This would give the Agricultural University a status in the minds of Educational Authorities in Europe and America, which an Agricultural University pure and simple would never by its own unaided efforts be able to reach.

The author's visit to Dookie Agricultural College, where he spent a part of two days, was one of the most interesting of all those made to institutions of the kind. He went to the Colonies under the firm impression which he still holds, that to put the son of an ordinary farmer, accustomed from his youth to see and take part in farm-work, to manual labour when he goes to college, is a distinct waste of time and a hindrance to the scientific study which he should there undertake. It is besides unpopular with both parents and students belonging to the farming-class. The agricultural college at Dookie has been made a complete success in its way, and performs a most important function in a new country, where those who take to farming are not, as in this country, the sons of farmers, but are drawn from towns and from classes of the community with no hereditary knowledge of the practices of agriculture. It is, therefore, necessary that students of this kind should see and do the ordinary practical work of a farm, but the same standard of proficiency need not be expected at the end of a given period of time from students who have everything to learn as compared with those who are familiar with practical work before they begin their scientific studies.

The College is in the north of the Colony, about 25 to 30 miles south of the River Murray, and less than 20 miles east from Shepparton on the Goulburn River, which traverses a beautiful rich alluvial valley, through which the railway going south of Melbourne also passes.

The first Principal of Dookie College was Mr. R. L.

Pudney, M.R.A.C., F.H.A.S., who was succeeded on his removal to the Longernong College (which the Government sent him to open and organise) by Mr. **J. L. Thompson**,* the present Principal, who is also Professor of Agriculture as well as Manager of the College farm. Mr. Thompson is an excellent type of a long-headed Aberdeenshire farmer. He studied agriculture under McCombie of Tillyfour, whose name is so intimately associated with the improvement of polled Aberdeen-Angus cattle, and went out to Australia in charge of an important consignment of these animals.

The College (including outbuildings, all of wooden

Dookie Agricultural College, Victoria.

framework) was erected in 1886, at the **Cost** of £2,973 13*s.* 8*d.* The main block shown in the accompanying figure is a convenient little unassuming building with frontage of 160 feet, and contains a spacious lecture-hall with a raised stage, dining-room, studies, library, teachers' quarters, and sleeping apartments for students.

The farm buildings stand at a convenient distance from the College buildings and on a lower level. Every convenience which is necessary for the proper working of the farm, and for the instruction of pupils in many distinct branches of work, is provided.

* Mr. Thompson has recently been appointed the first Principal of the Agricultural College at Ham Common, New South Wales.

The property extends to 4,846 acres, of which about 400 acres are under cultivation. The most of the land is out in grass and is of fair grazing quality. A considerable **variety of stock** is kept; including pure-bred Duchess Shorthorns, and Hereford cattle, and of sheep—Merinos, Lincolns, South-Downs and their crosses, together with a considerable number of black Berkshire pigs.

The full complement of **pupils** who attend the college is forty, and they are admitted, if above fourteen years of age, in the order of their application, as a larger number ask to be received than can be accommodated. The annual charge for board and residence is £25.

On this basis it is estimated that the education is given free, in conformity with the principle of free education which has been generally adopted in the Colony.

The Curriculum extends over two years (with vacations during February and August), at the end of which time the student who has acquitted himself with credit, and has attained a certain standard of proficiency tested by examination, is awarded a diploma. No student is permitted to remain longer than three years.

The teaching staff consists of the Principal, a Science Master, and an English Master. One hundred lectures are given on Agriculture by the Principal; one each week, on the Friday evening, when all are expected to attend. The remainder of the class-room instruction is given by the two masters, in the subjects of Chemistry, Botany, Geology, Entomology, Mathematics, English, Surveying, and Book-keeping. The arrangement for **practical work** is somewhat unique. The students are told off in two divisions; one division works all day upon the farm or in the yard, while the other engages in lectures or other scientific or theoretical work in the class-room and laboratory. The following day the workers change places with the learners. Manual labour, and the study of books, are consequently undertaken on alternate days, and it is found that the interference of the one with the other is reduced to a minimum. **Examinations** of two hours' duration are held on Saturdays in addition to sessional examination at the end of each term. The pupils take a lively interest in the **work of all kinds**, which in addition to the ordinary routine of an arable and stock farm embraces experimental work on an area of fifteen acres set apart for the purpose; orchard and garden culture; grape growing and wine making; olive picking and oil pressing; syrup making from green Chinese sugar-cane; and dairy work of all kinds from the milking of the cow to the separation of the cream by Laval's separator and the manipulation of the various products.

In a country where the summer temperature is as high as it is in Australia it is very important to secure the most approved dairy appliances and house accommodation. At Dookie the **Dairy-house** is sunk below ground and covered with three roofs, one above the other, with air spaces between.

The practical results of this **College** or more correctly **school-farm** system, are thoroughly satisfactory; the Colonial youths receive the training they desire and stand in need of, although, of course, the standard of scientific instruction is admittedly not high. The practical work must be considerable, considering the great variety of products grown, as the labour of only six hired men is employed regularly—the students do all the rest.

In external competitions the College has, during the few years of its existence, secured a lion's share of prizes for farm produce—including a £40 gold cup for wheat and numerous prizes and certificates at the Melbourne, Paris, and New Zealand Exhibitions, and various important show-contests.*

* Extract from the Principal's Statement on prize day, July, 1890.

"Last year the college had been awarded the Grand Prix at the Paris Exposition, and a gold medal for wheat. Since then the institution has been

It yet remains to be seen if the **main virtue lies in the system** which has been described, or is centred in the individuality, power of organisation and adaptation of the Principal. Certainly more depends upon the individual resources of one man in this institution than in any of the numerous Agricultural Colleges with which the writer is familiar in either Britain or America. Whatever the merits are of the system, and however suitable they are to the existing condition of things it is not one which can be perpetuated, but must change as the country matures and develops. When waste lands are broken in and the youths who want to study agriculture are the sons of farmers who do not require to learn how to fill a manure cart, harness a horse, hold a plough, or lend a hand to bring a southdown lamb or a short-horn calf into the world, the practical work must give place to scientific study of a wider and higher order than that undertaken at present. At this stage of development book-work is the most probable safeguard upon which an unpractical Principal who lacks the resources of Principal Thompson of Dookie will fall back to avert the consequences of complete and conspicuous failure.

The fact that it must, in time, change is not a ground for objection to the development of the Agricultural College or school-farm system, but rather an argument in its favour, since there are reasonable grounds to believe that, in what will naturally be the development of the system originated so successfully at Dookie, a higher standard of proficiency

awarded the following first prizes at the New Zealand and South Seas Exhibition :—1st for the collection of wheats ; 1st for muscatel raisins ; 1st for dried fruits ; 1st for silk cocoons ; 1st for olive oil ; 1st for Hermitage natural wine ; and 2nd for English barley. Two years after the foundation of the college it was awarded nine 1st prizes at the Melbourne Exhibition of 1881, and a gold cup valued at £40 for the best twenty bags of wheat grown in the North-Eastern district among thirty-four competitors. In the same year the college secured a first award at Adelaide, and fifteen 1st prizes at the Melbourne Centennial of 1888."

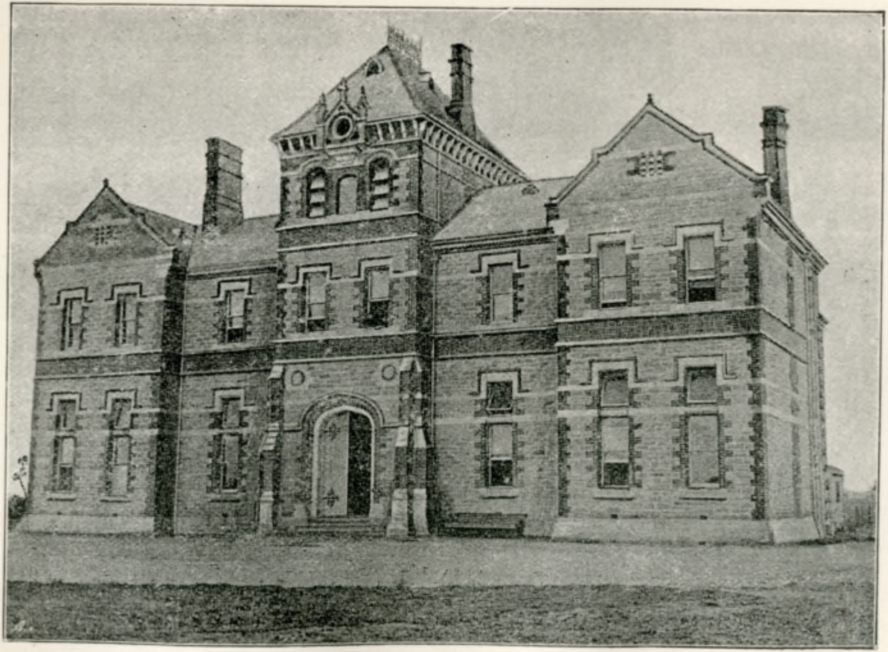
will ultimately be attained; in other words pupils who have gained practical experience at home will be able to carry their scientific study to a much higher point, than at present, by a residence of two years at an Agricultural College.

Longernong Agricultural College is in the north of the Colony of Victoria, in the Wimmera district, about two miles from Dooen Station on the main line between Adelaide and Melbourne, and a few miles from the boundary-line between Victoria and South Australia.

The College was **opened** in March 1889, and is conducted on a plan similar to that of Dookie; the students are limited to forty; and the annual fee for each is £25. The scheme was organised by Mr. R. L. Pudney, who handed over the institution to Professor Brown the present Principal who had recently arrived in the colony from the Guelph Agricultural College, Ontario.

The land in connection with the College extends to 2,400 acres of rolling country of heavy and tenacious clay. It has been laid out with belts and clumps of trees, and a large experimental field in front of the College has been levelled for the purpose of carrying out an elaborate series of experiments to test the merits of various crops and manures. One great object in placing the College in this locality was to secure an **experimental station** in a district which had been run out by too frequent wheat growing and thus to show by experiment to a large body of farmers who are not in a position to be able to afford to conduct experiments on their own account, what could be done with the land.

The farms in connection with Agricultural Colleges in the Colonies are expected to be show-places capable of instructing the ordinary farmer as well as of teaching the youthful aspirant to the business. The lesson taught at **Dookie** is unlike the practical lesson taught by most show or model farms; a balance on the right side of the year's



XXII.—ROSEWORTHY AGRICULTURAL COLLEGE,
NEAR GAWLER, SOUTH AUSTRALIA.

accounts can also be seen, in addition to improved methods of working. For this and the reasons that have already been detailed, Dookie has been made the type of the various institutions which are being organised in different parts of the Colonies. The site of Longernong has no doubt many advantages for a college but **as an experimental station** it might prove to be far from satisfactory. The experimental field was broken in from the natural Bay-of-Biscay country, which necessitated levelling. The consequence is that the condition of surface is artificial and irregular to such an extent that the results of small-plot areas cannot be relied upon. Had the question been one of comparing one large field with another, the effect of levelling would have been in a great measure eliminated; but with small areas the artificial making-up of low levels at the expense of the higher places must render the plots unnatural and uneven in yielding capabilities. The difference on a small plot may not be great, but when calculated into amounts per acre the results may become seriously misleading.

Roseworthy Agricultural College, in South Australia, is situated about 35 miles to the north-west of Adelaide, but within the convenient distance of three miles from a railway station on the line from Adelaide passing Gawler and Kapunda. The College is a massive two-storey stone structure of handsome appearance, which cost £6,000. Its surroundings look bare and unfurnished at present for want of trees, but this is a defect which time will remedy.

The College farm extends to 849 acres of light, poor soil of a description that would be termed "douf" in Scottish phraseology, and rests upon porous limestone. The land was specially purchased by the Government for the purpose, at six guineas per acre. More than one half of the area was, at one time, covered with the poorest description of South Australian mallee-scrub. Such land is inferior to the corresponding scrub-land of Victoria, which is no doubt partly accounted for by the deficient rainfall, averaging about 15 inches. This inferiority appears to be a misfortune which will continue to militate against the usefulness of the institution, not only in connection with the teaching of practical agriculture, but also in the very important matter of securing a balance on the right side of the annual statement of accounts. It seems a pity that in selecting a site for a College farm a better subject had not been secured. It would have been sufficient had two or three fields on the area chosen been "barren and unfruitful."

Mr. William Lowrie, Professor of Agriculture and also Principal of the College, is a graduate of the University of Edinburgh (where he had a most distinguished career as an undergraduate, being the Steven Scholar for 1885), and studied the science of Agriculture under the late Professor Wilson, of the Chair of Agriculture and Rural Economy. His knowledge of practical work had been gained while quite a youth through engaging, personally, in all sorts of farm operations. **The students** number about 30; and there is, as yet, no great difficulty experienced in accommodating all who desire to enter. **The course** extends over two years, and is more theoretical and more highly scientific than that at Dookie. Chemistry and the allied sciences are more profoundly studied, and only eight hours of manual labour per week are demanded of students.

There is a field set apart, in which is carried out a series of elaborate and well-planned **experiments** with various crops. Turnips and forage crops, with the exception ot thousand-headed kale, had almost completely failed. The vigour of growth and deep-rooted character of this plant seem to be able to cope with the sterility of soil and aridity of climate to a much greater degree than "roots," or the various leguminous or graminaceous forage plants. One plot was pointed out that had successfully withstood the influence of a continuous drought of eight months. Though poor, Roseworthy farm is in a **wheat-growing** district.

May is there the usual month for sowing wheat or the other common grain crops, and harvest takes place in November and December.

Professor Lowrie's efforts are not altogether confined to the instruction of a limited number of resident pupils, as we find him on 2nd July last giving to the Wasleys Farmers' Club a lecture entitled "Mixed Farming," on such interesting and instructive topics as are mentioned below. It was pointed out that the common practice of **continuous wheat-growing** with no greater aim than a crop of 15 bushels per acre was far from a good one on those immense areas of country which could, if required, grow other crops well under a proper system of rotation. The pasture in the Colony was far from satisfactory. In place of grass, what was called pasture was simply a rank growth of weeds.

The author observed that the chief weed forming pasture in South Australia was an imported European species of *Inula*, a plant with a yellow flower—which is the prevailing colour of Australian flowers. It maintained its position of importance in virtue of the property possessed of remaining green during summer, when most other plants are burnt up by the sun for lack of moisture. Beside this was the *Œnothera*, a weed with a yellow bell-like flower, said to be excellent for both beef and milk production, though it has the taste of our dandelion.

The Cape-weed or Cape-dandelion (*Cryptostemma calendulacea*, R. Br.) is one of the most common weeds forming the green sward of pasture-land of poor or moderate quality. It is of little value while green, but, when dried and shrivelled, the leaves are an important "stand-by" for milch cows and other stock in hot weather. The so-called native dandelion (*Hypochæris radicata*, L.) has a small yellow flower. The flower of the Cape-weed is also yellow, but it is distinguished by a dark spot in the centre. It is objected to on the good grazing-land in the

Mt. Gambier direction. There is also a minute geranium (*Geranium dissectum*, Linn.) which is very valuable in South Australian pastures.

It was pointed out that in the **formation of pastures** it would be infinitely better to use the seeds of many of the excellent native grasses than those of imported European species and also to adopt a system of mixed farming, which involved **sheep-grazing**; cattle breeding and feeding were out of the question, as the small farmer could not compete with the large station-owner in beef production. Sheep, however, manured the land and enabled farmers to clean it. Ultimate exhaustion of the soil was impossible; but temporary exhaustion was too frequent and might be prevented by a judicious system of mixed farming involving the depasturing of sheep, which, after making use of the food consumed, left much of the valuable manurial matter contained in it upon the soil in their droppings. A comparison of the **power of exhausting soil** in the cases (*a*) of a fat sheep, and (*b*) of a 15 bushel crop of wheat, showed a result greatly in favour of the sheep.

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.
	lbs.	lbs.	lbs.	lbs.
Sheep	2	1	1	1
A fifteen bushel crop.	16	11½	18	6½

The 15 bushel crop of wheat exhausted the ground as much as eight to ten sheep, and the process of exhaustion in the latter case was so slow that the natural disintegrating process, always at work in the soil by atmospheric and other agencies, was able to do more than counterbalance the small amount of the manurial substances carried away by sheep as component parts of their carcasses. The existing want of sheep-proof fences was a drawback which the possession of a few sheep would speedily undo. **The cross** produced by the Hampshire ram on the Merino ewe would possess both of the important requisites, heavy weight and early maturity.

Bare-fallowing of land in place of manuring was too much practised as a means of restoration. It should be confined to its proper function, the clearing of the land of weeds. Fertility ought to be maintained by manuring in some shape or form, not by fallowing. Animal manure in the shape of sheep's and pigs' **dung** would be provided under a proper system of management. Peas were specially valuable as a crop where **pigs** were kept. By some experiments which had been recently carried out at the College, of four pens of pigs set apart to test the relative values of common food-stuffs, it was found that in the same space of time the first, fed on peas, gained 527 lbs., the second, on wheat, 510 lbs., the third, on slops, 486 lbs., and the fourth, on green-stuff, 103 lbs. The pea-fed pork, with peas at 3*s.* 4*d.* per bushel, left a good profit over and above the manure, even at the very moderate price of 4*d.* per pound for bacon. A moderate and commendable opinion was expressed with regard to the system of **ensilage.** A Victorian Commission on the subject had issued conclusions which were unduly exaggerated by them, and claimed for silage a position which was altogether untenable. The system was one which might properly find a place in mixed husbandry, particularly as a cleaning crop, but too much was not to be expected of it. Of the various forage crops the palm was justly given to kale, although it does not preserve well in silo. The importance of **fruit-growing** and vine-planting was urged in view of the very special suitability of the Colony for these branches of rural industry.

With such words of wisdom, replete with sound, practical information supplied gratuitously to the farmers of the

South Australian colony, the ultimate result must necessarily prove to be of immense advantage to the agricultural branch of the community.

Lincoln Agricultural College on the Canterbury plain at the distance of a drive of 14 miles from Christchurch, in the South Island of New Zealand, was visited on August 23rd, 1889, in company with Mr. Thomas Acland, a gentleman who possesses the commendable enthusiasm for the improvement of the agricultural interests of the country, which is so conspicuously developed in the person of the Right Hon. Sir Thomas Dyke-Acland, of Killerton, Devonshire, the head of the family.

The College buildings are by far the finest in the Colonies, as may be seen from the accompanying plate. In appearance they rival, if they do not surpass, the buildings of the Royal Agricultural College, Cirencester, England.

The school was founded in 1872, and 100,000 acres of pastoral land were set apart by the Provincial Council for its endowment. In 1880 the buildings were finished and opened for the admission of students, and the fluctuation in the **numbers** of those who have been in attendance may be gathered from the following figures:—

1880.	16 students.	
1881.	41 "	
1882.	38 "	
1884.	36 "	and fee raised from £40 to £45.
1885.	Fee raised to £65.	
1886.	19 students.	
1888.	2nd term 16 students.	

The management of the College was given to the Governors of the Canterbury College—a body elected by the ordinary University graduates and with hardly a trace of what might be termed an agricultural instinct among the whole of its members. £8,000 of the money which

III.—Lincoln Agricultural College,
Near Christchurch, New Zealand.

clearly belonged to the funds of the Agricultural College, had been appropriated to aid in building Christchurch University; but no doubt this sum will by-and-by require to be refunded. The whole undertaking had fallen into such confusion, that a **Royal Commission** was appointed by Government in October 1888, to inquire into the condition of the institution and generally to make recommendations regarding its better government in future. The report of the Commission was issued in February 1889, and exposed some extraordinary abuses which had crept in. It was discovered that the debit balance of the building account showed a debt of £28,089, on which interest at the rate of nine per cent. had to be paid, while there was a balance to the credit of the endowment account of £52,700, yielding only six per cent. of interest, and thus losing a considerable annual sum to the funds of the Agricultural College. It is not surprising under the circumstances that the total loss in ten years amounted to £5,824.

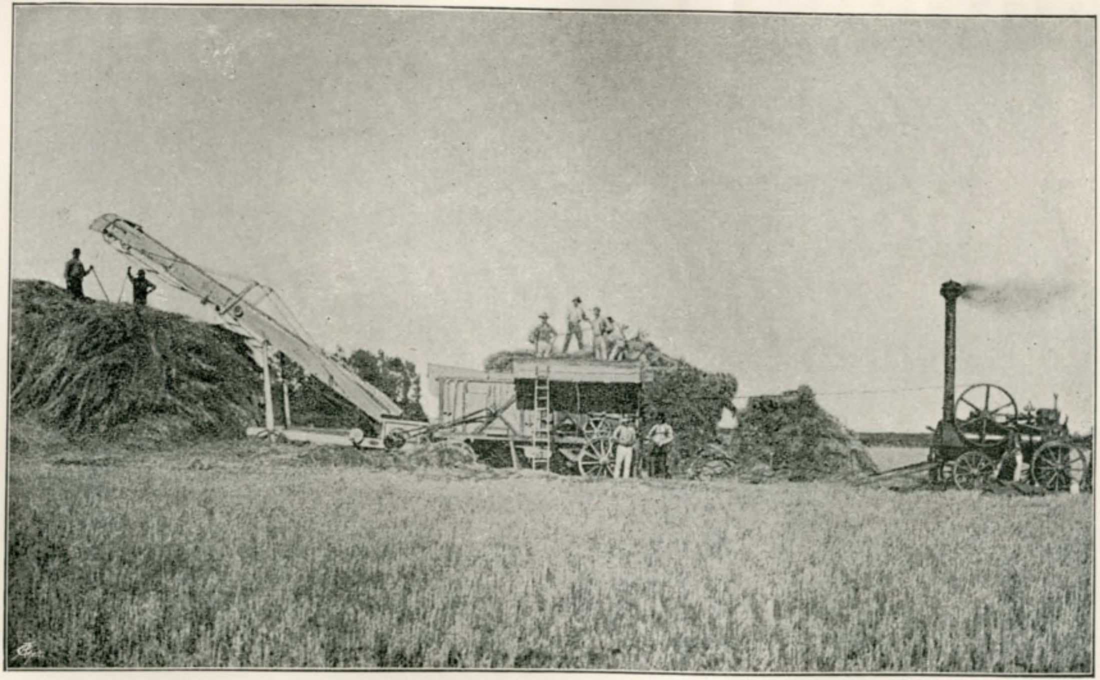
The original intentions in founding the College were to raise the standard of the technical education of farmers' sons and to conduct experiments. The latter has not been carried out to any great extent for lack of money, and the number of pupils drawn from the farming-classes, was seriously and naturally reduced by the increased fees, which were made decidedly too high even for the most prosperous times. Since better arrangements in this matter have been made, the number of pupils in 1890 rose to forty.

Professor W. E. Ivey—the agricultural instructor—a distinguished Cirencester graduate, is also Principal of the College. He was at one time manager of the farm, but the Commission wisely recommended the appointment of a practical manager, who now takes full charge under the Principal. The duties of teaching, together with the direction of the practical work of such a place was more than any man could do justice to; and the new arrangements have already shown the wisdom of the course taken.

In an interview reported on 24th August, 1889, in the columns of *The Press*, Christchurch, the author had the privilege of making the following suggestions with regard to the future control of the College and farm. In place of its remaining under the Board of Governors of Canterbury College, the appointment of a **Special Board or Governing Body** for the control of the College and its finances was recommended:—to consist of two representatives appointed by the Board of Governors of Canterbury College; two by the Government, as it should provide some part at least of the sum required to carry on the College; two by the various Agricultural and Pastoral Associations; along with the Principal of the College or the Professor of Agriculture—seven members in all.

The College lands should not be turned into a model farm, nor should they be mainly set apart for trying **experiments**, but maintained simply as an ordinary farm managed in an ordinary way, such as a farmer would adopt on his own account. There might be plots in one or more sections in which simple experiments might be carried on to instruct students in experimental methods, the exercise of which should form a part of every farmer's yearly practice. A large or important national experimental station could never be safely or properly conducted if students were allowed to have the run of the experimental grounds, and if they were not permitted free access at all times, the work would be better conducted in some distant or separate institution.

The Colonies having adopted a system of **free state-education**, it seems to be the duty of Government to assist in making the College a place where a man who intends to engage in farming on a small scale, may receive instruction which will the better enable him to do so profitably.



XXIV.—Threshing Grain at Lincoln Agricultural College Farm,
Christchurch, New Zealand.

To this end the scientific instruction does not require to be more than elementary. If practical instruction is to be given to any considerable extent, the system adopted should be that of field-work one day and book-work the next. This saves time and is infinitely better than an attempt to work one half and study the other half of each day.

Before a system of education for New Zealand can be complete or satisfactory, **a system of instruction** in the principles of agriculture **by the schoolmasters** in country schools must be established. The rural schools would create an interest in the subject and form the introduction by which the best pupils would ultimately pass on to the Agricultural College, which should hold an intermediate position between the rural schools and the University, at which latter institution there ought to be a **degree** conferred in the department of agriculture in a manner similar to the B.Sc., in the department of agriculture, as conferred in the University of Edinburgh. The best men would then have a career open for them, and the poorer classes ought, by means of bursaries or scholarships gained by open competition, to be enabled to take advantage of the instruction offered. Unfortunately the **constitution of the New Zealand University** is such that there is little hope, for many years to come, or, in other words until the population is vastly increased, of any successful attempt being made to establish an agricultural department. The University may be said to consist of the three affiliated institutions—Otago University, Auckland University College and Canterbury College. Had the whole energies of the country been concentrated in one central University, it might have been possible to secure with a few necessary additions to the teaching power, the staff requisite for the maintenance of an agricultural curriculum ; but, as it is, local jealousies would not permit Government to establish an agricultural centre in one without doing the same in the other two Colleges. The consequence is that New Zealand must remain without a University connection for the important subject of Agriculture, or else she must provide, at three times the necessary cost, three times as much teaching machinery as is necessary to do the work. This is one of the misfortunes inseparable from a form of Government which is apt to encourage the development of local or self rather than community interests.

CHAPTER. X.

CHEMICAL ANALYSIS OF SOILS.

Chemical Analysis of Soils—Exaggerated Importance—The Analytical Chemist's Position—What is Impossible and what Possible—The Importance of Drawing a Distinction between the Available Ingredients of a Soil and those in a Fixed Condition—Amount and Kind of Mineral Food in a Crop of Wheat—Weight of Soil per Acre—Result of Analysis—Worthlessness of Tables of Analyses of Soils—The true Value of Soil Analysis—Rothamsted Experiments — Professor Hilgard's Work in California—The Farmers' best Course.

Chemical analysis of soil seems to be the first idea which occurs to the mind of one who is inexperienced in agriculture, when he thinks of agriculture being taught as a science. Many never get beyond this first idea, and find nothing in the world of their imagination, beyond analysis of soil.

The author does not hesitate to affirm that the subject of analysis of soil has occupied quite an exaggerated position of importance, not only with the unlearned, but also among those who ought to have known better. **One individual**, often of no repute in the scientific world, resolutely and dogmatically takes the lead, and many follow, sheep-like, without enquiry. This has been painfully the case in connection with soil analyses; and it has arisen mainly through a mistaken idea in the public mind of the possibilities in this direction within the power of the analytical chemist, and from a misapprehension of the question usually put when soil is sent to him to operate upon.

If when an analytical chemist was supplied with a dozen soils to examine, he could be depended upon to return the answer :—this soil is fertile ; that is unfertile ; this will grow mangel-wurzels better than turnips ; and that will grow good cabbages but inferior potatoes—then there would be some basis for the faith placed in the chemical analysis of soil. This position has not been attained, and it can never be attained ; it is in fact an absolute impossibility. When the analyst has a soil sent to his laboratory, he is usually informed whether the soil is rich or poor, and he sets himself to discover the reason why. There is no difficulty then in coming to a satisfactory conclusion in his own mind, purely from the analytical standpoint, as he ignores all other conditions essential to a good soil, viz., depth, mechanical consistency, moisture, and location. **It is quite impossible to determine** with certainty in the laboratory, or by any other test than the growth of crops upon it, whether an ordinary agricultural soil is good or inferior.

There are certain exceptions which will be alluded to later, but they do not alter the significance of the remarks as regards the great bulk of cultivated soils wherever situated. It is an admitted fact that, frequently, what appears from the laboratory test to be the inferior of two given soils, is in reality the better of the two for practical purposes.

This may be due to the conditions already enumerated, which are outside the sphere of chemistry, but it may also arise from the difficulty, nay the impossibility of determining what amount of the mass of material under examination is immediately available for the use of the next crop, and what may require 1,000 years or possibly 10,000 years for its amelioration or preparation into plant food. **It is an insult** to the intelligence of the educated portion of the human race, for the analyst to come forward and say that, by testing a given soil-material of almost bewildering complexity in a certain admittedly artificial fashion necessary to secure rapidity, he can determine what will be the actions and functions of that material subjected to the routine of nature's laboratory, which is altogether different from his own.

The reader may gain an idea of the **complexity of the question** set to the chemist when he realises the facts, (1) that **a 30-bushel crop of wheat**—straw and grain—requires for its healthy growth about 80 pounds of the following seven substances, taken up in the form of soluble mineral compounds—potash, phosphoric acid, lime, sulphur, magnesia, soda, and chlorine—named in order of greatest amount; (2) that **soil a foot deep** is estimated to weigh 4,000,000 lbs. per acre; (3) that **the wheat plant** may draw nourishment from a depth of 8 or 9 feet, but, for the purposes of the illustration, it will be sufficient to say 6 feet. This will give the wheat crop a hunting-ground per acre of 24,000,000 pounds of earth from which it is able to supply itself with the 83 pounds of mineral required.

No analyst, using the ordinary processes for soil analysis, can determine whether or not such infinitesimal amounts as are required by the crop are present or are not present in an available form in a soil. **He can tell** the relative proportions of the bulk of the material in a rough way, but this is of little or no value to the existing generation; unless there is something present which is poisonous and consequently inimical to the life or healthy growth of a plant. What interest can it be to a man who wishes to know whether his field will grow a crop next year, that it contains as much lime, soda, and magnesia as the crops will require for at least 10,000 years, but that unless he applies manures, the potash may wear out at the end of 8,000 years, and the phosphoric acid, if he be not careful, probably in 5,000 years? No, this foisting of soil analysis into the forefront of scientific agricultural teaching, and into the view of the generally ignorant public, is merely a relic of the **defective conception of true work**, which is usually to be discerned before those who first begin to teach have themselves mastered the bearings of their subject. It is high time that the **mask should be dragged** from the face of the impostor, and such nostrums as tables comparing the results of the analyses of soils for such distant and absolutely different parts as Australia, St. Helena, Alexandria, Killarney and Timbuctoo, expunged from all text-books that are intended to be of practical use.

The subject of agriculture, which is of immediate value and special interest to the student, is far too great and too important for him to be able to trifle with soil analyses, unless at a sacrifice of both interest and utility.

Soil analysis is not altogether without its true place and real value, but the position it should occupy ought to be comparatively insignificant in matters of every-day practice. **No one would deny** that the soil analyses of the experimental plots at **Rothamsted** were indispensable in coming to conclusions regarding the results of experiments. In this instance, however, the contents of early and recent samples of soil from the same plot, taken with the lapse of an interval of a few years between, can be contrasted with advantage. **The change taking place** through a period of 20 years can thus be noted and its influence estimated, in certain, at least, of the more valuable constituents. Chemical research of this kind in soils is of greater importance in connection with the organic or combined nitrogen, than with the mineral portion of plant food.

The work of Professor E. W. Hilgard of the University of California, College of Agriculture, Berkeley, is another **striking example** of the real value of the analysis of soil. Californian soils are, however, charged with alkali salts which, when in excessive amounts, act as poisons to crop plants. No one is more ready than Professor Hilgard himself to admit that the deductions to be derived from the analysis of cultivated or manured land is of no practical value to the ordinary cultivator, and that it is only in exceptional cases like that of the detection of excess of alkali that analytical work upon soils may be relied upon with advantage.

A farmer has within his own sphere a much more interesting and useful method of testing the soils of his various fields, by carrying out simple manurial experiments while his crops are growing. He will not only find this more instructive, but more practical and less expensive than a worse than doubtful analytical test.

CHAPTER XI.

IRRIGATION IN AMERICA AS A GUIDE TO THE AUSTRALIAN COLONIES.

Irrigation—Its Antiquity, Diversity of Character, and Results—Literature—Indian System—Aztecs—Improved Methods not yet Perfect — Suitable and Unsuitable Crops — Comparison of American and Australian Irrigation—Level Land at Phœnix, Arizona—Value of Water-Power in Irrigation Canals—Australian Sources of Irrigation Waters—Pumped Water—Necessity for Manure—Mildura—Importance of Knowing the Dangers attending the Application of Irrigation Water—Too much Water used and Reasons why—Various Methods of Measuring Water—Surface Flooding—The Water-Table—Alkali Efflorescences—Reh or Usar in India—Professor Hilgard's Classification—The Effect of Carbonate of Soda in Soil—Alkaline and Acid Reactions in Soils—Saline Impurities in Irrigation Water—River Water Application—Irrigation Laws should Provide Drainage—Rise of the Water-Table—Irrigation Prospects in Australia—Surface Irrigation—Side Irrigation—Sub-Irrigation—Selection of Crops to Prevent Alkali—Lucerne (Alfalfa) the most Valuable Crop under Irrigation.

Irrigation is one of the oldest of agricultural practices, and has been continued and handed down to us from a period prior to any written history. We may infer this from the fact that some of the richest land under cultivation, where the most ancient peoples dwelt, cannot be made to produce anything without the artificial application of water.

Irrigation is, on account of the variety of objects for which it is practised, the diversity of conditions under which it is employed, and the complicated nature of the scientific principles involved, one of the most varied of all the numerous branches of agriculture which now call for investigation. Although in some instances the practice of irrigation has been carried to great perfection yet there has been upon the whole a distinct lack of scientific investigation and explanation of the reasons of success and the causes of failure. **In China**, the centre of by far the greatest and most important irrigation system in the world, a vast population has been reared, that could not have existed but for the artificial application of water to the crop-growing soil. Here necessity and the pressure of population have schooled cultivators in the economical use of water, and saved them, it may be presumed, the necessity of paying for the experience which has been bought by beginners in British India and the Western States of America, who used it to excess in the early days of their inexperience.

The application of water to land seems to the uninitiated to be a most simple operation, and the rapidity of growth after a warm and refreshing shower of rain blinds the casual observer to the fact that water applied in an artificial way is associated with disadvantages and difficulties to the cultivator which are frequently more or less permanent, and also at times accumulative. No doubt a vast amount of useful practical knowledge is possessed by those who have been engaged in irrigation as a life occupation, and who at the same time have benefited by the instruction of those who have preceded them in former generations, but there is a want of a collation of scientific facts, and of explanation of systems and principles.

The literature is meagre, new, and unsifted, and the subject not sufficiently studied. The great opportunity which Great Britain has had in **India** of performing her part in this connection has been lost. Although the engineering works of the great irrigation systems of the country have been executed and maintained with admirable skill, yet the distribution of the water provided by those works, has never been under any responsible expert authority. The consequence is that in many places irrigation has proved to be more of a curse than a blessing, and no reliable statement of the facts of interest which occurred has been secured.

Although the ancient **Aztec** inhabitants of Mexico practised irrigation extensively thousands of years ago, their systems were more or less crude and similar to those of their Red-Indian successors to be seen in operation at the present time.

The improved methods of irrigation now being extended in the fruit-growing regions of Western America may be said to be merely in their infancy. Crops have, no doubt, been successfully grown for years; and this may be called the first result of the application of water; but there are after-effects upon the land which are accumulative and which have not yet been fully investigated.

Experience has reached far enough to show that it will not do to jump to the conclusion that, if fruit grows well for the few years after water is first applied, it will continue to do so. This being settled, it is then necessary to determine what waters are unsuitable and how to apply good waters, so that they may do the minimum amount of injury to the soil. These are the questions that are now of special interest in the Irrigation States of America. They are questions which will be foremost in the development of Australian irrigation.

The American plan of irrigation, as represented by the new and improved methods of application, is clearly more suitable to Australia than that of any other country, in so far at least as the conditions of the two countries are similar. **The climate** is one point in which the regions requiring irrigation in Australia and the arid Western States of America, are in a great measure alike, and, naturally, the crops to be grown will be practically the same. In connection with the cultivation of small areas under investigation, **fruit** of various kinds may be held as ranking high in importance; not because fruit is better suited to irrigation than some of the forage crops, but because it returns a more valuable yield per acre.

According to present information it will not pay in America to grow grain crops on land under a great irrigation system. At the current prices for grain and with the millions of acres of land in the various wheat-growing regions of the world that will produce grain at a minimum of cost, irrigated land cannot compete with the land mentioned, unless in such an exceptional country as **Egypt,** where two crops a year can be secured, and where cornland is worth a rental of £5 per acre.

Although the irrigable portions of Australia and Western America resemble each other in some striking and important features yet there are dissimilar conditions which are unfortunately in this respect not favourable to Australia. The entire system of American irrigation is being accomplished by means of **gravitation.** On surfaces which trend from the central mountain midribs there is an appearance as if the whole country had originally been intended for irrigation.

The table-like surfaces of certain of the mountain-girdled plains in the western valleys, such as that which the writer visited at Phœnix in Arizona, having a fall towards the south-west of about fifteen feet to the mile, appear as if they had been levelled by the aborigines. This idea is maintained by some, and is supported in their minds by the investigations of Mr. Frank Hamilton Cushing, Ethnologist to the National Government at Washington, who estimated that the ancient irrigation works in this district would, when in working order, be capable of supporting a population of over 300,000 inhabitants. There is no doubt that a plain of twenty miles in width could have been levelled by an industrious people who were so numerous, but it is much more likely that the level surface is a natural formation laid down at the bottom of an inland sea or lake. There would have been stronger grounds for the maintenance of the former theory had the plain at Phœnix been the only flat land ; but smoothness of surface is a peculiar feature of the western country away from the mountain ranges.

The uneven and pitted surface of the Bay of Biscay country which comprises so large an area of the flat irrigable land of Australia, compares for irrigation purposes very unfavourably with the flat land of the Western States of America.

There is a vast tract of country lying to the east of the Rocky Mountains with an inclination to the south-east of about ten feet to the mile, which will come within the irrigation area. **It is believed**, although no special survey has yet been made, that it will be possible to find, and put under control, abundance of water for the needs of the arid lowlands, in the mountain ranges and what flows from them ; and the lie of the country is such that all this can be done under a system of gravitation and therefore at the least possible cost.

The cost of canal construction differs considerably in the different districts, owing to the nature of the ground and the difficulty of securing the water-supply. The Bakersfield canal works cost $2.50 per acre, a rate similar to that in Kansas, while in Colorado and Fresno the cost per acre of canalisation is estimated at from $5 to $6 per acre. The figure naturally tends to become less as the area supplied with water increases.

The height of the source of the water-supply in many of the American Irrigation Colonies, enables the water companies to make a considerable revenue from **letting the available power** for electric lighting purposes, for flour-mills, etc. where falls exist in their main channels. The rent paid per horse-power per annum is about £6. **In Australia** irrigation water is found in low-lying, steepbanked rivers, and can only be made available on a larger scale by one or both of the expensive processes of pumping or building weirs.

At the present rate of wages and prices, **a pumped supply of water** to land must of necessity be restricted to an intensive system of cultivation, which under fruit or some other special crop will return more than the average yield got by ordinary cultivation. It appears, after a careful study of the bearings of the case, that the pumping of water for irrigation purposes under the most favourable circumstances will not pay, unless the land to which it is applied, including its irrigation conveniences, is worth £20 per acre, and can afford to pay a charge of 10*s*. per acre per annum for the water right. These figures place such irrigation land, for the present at least, altogether out of the range of grain growing with crops of Colonial averages at current prices.

It must not be imagined that the application of water alone without manure will keep up the fertility of soil and guarantee greatly increased annual returns. **Virgin land** of good quality when first broken in, with irrigation or without irrigation, will yield heavy crops ; but if cultivation is continued without manuring, in a very few years the yield is greatly and quite naturally reduced, whether water be applied or not.

Where there are facilities for employing the American system of gravitation to advantage (and this is so in many places where the water-levels of rivers have been raised by substantial masonry weirs), the cost may be considerably less than where pumping is necessary. So different were the experiences of Western America, with her gravitation system of application, as compared with those to be encountered in Australia. when by the irrigation scheme of **Mildura** and **Renmark**, the greater part of the supply was proposed to be got by pumping from the River Murray, that it was at first felt by many that the venture was in a great measure a new and untried experiment. So far as the system of distribution by pipes was concerned, the work could be no new undertaking after the experiences of the promoters, **Chaffey Brothers**, who developed the irrigation works at Ontario, California—perhaps the most complete and economical system of gravitation supply-pipes to be found in America.

With the establishment of a satisfactory market connection, for disposal of the fruit from the Mildura colonies, the success of the fruit-growing business in the hands of those who understand it may, in the light of recent reports and experiences, be looked forward to as a certainty ; and one which will open up an industry of great importance to the Colonies.

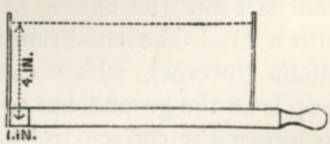
It remains, nevertheless, to be seen to what extent irrigation can be employed to extend the borders of the area of ordinary agricultural cultivation.

It ought to be of interest to those who are connected with irrigation work in the Colonies, or who, like the author, look upon irrigation as an important factor in the development of the arid regions of Australia, to know what have been the experiences in Western America, and to hear of the difficulties that have been met with, as well as of the rich rewards that have fallen to those who have been successful. The most experienced irrigators under the new methods are still only learners. It is therefore not to be wondered at that the details of the systems employed in various parts, not particularly dissimilar in character, are yet widely different ; and, moreover, that the full effects of the injuries sustained by those who have most seriously erred are not yet fully realised. It seems that one of the **most natural mistakes** to commit is to apply too much water. It is led up to by a very simple process of reasoning to the effect that, if a little water is good, more water ought to be better. Some favoured spots do for years escape serious injury, or in fact any perceptible injury from the application of infinitely more water than the amount required ; but in other places the injury is immediate and easily observed. Common-sense ought to teach the observant that, owing to the irregular distribution of rainfall which comes in season and out of season, much of the moisture the earth actually receives is of no value to the annual crop, if indeed it does not injure it. It may readily be inferred that, if applied at the proper time when the crop stands in need of it, a greatly reduced allowance per acre would suffice. This is the first striking advantage which a system of irrigation has over the natural rainfall method of water-supply: it can be turned on or off as circumstances require.

There are **various methods of measuring** and estimating the amount of water applied to land. In the irrigation department at Washington, the "Acre-foot" e.g., the amount of water which if permitted to cover one acre would measure one foot in depth, is the standard measurement adopted.

The oldest, simplest and best **standard unit** for water measurement is the flow of a cubic foot per second, but the unit in almost universal use in the Western States is the miners' inch, a relic of the early California gold-mining days. It may be defined as the amount of water passing through an opening an inch square under a pressure of a specified number of inches of water measured from the surface of the body of water to the centre of the exit opening.

In Colorado the legal pressure is six inches of water, and in California that in common use is four inches, as shown by the accompanying figure. Under the latter circumstances fifty miners' inches are equivalent to about one cubic foot.*



Method of Measuring a Miners' Inch of Water.

* Or the value of the miners' inch may be stated as follows—

1 Miners' Inch —	0·02 cubic feet =	0·1496 gals. per second.
1 ,, ,, —	1·2 ,, ,, =	8·976 (or 9) gals. per minute.
1 ,, ,, —	72·0 ,, ,, =	538·56 gals. per hour.
1 ,, ,, —	1728·0 ,, ,, =	12,925·44 (or 13,000) gals. per 24 hrs.

The amount of water allowed in terms of the miners' inch measurement varies considerably. A continuous flow of a one-inch stream on the four-inch pressure is considered sufficient for ten acres at Ontario, and for three acres at Riverside.

No doubt the unit of a cubic foot per second, being altogether more satisfactory and more simple, will ultimately be adopted both in Australia and America.

The surface flooding of land is followed by the compacting of the particles of the soil and the hardening and solidifying of the surface. One and all of these effects are against the perfect growth of crop plants, and the injury resulting is accumulative, in soil of a given density, usually in proportion to the amount of water supplied. Soils that contain a fair amount of clay, or are rich in vegetable matter, also crack or open up deeply on drying, and thereby compress and injure the roots of growing plants, besides exposing a greater surface from which excess of evaporation takes place and loss of moisture proceeds.

To obviate these tendencies in land growing fruit-trees or crops sown in rows, frequent cultivation is necessary to keep the surface in a finely divided, powdery condition. There is no practical method by which evaporation can be so effectually reduced to a minimum, as by a layer of finely divided soil closely covering the surface. The moisture is held fast and the baking of the soil containing the roots, into a brick-like condition, is prevented. Land growing alfalfa (lucerne), which cannot be cultivated while the crop is on the ground, has to be ploughed up now and then to loosen the surface, to let the water get into it, so hard does it become by repeated watering. This operation can be performed with impunity as it does not destroy the roots of this crop, which subsequently grow with increased vigour.

The induration of the surface-soil is not the only serious damage done in soils by excess of irrigation.

The water-table or the surface of subsoil water is frequently injuriously raised, so that the area becomes water-logged and the crops actually drowned out. In some irrigation districts of California where excessive quantities of water have been used for a number of years, the basin into which it has been poured has gradually been filling the interstices of the subsoil particles from below, so that the water-table has been forced up from a depth of forty feet to a few feet from the surface, and in some instances up to the surface itself. The remedy in the latter instance has been to stop the excessive use of water, and to dig round a field so affected a drain seven feet deep, to carry off the surplus water as it rises. If permitted to come up into the surface layer occupied by fruit-trees or crop plants, the deep roots rot off, and the area of the feeding-ground as well as the feeding power of the plants or trees are thereby diminished. The raising of the water-table is no doubt an advantage if it do not approach too near to the surface. In some places where the proper conditions in this respect have been secured, the subsoil moisture has been sufficient to grow crops without irrigation.

Perhaps the most baneful result of an excessive use of water in a hot climate is the appearance of **alkali efflorescences**, which destroy vegetation and render the soil barren. The soluble salts of the soil are dissolved by the abundance of water soaking through it and are carried in solution by capillary action to the surface, where they are left as a crystallised crust or powder when the water goes off by evaporation.

An excess of soluble salts in a soil is hurtful to vegetable life, even although those salts are such as are beneficial to plants when present in moderate quantities ; but this is not a usual cause of difficulty. The effects are as a rule only baneful when by means of evaporation the surface becomes charged to redundancy. Eliminate the action of evaporation and nothing of an unusual or injurious nature could be detected in either the soil or soil-waters of many badly affected districts. If the young or tender plant is poisoned soon after germination, or if the hurtful condition of soil is induced during the growth of the plant, the bases of the stems rot as the crop advances to maturity, but before it can form and perfect its seed.

It is evident that whatever will tend to maintain the soluble salts in the body of the soil and prevent their appearance on the surface ought to have consideration as a remedy against the evil. To this end **under-drainage**, to prevent so much water rising, and frequent and deep cultivation of the surface soil to mix and powder it, have proved simple and efficacious mechanical means.

The salt or alkali soils of California correspond in a number of important particulars to the **reh** or **usar** soils of Northern India. We are indebted to **Professor E. W. Hilgard** of the University of California, at Berkeley—the Soil-Wizard of the West—for much valuable information regarding the causes and prevention of injury by alkali accumulations.

This authority divides the substances forming the alkali deposits into three classes,—(*a*) neutral alkaline salts, such as common salt, Glauber's salt (sulphate of sodium), sulphate of potassium, etc. These are injurious only when present in large quantities, and relief can then be obtained only by washing them out of the soil by means of underdraining and flooding the land. (*b*) "Soluble earthy and metallic sulphates and chlorides, such as sulphate of magnesia (Epsom salt), bittern, chloride of calcium, alum, copperas, etc. The cheap and efficient antidote to most of these substances is lime or marl." (*c*) "Alkaline carbonates and borates. These, especially the former, are injurious in the smallest amounts, rendering the soil-water caustic and corrosive, and in clayey soils rendering it almost impossible to obtain good tilth by their peculiar action upon clay. The antidote to these (the true alkali salts) is gypsum or land plaster."

The carbonate of soda is by far the most injurious of all the "alkali" salts enumerated under the three headings. This arises not only from its corrosive power, but is also due to the peculiar action (shared with the carbonate of potash) which makes it almost impossible to produce a tilthy condition in true clays. They are maintained in the most "impalpably divided condition—that of well-worked pottery clay," in place of the flocculent though tilthy state it assumes in a cultivated soil; and they bring about the dissolution of the vegetable matter or humus, the effect of which action is made apparent by the dark appearance of the alkali-spots or "black alkali" in some localities.

Although the final result of the presence of reh in British India is barrenness, as in the case of the alkali-soils of California, the conditions in the two, countries when compared differ somewhat in detail.

The neutral sulphate of soda or Glauber's salt, at one time largely used as a drench for cattle, is the most prominent ingredient in the Indian alkalies, common salt—or chloride of sodium—coming next.

In California, although each of the salts named forms a large percentage of the total amount present, yet in a considerable number of cases **sodium carbonate** is most abundant, and in others, if not most largely represented, it is almost invariably present in such quantities that its presence, owing to its noxious effect, is productive of the greatest share of the resulting injury.

Clay soils in California are reported to suffer more severely than light or sandy soils, while in India certain light sandy or silty soils are as badly affected as any. In India, in addition to the primary causes which are present in the case of the rise of efflorescences in any country—viz., heat sufficient to produce rapid evaporation, and a sufficient abundance of water to be evaporated—there seems often to be some mechanical defect in the salt-retaining power of the soil. There is little doubt but that the peculiar influence, which the carbonate of soda has upon clay, has also a good deal to do with the fact that heavy soils in California suffer to a greater degree than light soils in the same neighbourhood or than the heaviest class of soils in India.

The chemical reaction of a fertile soil is slightly acid. The presence of the mild and useful agent, carbonic acid, is a sufficient explanation of this fact. Neutral salts, although soluble, do not readily exercise any injurious influence unless when present in large quantities. It is the caustic nature of the carbonate of soda which gives an alkaline reaction that is mainly responsible for the injury resulting from the presence of this salt in even very small proportions. The object aimed at in applying gypsum as a chemical antidote to soils poisoned by salts of the alkalies is to induce a neutral condition.

Deep drainage, together with frequent and deep surface stirring, is necessary in the presence of alkalies of whatever kind.

The saline impurities in irrigation water is another matter for consideration of equal importance with the existence and character of the soluble salts in the soil. It is, moreover, a subject which will require careful investigation in Australia, where so much of the artesian water, which has been tapped, is what is termed "sweet" water having a distinct flavour of mineral salts. This water is in no way hurtful to stock when they become accustomed to it, but is not to be used for irrigation purposes.

The determination of soluble matters in soil or in water can be accomplished with certainty by the analytical chemist, and when the results are presented useful deductions can be drawn from them. But in this instance the materials are sought for in the condition in which they naturally exist and have not to be changed in form nor has a conjecture to be made as to the possible nature of them, as in the case of a so-called "complete" soil analysis.

It should be remembered that the solid contents of clear river-water usually vary from five to twelve grains per gallon. **Sweet waters** from artesian wells in Australia are unfit for irrigation purposes, as the percentage of saline matter is immensely greater.

It is interesting and instructive to estimate the **amount of saline material** left in the surface layer of soil by a system of irrigation where river-water is used, and where the whole is ultimately evaporated, there being no escape into drains or into a porous substratum. It should also be understood that the power of the soil to incorporate a certain amount of soluble matter, has been fully satisfied. Ten inches in depth of water is a convenient amount to select as a basis for the calculation, and it is at the same time a usual annual amount actually applied in practice. Seven grains to the gallon, and a period of ten years in which to carry out the work, would give the following results. One gallon of water will cover about $1\frac{1}{2}$ square feet, 1 inch deep; or two-thirds of a gallon, 1 square foot, 1 inch deep, or $6\frac{1}{2}$ gallons per square foot is equal to 10 inches in depth of water. In ten years there would be a deposit of 455 grains, or about one ounce of alkali upon each square foot. If this consisted of salts which entered into the composition of plants or were not hurtful to them on account of the salts being distributed through the whole body of the soil occupied by their roots, the addition would act as a manure rather than as a cause of injury.

Much, therefore, depends upon the character of the salts thus accumulating. If free from carbonate of soda, little fear may be entertained of **river-water** producing serious consequences, unless when it is applied to an area where there is no means of escape for subsoil water. Land on river-banks is not likely to be thus affected, as it is found that surplus irrigation water usually finds its way back into the river at a lower point. A case in which danger in the application of river-water may be predicted, is when a canal, carrying river-water, is led into a land-locked depression with only evaporation as a means of escape for moisture. Under such conditions in a hot climate few river-waters could be used for irrigation without the ultimate result being injurious. The substratum gradually fills up the basin, and, as the water rises, soluble salts are carried with it from considerable depths. So important is the matter of the existence of a means of escape for surplus water, that the **irrigation laws** of any community should **provide** for a **drainage system** where no adequate natural means of drainage exists. It might not at first be necessary to drain for a few years, but if the water-table in the lower levels were ultimately found after regular inspection to rise near to the surface, the community in question should be bound to construct drains, so that the owners of land at the lower levels should not suffer by their property becoming water-logged through soakage of water from the higher levels. Near Fresno, in the great Californian valley, the **water-table has risen** from a depth of over forty feet till within three to five feet of the surface and in a few places to the surface. In the Salt River valley in Arizona the subsoil water has come up thirty feet nearer the surface since it was settled and irrigated.

Irrigation on a large scale **in Australia** is comparatively new, and many of the dangers and difficulties detailed and discussed have not yet appeared; but the necessity to begin now to **use** preventive **precautions** is none the less urgent. The results referred to are the accumulated results of irrigation carried on under conditions that are very similar to the conditions which prevail in the Colonies. They have been found equally true in vast areas in India and in America; and it may be taken as purely a matter of cause and effect that the ultimate result in Australia will be similar under similar conditions. The same natural laws govern the work of irrigation in the three countries, and, in fact, in all parts of the world similarly situated. Australia need therefore look for no special dispensation to secure immunity from numerous evils which spring from misguided practice. Her only chance of escape is to employ the means which the results of previous experience have placed at her disposal.

The system of **surface irrigation** is most generally adopted because it is most simple and least costly to establish ; but of the three common methods—(*a*) surface, (*b*) side, and (*c*) sub-irrigation—it is the one attended by most injurious consequences to the land and to the crop.

Side irrigation may be shortly defined as the supply of water to land by soakage from the sides of open ditches, so that the surface is never injured by flooding. A simple and effective modification of the side or soakage system is in general use in the orchards of the Western States, where the water is guided into three temporary furrows or channels opened on each side of a line of trees and then allowed to percolate through the body of the porous soil lying to the right and left. After the water has been turned off, and sufficient time has been left for the surplus moisture, not firmly held by the soil forming the channels, to sink, the surface is cultivated and the channels obliterated to prevent their becoming hard and opening in cracks.

Sub-irrigation is the system which is held to be the most perfect of all the various methods of applying water where the soil conditions are suitable, because, by leading the water on to the land in subterranean channels, which are laid like ordinary tile or pipe drains, the least possible supply of water is made to serve the purpose with the greatest benefit to the land and at the least cost of maintenance. The channels, if properly constructed, also act as drains when not required for the supply of water. The one drawback is the vastly greater original capital involved in this system than in any other, in laying down the underground distributing channels. The cost of tile-draining a field in this country is estimated at from £6 to £8 per acre, according to the nature of the land and the consequent depth of the drains, and width between them. The average cost would be still greater in a new country where wages are high and materials are expensive. **The total cost,** including head-works and distribution, of conducting water upon land in the territory of Arizona, one of the most successful and most perfect irrigation centres that are to be found in America, is only $8 to $12 per acre. No explanation is necessary to show that, under ordinary circumstances where capital is dear, the additional expense of £6 or £8 per acre must make the cost prohibitive. Moreover, in the case of land with a porous subsoil a portion of the irrigation supply might sink and escape from the soil without benefit to the crop.

A good deal can be done to **prevent the appearance of alkali,** and also to ameliorate the condition of soil suffering from it, **by the selection of** deep-rooted and vigorous growing crops that cover and shade the surface and absorb the water they require by deep and fleshy roots well down in the soil or subsoil. In both ways such crops lessen the upward current of water by capillary action, and consequently lessen the accumulation of soluble salts near the surface. It was thus that the author explained, in his work on India, the success of the growth of the rain-tree (*Pithecolobium dulce*, Bth.) on usar or reh soils.

By the decay of deep fleshy roots in the soil, its power to retain soluble salts in its substance is increased, and the total amount left free to circulate in the water of the soil is proportionally diminished.

The crop of all others which, from a scientific as well as from a practical and useful point of view, has given the best results under irrigation, is **Lucerne** or Egyptian clover (*Medicago sativa*), the Alfalfa of the Western States of America. It is also a crop which is admirably suited to the conditions existing in the Australian Colonies. Grain crops are far from being well adapted for irrigation, or indeed for growth, in aught but a limited area of Australia, until some preventive of the rust of wheat has been discovered; but where lucerne can be freely grown for hay, or made into silage against a time of scarcity, or can be consumed where it is grown by grazing and fattening steers from the up-country stations, there can be no lack of inducement for the development of the irrigation systems of Australia. On the irrigated lands of Arizona two acres of lucerne are sufficient to graze five large bullocks or horses; and it is estimated that three-year-old fattening steers grow beef at the rate of two pounds per day when fed on green lucerne raised by irrigation.

CHAPTER XII.

POSITION OF COLONIAL IRRIGATION.

Irrigation in Victoria—Statement by the Hon. A. Deakin—Report of the Secretary—National Works—Irrigation and Water-Supply Trusts—Proposed Trusts—Waterworks Trusts—Domestic Water-Supply—Boring for Underground Water—Australian Irrigation Colonies—Terms of Contract—Mildura—Renmark—The Scheme—The Town—Capital Spent—Agricultural College and other Institutions—Number of Settlers—Prices of Land—Character of the Soil—Pumping Machinery and Engines—Size and Extent of Canals—Finance the Great Question—Possible Drawbacks—Depth of Soil—Clay Subsoil—Soluble Salts Objectionable—Competition with other Colonies—Reduction in Price of Fruit Possible—The American Growers' Markets—Prospect for Australian Fruit in Europe—Dried and Preserved Fruits—Increased Consumption of Preserved Fruits and Jams as a Substitute for Cheese—Want of Experience on the Part of Settlers.

Irrigation in Victoria may be said to have begun so recently as 1886. The first prominent advocate of it was the late Mr. Hugh M'Coll, and at his much regretted death, his mantle fell upon the no less able and enthusiastic exponent of the cause, **The Hon. A. Deakin.** At a conference of irrigation authorities held in Melbourne in March 1890 Mr. Deakin, then Minister of Water-Supply, in an interesting and lucid speech explained the irrigation scheme of the Government. He pointed out that the area of good land which it was possible to irrigate extended to about 3,000,000 of acres, worth, without irrigation, £11,000,000, and that the sum it would be necessary to provide to aid in carrying out the works would not in the end exceed

£4,500,000, advanced at the rate of about £500,000 annually.

To fully understand the position, it will be necessary to refer briefly to the most recent official returns dealing with the question.

The fourth Annual General **Report by the Secretary** of the Victoria Water-Supply gives the position of the irrigation schemes of that Colony up to the end of June 1890.

Under the heading of **national works,** that located in the **Goulburn district** takes the first and most important position. A weir of solid masonry has been built about eight miles to the south of Murchison township, to dam back the waters of the Goulburn River, so that when the works are complete, two main canals will be provided to carry an immense body of water now running to waste on to the surface of the adjoining fertile alluvial plains.

The smaller of the two canals now undergoing construction and intended to be thirty-one miles in length from the weir to the Broken River near Shepparton, branches off on the east bank of the river and will have a maximum capacity of 20,000 cubic feet of water per minute. The canal flowing to the west is intended to be eighty-four miles in length, and to convey 100,000 cubic feet per minute. This branch will pass through an enormous reservoir to be formed on the site of the Waranga Swamp to contain a reserve supply against the dry season of 9,000 millions of cubic feet, of which about 7,750 millions cubic feet, or 48,000 million gallons, will stand high enough to be available for irrigation. **The Loddon Irrigation Works** on the Loddon River, near to Laanecoorie, are intended, by means of a weir of concrete masonry and an adjoining bank, to possess a reservoir-capacity of 576 millions of cubic feet of irrigation water.

Kow Swamp Irrigation Works will involve the conversion of Kow Swamp into a reservoir with a capacity of 1,450 million cubic feet for the summer supply of the lower part of the Loddon valley, measuring about 130,000 acres. The winter supply is to be drawn from Taylor's creek.

Campaspe Irrigation Work is meant to be a regulating storage reservoir on the Campaspe River near Langwornor. The weir will be of concrete 900 feet long at the top and 80 feet high in the centre, and the reservoir will have a capacity of 785 million cubic feet.

At Broken River, near Benalla, it is proposed to erect a weir and utilise the Mokoan Swamp as a reservoir to store about 2,700 millions of cubic feet for use in summer in Broken River and Broken Creek districts.

National works are also projected at **East Wimmera, West Wimmera,** and **Werribee,** but nothing but the surveys have been accomplished yet.

The actual distribution of the water received from the national canal works is accomplished by means of **irrigation** and **water-supply trusts,** of which twenty-seven now exist, seven having been formed during the past irrigation year. The total area of the districts under the trusts is 2,683,557 acres, of which 1,716,983 acres are irrigable, and of these 503,438 acres can be irrigated annually.

The trusts have power to borrow in all £1,677,360, but the Board of Land and Works has agreed to provide £1,240,858, consequently only a small balance remains to be raised in the open market. The Board has already advanced £457,145 and will provide the remainder of the promised sum when it is required. The present gross value of the land capable of being irrigated by the Trust water, is estimated at £6,554,305, and the present annual rateable value only amounts to £282,973.

The schemes of fourteen **proposed trusts** are now under consideration. They will irrigate a net area of 1,899,385 acres, of which 409,920 acres will be watered annually. The gross value of the land is estimated at £8,101,030 and the total cost of the schemes at £1,233,800.

Waterworks trusts, to the number of forty-three, exist throughout the Colony of Victoria. On these the Government has advanced on loans £762,379 16*s.* 8*d.* and is still liable to provide £154,578 2*s.* 9*d.* for similar purposes when necessary.

A domestic water-supply has been provided to twenty-three municipal bodies by means of Government loans, the total of which now amounts to £601,619 0*s.* 4*d.*, besides the sum of £158,420 of unpaid interest and moneys due towards redemption. As a result of the shifting of the centres of population, owing to the uncertain nature of mining operations, a large amount of these liabilities must now be looked upon by Government as bad debts.

Boring in search of underground water has been carried on in the Colony of Victoria for the past four years at a total cost of £42,700.

Two chains of boring works have been made with the object of testing the possibilities of the Mallee desert country; the one from Nhill, the other from Donald, extending north towards the River Murray. The results are so far disappointing, as artesian water has not been found, and it is thought that the abundant artesian supply belonging to the secondary formations in Queensland and also in New South Wales, does not pass under the Mallee area in Victoria. The water which has been tapped by the borings is mostly salt or brackish, although in a few instances fresh water has been got, and is available for pumping.

The Australian Irrigation Colonies of Mildura in Victoria and Renmark in South Australia were established by the energy and enterprise of Messrs. George and W. B. Chaffey, two Canadians who had been successful pioneers of irrigation applied to fruit-growing at Ontario, California. Their arrival in Victoria was one of the results of the official visit which the Hon. A. Deakin, President of the Royal Commission on Water-Supply, paid to the irrigation centres of Western America in 1885.

The terms of contract with the two Governments were drawn on similar lines. The two Colonies are worked separately, though under the same company—Messrs. Chaffey Bros. Limd.

Renmark Irrigation Settlement is 140 miles west from Mildura, and further down the Murray.

Mildura is situated in the north-west corner of Victoria, 340 miles north-west of Melbourne, on the southern bank of the River Murray, adjoining that part where it receives the waters of the River Darling from the north. The total area secured under the contract amounts to 250,000 acres.

The company was bound to spend £35,000 within the first five years, and during the three succeeding periods of five years, £140,000, £75,000, and £50,000, respectively, or a total of £300,000, within twenty years. The regulations fix the maximum amount of water to be taken from the Murray River during each month of the year, in order to prevent the river being so reduced as to interfere with its navigation.

At Mildura 25,000 acres of land were cleared and surveyed into blocks of ten acres. **The scheme** adopted was that which has proved so successful in the irrigation Colonies of Western America, and work was begun on 1st October, 1887.

The town or commercial centre of each Colony is laid out in building-blocks with broad streets at right angles to each other; the main avenue being a boulevard of 200 feet in width. The water is carried in a net-work of pipes, and let on to each ten-acre block at the highest corner and left for the owner of the land to distribute by gravitation through surface channels. No enterprise of the kind was ever more widely **advertised**, and the result has assumed proportions beyond all ordinary expectation. The total amount of **capital spent** by the company at Mildura up till the end of June 1890 amounted to £183,835, a sum more than five times the amount of the contract minimum for five years. **Ample reservations** have been made for the endowment of an Agricultural College, and everything has been planned for the development of a complete self-contained community representing all ordinary institutions, trades, and professions. About 3,000 **people**, including 350 school children, are now settled on the land, with the privileges of local government granted to them. A State School, Post and Telegraph Office, and Custom-House, have also been erected.

About 10,000 acres have been sold up till the present time, and of this 4,500 acres are cultivated largely under fruit-trees and vines, both of which have done well.

The land is sold at from £15 to £20 per acre, and even more is got for favoured spots, while various inducements are offered to settlers in the shape of easy terms. A portion of the money is allowed to remain unpaid for a term of years at interest. A settler who does not care for the hard and irksome work of breaking fresh ground can, after selecting, get the company to work his block for a year or two on contract.

The soil has been thus described by Mr. T. Hardy. "There appear to be four distinct kinds of land in both places: 1. The lower flats, which are thickly covered with red-gum and liable to inundation every summer. 2. The flats from ten to fifteen feet above the present water-level of the river, and which are generally covered pretty thickly with the box-tree gum. These flats are liable to inundation by heavy floods, the soil is very clayey and sets very hard in dry weather. 3. Above this are the flats, more or less undulating, covered generally with mallee. The soil in most places is a red sandy loam, with a clay subsoil. In some places limestone, in round lumps, comes within a few inches of the surface, but in most places the soil appears of sufficient depth for all cultivation. This description of land comprises, I should think, three-fourths of the whole.

4. The sandy ridges covered with bull-oak and native pines. The sandhills appear to be fairly good land, with a clay subsoil at varying depths. The last two kinds of land are the only ones suitable for the cultivation of vines or fruit-trees. Which will do the best will be found out in time. Very likely the pine land will be best for oranges, lemons, apricots, peaches, and for table grapes ; but probably the mallee land will be the best for the raisin and currant vines."

It is claimed for the **pumping machinery** that it is the finest ever erected. The total indicated horse-power of the engines amounts to 2,000 ; these are placed in substantial brick buildings.

The work of lifting the water a height of thirty-five feet is done by immense centrifugal pumps, driven by direct acting triple-expansion engines. Four **pumping stations** now exist, but a fifth is contemplated, where plant will be erected capable of raising 650 tons of water per minute to fill an immense lake or billabong which opens into the main channel. The lake is filled by the river when in high flood, but it is thought necessary to erect the pump as a precaution against a water-famine, should the river not rise sufficiently to fill the lake.

The channel from the pump to the lake is 100 feet wide and four feet deep. The depth of the main irrigation-supply **Canal** is four feet, the width twenty-five feet, and the length five and a half miles. A high-level channel is twenty five miles long, fifteen feet wide and four feet deep.

The important question of whether the enterprise will pay, is not yet solved. The development so far may be said to rest entirely upon faith and advertising, although it must be admitted that the promises of fruit from some of the earlier planted vines and trees are very encouraging. Even the original Western American schemes upon which the Mildura Colony is founded are yet on their trial as regards their **financial success.** It is the impression of many men of experience that the irrigation land in the Western States of America will ultimately prove to be too dear. Should this be the case the land at the Australian Irrigation Colonies will be in a similar position.

There is no assurance that the extreme prices of irrigated fruit-growing land may not turn out to be, like the extreme prices of early-potato-growing land in the Channel Islands, ultimately the ruin of the greater part of the community interested, although the profits obtained for many years were phenomenal; for assuredly the value of fruit-growing land is only maintained by the extreme prices of fruit, and, as in the case of the potatoes, the enterprise is likely to encourage the development of an immense host of competitors.

There are possible drawbacks which are liable to interfere with the growth of these Colonies.

The depth of soil is often given at one foot to eighteen inches above the clay. There is a distinct relation between the depth of soil and its capacity for producing crops. It is quite certain that the depth of soil on the Irrigation Colonies is not sufficient to maintain a satisfactory state of fertility without a liberal application of manure, unless it be found that the **clay beneath** is of a character which will permit plant roots to penetrate it and to use it as soil. No doubt the clay will conserve the water applied; but, at the same time, the water must in those circumstances be used with great caution and skill to prevent water-logging; and a thorough system of under-drainage is essential.

It is very frequently the case that fruit-trees in Britain do remarkably well until their roots go down to touch the clay, when they become cankered and diseased.

If settlers are in reality depending upon the **soluble salts** belonging to the Murray River water to act in place of manure, they cannot fail to be grievously disappointed. They will find that one of their greatest anxieties will be to get quit of those very soluble salts that are pointed to as an inducement for settlement. In a comparatively shallow soil resting upon clay the soluble salts cannot be washed out unless there is a good system of deep-drainage, which will add considerably to the price of the land.

It must not be forgotten that the **irrigation colonies have to compete** with the fruit-growing areas of other Colonies where irrigation is not necessary. **A reduction** in the price of fruit must also be looked to, whatever market it is intended for. Even at the time of the writer's visit the prices of apricots and of grapes had, in South Australia, fallen considerably below the prices of the previous year, owing to the greater amount produced in the neighbourhood of newly created tinning works. Apricots had come down from £18 to £9, per ton and even at that figure the price could not compete with Californian apricots now offered at £7 per ton. With the development of Western American fruit grown by irrigation, lower prices have prevailed except in the case of oranges. Orange-orchard land still rises in price in America, and still pays excellent profits ; but with the growth of the industry at present rates there is no question that the days of much lower prices are not far distant.

The American growers possess a great **advantage** over Australian growers in having such an immense market at hand in the Central and Eastern States. Even now it is but a limited amount of fresh fruit that finds its way into the Eastern States. The Eastern market is still imperfectly supplied with fruit at moderate prices ; but when that market is filled up the surplus produce of the vast irrigated areas of the West must find its way into Europe. There it will compete, on exceptionally favourable terms, with the surplus exported fruit from the Australian Colonies. The cost of transit will be less and the surplus sent will be that of a much larger trade than the Colonial trade, and this will enable the American trader to do it for a smaller profit.

It is quite true that some of the **fruits will come to the**

European market at a time when fruit from other parts of the world is not abundant; but it is not likely that consumers will agree to pay a greater price for Australian oranges than they require to do for American oranges, considering the short period during which Australian oranges enjoy a monopoly.

It is more in the line of dried or preserved fruits that Australia may expect to establish a trade connection with Europe, and, in this branch, no special advantage can be claimed for the Colonies.

Although the labouring classes in this country have in recent years increased the **consumption of preserved fruits and jams** in a marked degree, yet there is a limit to this increase and one which is well worthy of consideration. The jam is not consumed in addition to other food or purely as a luxury, but it has supplanted to a large extent an important and valuable article of food in the shape of cheese. It is admitted that jam or preserved fruit is excellent in its way, (good for the purification of blood and for the digestion,) but, as a staple food for the support of a working man, time will not favour jam in a competition with full-milk cheese.

Perhaps the **greatest difficulty** which will be experienced for a time will be the ignorance and the want of skill of the settlers, who are drawn from all ranks and professions. Not only must there be ignorance of the methods suitable for an Irrigation Colony, but also on the part of many ignorance and want of experience of actual work. The conditions in this respect cannot differ greatly from those of similar settlements in America. It would be too much to expect the margin of profit to be great enough to guarantee the success of men without special knowledge and experience unless the trained and accomplished gardener, who is really the type of man wanted in an Irrigation Colony, were in the position of making a fortune in a few years.

Irrigation is also developing in New South Wales. At the end of 1890 the **Mulgoa Irrigation Act** was passed, giving authority to a company promoted by Messrs. Chaffey Bros. to secure water-rights for irrigating 18,000 acres of land about 30 miles from Sydney. The position of the land makes it necessary to supply pumping plant to raise the water to a height of over 180 feet from the Nepean River. The soil is reported to be suitable for the purpose, and the subsoil is of such a nature that it will probably not require artificial drainage.

CHAPTER XIII.

REVIEW OF THE POSITION AND OF THE IMPORTANCE OF IRRIGATION IN VICTORIA.

What Irrigation has accomplished in the Past—The Labour Question—Irrigation Laws—Want of Rain in Australia—Ignorance of Irrigation—Importance of Irrigation for Australia and particularly Victoria—Crowding in Cities—Provision of Labour—Advantages of Irrigation to Victoria—Effect of Growth of Rural Population—Irrigation a National Question—Relative Rights of City and Country Residents—Proceeds of Land Sales to go for Irrigation Purposes—Wealth Tends to Grow in Cities—General Responsibility of the Community to erect National Works—Centralisation of Population and of Wealth—Amount Received for Sales of Crown Lands—Annual Rental—National Works Built at Expense of National Exchequer—Occupiers' Liabilities and Increased Expenditure—Danger of Irrigators being Swamped by Debt—Board of Land and Works to Lend Money to Irrigation Trusts at first Free of Interest—The Responsibility of Management—The Trust may Dispose of Bonds—Funds to meet the Interest — Redemption of Bonds — Advantages of Lightening Liabilities at first—The District to be Responsible for Payment of Bonds—Interest Levied in Proportion to Water Used—Advantages Resulting—Most Water Required when Irrigation Begins—Minor Points Worthy of Consideration—Half of the Water is Lost by Leakage—Loss by Evaporation—Question of Water-right—The Riparian Law—Water-rights should Belong to Government.

IN advocating the value of irrigation it is now usual to point to **what has been accomplished in the past**, and to show that irrigation was the foundation upon which the greatest centres of populations and kingdoms of the ancients were reared. Among these are prominent, in the New World, Peru and Mexico, and in the Old World, Egypt, Assyria, Babylonia, Nineveh, Persia, India, Ceylon, and China.

One fact of vital importance in contrasting ancient with modern irrigation is not fully recognised or appreciated —viz., that the irrigation of the ancients was carried on when **the cost of labour** was so small as to be hardly worthy of consideration, whereas the irrigation of Western America and the irrigation of Australia are coming into prominence under a system in each country whereby wages are artificially maintained at an abnormal level.

The available cheap and skilled labour of the Chinaman is almost, if not wholly, excluded, and it is left to untrained hands to learn the work, and meanwhile to develop a system involving great skill and personal interest to make it successful. It will be seen how far greater engineering skill and wider scientific resources are able to overcome these disadvantages.

The unsettled and ill-defined condition of the **irrigation laws** in Western America indicates the great difficulty of coming to a final agreement or understanding among those who are directly or indirectly interested. So many systems of providing the necessary capital have been adopted, and so many methods are involved in the distribution, the apportioning, and the application of the water, that no uniform law could dispense equal justice in all the States within the arid or irrigation region.

To arrive at what would be an equitable basis of operations and a feasible **scheme** on which to work in Australia, it will be best to promulgate general principles, to point out a few of the leading difficulties, and to indicate in a general way the actual position of the Colonies.

Of the vast continent of Australia only a small fraction of the area is sufficiently **supplied with rain** to enable it to reach its maximum of usefulness. Excellent arable land which would grow crops in abundance but for the want of sufficient moisture, remains in the condition of a worthless desert; but the area which is attended with the greatest amount of loss and disappointment to the resident is that on which there is sufficient rain at times to encourage cultivation and occupation, and not enough to prevent the loss of the invested capital through the death of stock or the destruction of growing crops during frequently recurring periods of drought.

There is an immense amount of **ignorance** among the ordinary cultivators regarding the value of irrigation and the methods of its application—an ignorance far more profound and hopeless than the man of business would suppose; because among the smaller holders, who have perhaps the greatest need for irrigation, information of a useful and practical kind takes long to be communicated. Those who have suffered most from the want of water are unfortunately least able to take advantage of irrigation when it is brought within their reach and knowledge.

The great **question of irrigation** is not one of merely local or individual interest, but it is in the first instance essentially a National Question, and in the case of Australia one of the first magnitude. It is peculiarly a matter of urgency and importance in the **Colony of Victoria**—the most limited in area of all the Colonies—not that it is likely to yield greater results in Victoria than in other parts of Australia, but because the benefits to be derived are there more immediately required for the continuance and the expansion of Colonial prosperity. Hitherto a large section of the labouring classes of Victoria has been engaged in mining; but, great though the numbers of mining workers are, their increase cannot be expected to keep pace with the increase of population, and, moreover, in a mining community there is always a percentage who wish to change to more congenial occupations. Room ought to be made for this class and for the increasing surplus of the total population. Already the pressure of too much **crowding has been felt in the large cities,** where the "unemployed" difficulty presents itself from time to time with the depression of the trade barometer.

It is no duty of Government to **provide labour** for those who choose to call themselves the unemployed, unless as an alternative in a matter of extremity to avoid a resort to a system of pauperising by gratuitous charity; and even in such a case the offer of employment ought to be safeguarded by tests which would guarantee the genuine character of the demand for it.

Though this is admitted, the fact does not exclude a Government from shaping a National Policy in such a way that, while a great and important object is the first and by far the most prominent feature of a scheme, there may exist a subordinate advantage of considerable importance to the labouring community. The question which the Government of Victoria had to face, in determining the necessity for and feasibility of irrigation, was not merely the interests of the existing agricultural or land-owning population, but the general question of how the Colony as a whole would be benefited. It was abundantly evident that, if some additional channel were not opened for useful surplus labour, it would either leave the Colony in search of employment or remain to aggravate the "unemployed" difficulty.

The advantages to the Colony of a comprehensive scheme of **irrigation** may be enumerated as follows:—

(*a*) The retention and the increase of population.

(*b*) The increase of national capital by transforming the labour of a large number of able-bodied workers into national property.

(*c*) The increase of the useful area of the Colony by conferring a value upon land which, without water, could have little or no value.

(*d*) The increase of the home food-supply and, possibly, of a surplus supply available for exportation.

(*e*) The increase of the general trade of the country.

A large and prosperous agricultural community cannot spring into existence without a concurrent development of a town and trading (including a manufacturing) community necessary to supply their needs and form, as it were, the back-support and framework of the rural picture which is being contemplated.

By the establishment of a prosperous rural community, a certainty is made of the appearance of a population representing numerous trades and professions which, in our elaborately developed system of division of labour, are absolutely necessary for the supply of the innumerable requirements of people living in the country. These traders in return pass on the money which they earn to other traders who do duty for them, and so a vast semi-social and commercial network is made of the country people, the residents in villages and small towns, and city communities, in which the benefits of the existence and prosperity of the one class is passed on to the next, and through them and their associates and surroundings to the community at large.

If the principle of protection is in any way justifiable as a national measure, it is on the ground that the benefit conferred by it is not confined to the class which it is meant to directly help, but that the advantageous results, which must be admitted to be indispensable in a young and struggling community, filter through the favoured classes to many others besides.

The question of **irrigation is clearly a national question** and for that reason the whole weight of its cost and responsibility should not be thrown upon one class—the land occupiers—but be shared by Government as the representatives of the community which is ultimately to reap the greatest benefit. The town community has already derived benefits, which have cost them nothing, from the work of the pioneer-settlers, so that at the present moment the majority of the community is in debt to the minority in the country, in virtue of the greater bodily suffering and inconvenience to which those who have undertaken pioneering have been subjected. It may be argued that pioneer-settlers have reaped the reward of becoming land-owners; but they only do so as members of the community, and their possession of property, which their own energy has made more valuable than it was in its original state, does not detract from, but adds to, the total capital of the nation. If they manage the property to the best of their ability, for which there is a strong personal inducement, they act in a most important sense as stewards for the community. All the advantages which the existence of property confers are distributed and maintained. The question at this point resolves itself into a matter of the artificial distribution of wealth, which cannot be undertaken without serious danger of social anarchy and confusion.

Where Government **lands remain to be disposed of** in an irrigation centre, the proceeds of sale should naturally be employed in developing the future capabilities of the district by being added to the fund intended to defray the expenses of the construction of the main irrigation or other national works What justice can there be in the prior claim of the wealthy residents in such a centre as Melbourne to the money derived from the sale of land perhaps 300 miles away to help to relieve them of a share of the burden of taxation, by placing the money to the general revenue account? The residents in a large and growing city derive advantage from the circumstances of their surroundings, because **wealth tends to grow** as well as to accumulate—capital increases in virtue of the increase of population, and with growing prosperity there must of necessity exist a large and well-paid labour-market. There is clearly no part of the country which has a greater right to the money derived from the sale of land, than that part in which the land in question is situated.

If land was sold in times past and the proceeds appropriated by the Government of the period for general purposes, it is equitable that the community which then reaped the benefit and has grown rich in virtue of it, should not be free from **the responsibility** of making good the liability to the locality in which the land was sold, by being asked to contribute to the expense of carrying out important national works, such as those required for purposes of irrigation, although it is necessary to assign to these works local and often obscure positions.

One main cause of the widely deprecated evil of **centralisation of population**, is the centralisation of wealth in the great cities. The labouring classes naturally gravitate to the places where they can find at the same time the greatest amount and the greatest variety of employment. Philanthropists and philosophers may harp unsuccessfully till Doomsday on the necessity for "planting" the population on the land of a country, if the Government, in the absence of private enterprise, does not see fit to give an impetus to the decentralisation of wealth, by extending liberal aid to public works of acknowledged importance for the development of the country in those distant parts where population is scanty, and where the burden must otherwise be borne by a limited number, or avoided altogether. The longer such a movement is delayed the more difficult does it become, as people reared in town are, as a rule, through want of experience in the modes of country life, incapacitated, both by inclination and ability, for taking part in rural occupations and pursuits.

It appears from Hayter's 'Victorian Year Book for 1888–9,' that up till the end of 1888 the **amount received from the sale of Crown lands** in Victoria was £23,981,531.

The same official publication states that an **annual** rental of £48,727 is received by Government under the Land Act of 1884 for 11,819,247 acres of unalienated land held under pastoral leases, and grazing leases and licences, and that a further annual sum of £6,496 is also received for 9,249,719 acres of mallee pastoral land under lease. With a total income of over £55,000 from land under lease, above and beyond the large capital sum which has been realised in former years from the sale of land, the Government of Victoria is well entitled to put itself in the position of a liberal and independent landlord, who does not look for a return with interest for every shilling spent on his property, but who considers what is best for his estate as a whole, and takes into account the amenity of his surroundings, together with the contentment, prosperity and happiness of those who live under him.

In a word, the **national works** which it is found necessary to construct for the development of a system of irrigation for the Colony should be entirely and exclusively **built at the expense of the National Exchequer.**

It is impossible for the farming community to bear all the burden of such a vast improvement, nor is it right that they should do so, when the works are intended, not for their exclusive benefit, but for the benefit of the Colony. The finances of the landholders or farmers will have quite enough to do with the **increased expenditure** which it will be necessary to undertake in levelling the surface, in making the distributing ditches on their own holdings, and in changing the entire system of management, as this will involve the purchase of new machinery, and a considerable increase in the annual labour-bill. In the Western States the total cost is not so great as it will be in Australia, even should the head works and arterial channels be constructed at the expense of Government, owing to natural advantages of locality and condition of surface in America, where, moreover, a ready and increasing market for fruit is available. Thriving districts in the

Western States have had their progress checked through their leading men becoming hampered by irrigation liabilities. Many have been forced to sell prosperous branches of other business in which they were engaged, and concentrate their efforts upon their irrigation schemes to save them from bankruptcy.

The great point to aim at in settling an irrigation policy, is to prevent those who do adopt irrigation from being swamped with interest on borrowed money during the first few years, before they have been able to secure any extra return on account of the new departure, and before they have been recouped for their individual outlay.

In addition to the State providing the national, or head works, consisting of weirs across the various available rivers (to raise the water-levels), and the main, or trunk channels, it will be necessary for the **Board of Land and Works** to continue **to provide money** to the Water Trusts for the construction and maintenance of branch channels, and for the opening up of an arterial drainage-system where this is found to be necessary.

It is quite out of the question to expect the land-occupiers to pay interest upon the money expended, meet all their private extra expenditure, in addition to their original engagements, and remain solvent.

The Board ought to advance the **money free of interest** for a period of at least eight years.

The responsibility of the management of each district should be in the hands of a Trust elected by the vote of the community as at present, associated with a Government representative, who would annually report progress and take part in the deliberations of the Trust.

At the end of eight years, when the area under the Trust had been well developed, when the benefits of irrigation had been demonstrated, and when confidence in the ultimate success of the undertaking had been fully established, the Board of Land and Works might be relieved of the engagement to continue to lend the money, and might also be refunded the unpaid interest of the past eight years by the **Trust disposing of bonds** equivalent in value to the amount of the capital advanced by the Board, and the moderate interest upon it which the Government security would command, under general regulations similar to those laid down in the Amended Wright Irrigation Bill—the Act now in force in California—with the provision that a longer period be allowed for repayment of the money advanced, although it would be judicious to make some alterations in other matters of detail. By the regulations of this Act, after the sale of bonds has been duly advertised, they are disposed of to the highest responsible offerer, but not at less than ninety per cent. of the "face-value."

In the Colonies the bonds would require to be sold at par, else the transaction would be carried through at a loss and could not be recommended.

Coupons for the interest are attached to each bond, and are presented for payment to the treasurer of the Irrigation District as they become due—one falling in at the end of each six months.

The funds to meet the interest are raised by an assessment which is a lien upon the land embraced under the jurisdiction of the Trust.

For the first ten years, only the interest upon the bonds is assessed by the Trust and paid to the bond-holders as they present the coupons, but during the second period of ten years the assessment is increased, so that at the end of twenty years the whole of the sum represented by bonds is liquidated, together with the interest upon it. The weak point in this Act is the shortness of the time in which the whole liability has to be discharged.

In the case of the proposed Colonial scheme this would be extended to twenty-eight years, by the period of eight years in which the Government paid the interest; and it would be well to extend it by four years more to give it a period of fourteen in place of ten years, in which to liquidate the bonds, seeing that the total amount of these would be considerably increased by the accumulation of interest during the first eight years.

The advantages which would result from lightening the burdens on the district at first, would be—the encouragement given to develop irrigation; the elimination of what might appear to be an unjust attempt to force the unwilling minority to bear a share of the expense; and the equalisation of the responsibility of payment according to the amount of benefit derived.

If the whole burden were thrown upon the district during the first few years, it would have to be met out of capital, or what would be more frequently the case, the individuals responsible would require to borrow money at a high rate of interest. If the assessment were a general one, in proportion to the value of the property, those who at first objected to irrigation, possibly through ignorance or prejudice, would probably become bitterly opposed to it and refuse to learn or to be persuaded. This source of irritation would be averted by State responsibility.

Although it would be necessary ultimately to make the **district** belonging to each Irrigation Trust **responsible for the payment** of the bonds, and consequently liable to an assessment in proportion to the value of the property, yet it would be in the interests of all concerned to assess the amount necessary to pay the **interest**, upon the amount of water consumed by the different individuals. Although this would necessitate more perfect supervision and greater accuracy in measurement of water, the results would be universally beneficial. A direct inducement would be held out to every individual to save water, a result not only beneficial to himself but also admitting of the limited supply of water in the country being extended to a greater number. The area of the district of each Irrigation Trust could thus be widened and its credit proportionally increased.

Those who did not care to irrigate, or whose land did not require to be irrigated, not being asked to pay year by year for the benefits conferred upon their neighbours by irrigation, the bitter feelings naturally roused by such circumstances would be obviated.

On the other hand, it would be quite fair and right to make each land-owner responsible for a proportionate share of the bonds representing the original outlay, as the value of his property would be raised through the development of the district and the increase of population and of trade which would be created whether he irrigated his land or left it in a state of nature.

It is upon the whole not an unmixed disadvantage that every land-holder does not demand a full supply of water at once, as it is found that for the first few years after irrigation begins, **a given area** of land **requires more water** than it is necessary to apply afterwards. For example, when the Mormons settled at Salt Lake City, there was from one source only sufficient water to irrigate 800 acres of land, while now over 5,000 acres are fully supplied by the same canal. It has been explained that irrigation closes the pores of the soil with an infiltration of rich silt, so that the body of the earth absorbs moisture more slowly and retains it better. The result will appear most prominently in the case of sandy soils, but it is seen more or less in all.

There are many **minor points worthy of consideration** after the great question of finances is settled.

In the Western States where the water is distributed by means of earth canals and ditches, about one **half of the water** taken into the irrigation system at the head works **is lost** by "seepage" before it reaches the points of application.

Not only is the water lost, but it sinks into and waterlogs the subsoil, to the detriment of the whole basin into which it is discharged. The question is a very important one for the Colonies where water in dry seasons is a scarce commodity.

It will be necessary to puddle with clay the bottom and sides of the large canals that are not lined with concrete or masonry, as the canals for water-carriage purposes are puddled in this country. The smaller and intermediate waterways could be finished on the bottom and sides with an asphalt or cement lining, a practice which is being largely adopted in America.

Evaporation is a considerable source of loss where water is confined at low elevations in tanks or dams in a very dry atmosphere.

It is estimated in Arizona that during the summer months an average of two-fifths of an inch escapes by evaporation from the surface of water in twenty-four hours, but it would probably not amount to so much in Victoria as to make it an important factor in the calculation.

The question of water-right is also one urgently demanding legislation in Victoria. The English law of **Riparian right**, which sprang into existence in a country where water was valued chiefly as a source of power, has been the bugbear of irrigation in nearly every country settled by an English-speaking people. This law, like many of our other laws, was adopted by Colonists and settlers without consideration of the difference of climate and conditions, and, once established, it is difficult to educate a community sufficiently to comprehend the injustice of its influence. The law of Riparian right practically prohibits the use of river-water for irrigation purposes as it confers upon the holder of each property abutting upon a natural watercourse the right to receive the full natural volume of a river or stream from the property of his neighbours above, while the responsibility is imposed upon him of delivering the same unimpaired in quality and undiminished in quantity to the proprietor below. He may divert the water from its natural course within his own lands, and use it to drive a mill-wheel, but he must return it to the original channel before it leaves his estate.

This law, although it is not always rigidly enforced, is in existence in every State in the American Union, with the exception of Colorado.

Before a complete system of irrigation can be properly established, it will be **necessary** by an Act of the Legislature of the Colony **to vest in Government all the water-rights** of the various rivers and important streams so that they may be turned to useful account for the benefit of the community. It would be necessary to compensate the owners of property, who now possess the rights under the existing Riparian law, for any loss sustained, but as these owners have only a right which does not involve appropriation but only temporary possession, their claims would be settled without difficulty.

One of the largest items of cost in the Irrigation of the Western States is the sum which has to be paid for water-rights which have been appropriated by private individuals or companies on account of the want of a necessary law constituting the sources of supply the property of the State ; but in California and Colorado legal provisions have been made to prevent extortion by water-companies.

Wrigglesworth & Binns, Wellington, N.Z.

XXV.—MRS. DONNELLY.

Wrigglesworth & Binns, Wellington, N.Z.

XXV.—Mrs. Donnelly.

CHAPTER XIV.

THE MAORI POPULATION OF NEW ZEALAND.

Mrs. Airini Donnelly—The Maori, Origin and Traditions—Numbers and Causes of Decrease and Increase—Characteristics—Property —Samoan Relatives of the Maoris.

PLATE XXV. is a reproduction of a photograph of Mrs. **Airini Donnelly** or Airini Karauria Tamaiwhakakiteaoterangi, perhaps the most remarkable Maori of the present time.

Mrs. Donnelly is an accomplished lady, charming in expression and manners, and a woman of rare ability. Although married to an Irish gentleman whose name she bears, she still occupies the distinguished position of chief of her tribe, in virtue of what the Maoris term the *mana* of the tribe, a term to be interpreted only by a combination of the three words "luck, power, and prestige." Merit, and neither age nor sex, is the basis of the claim to the possession of this principle, which may be called the essence of chieftainship. Mrs. Donnelly has both brothers and sisters, but none dispute her right to the position.

Mrs. Donnelly is perhaps one of the most able lawyers in relation to native affairs that New Zealand possesses, and her eloquence in court (equally conspicuous in Maori and in English) has earned for her the reputation of a Maori Portia. It is related of her that upon one occasion at one of the many tedious sittings of the native land court, she found the case in which she was interested drifting in a wrong direction, and requested the presiding judge that she might be heard. Her facts and arguments were so convincing that after an hour of unabated English eloquence, without a note to refer to, or a subordinate to prompt her, she turned the whole proceedings in her favour and gained the case.

Mrs. Donnelly's name is not unknown to English lawyers: as she figured as the chief defendant in the great will case Broughton *v.* Donnelly and others, which involved the decision as to who was the heir by will of her great-uncle, the native chief, Renata Kawepo, and which, after being decided in her favour in New Zealand, was appealed to the higher British court.

The designation **Maori** is equivalent in meaning to our word aborigines.

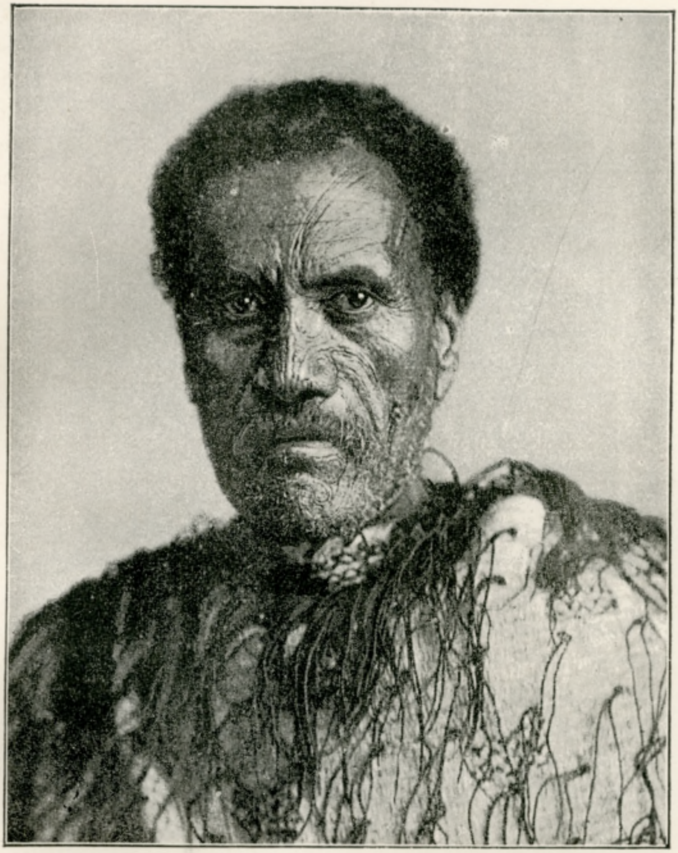
This race, which is believed to be of Malayan or Polynesian origin, is not indigenous to New Zealand, but is believed on the strength of various detailed traditions to have come about four or five hundred years ago from Savaii in the Samoan group (Navigators' Islands), or Hawaii in the Sandwich Islands. The various traditional accounts designate the original home of the race to be **Hawaiki.**

In giving evidence in the native land court, Maoris trace back their **ancestors** for twelve or more generations, until the time the first of them arrived on the island. On the other hand, under superstitious notions akin to "**Totemism,**" they sometimes declare themselves descended from a lizard.

Their records are not written, but are handed down from father to son.

The following is a sample of a genealogical line of descent, which also indicates the character of the native names:—

Kakuhara.	TeRangi.	Marangikaunnhia.
Tuohungia.	TeRu.	Mahia.
Rakahutia.	Hani.	TeKepa.
TeAotahu.	Luahirangi.	Paora Rakan.
TeWaena.		



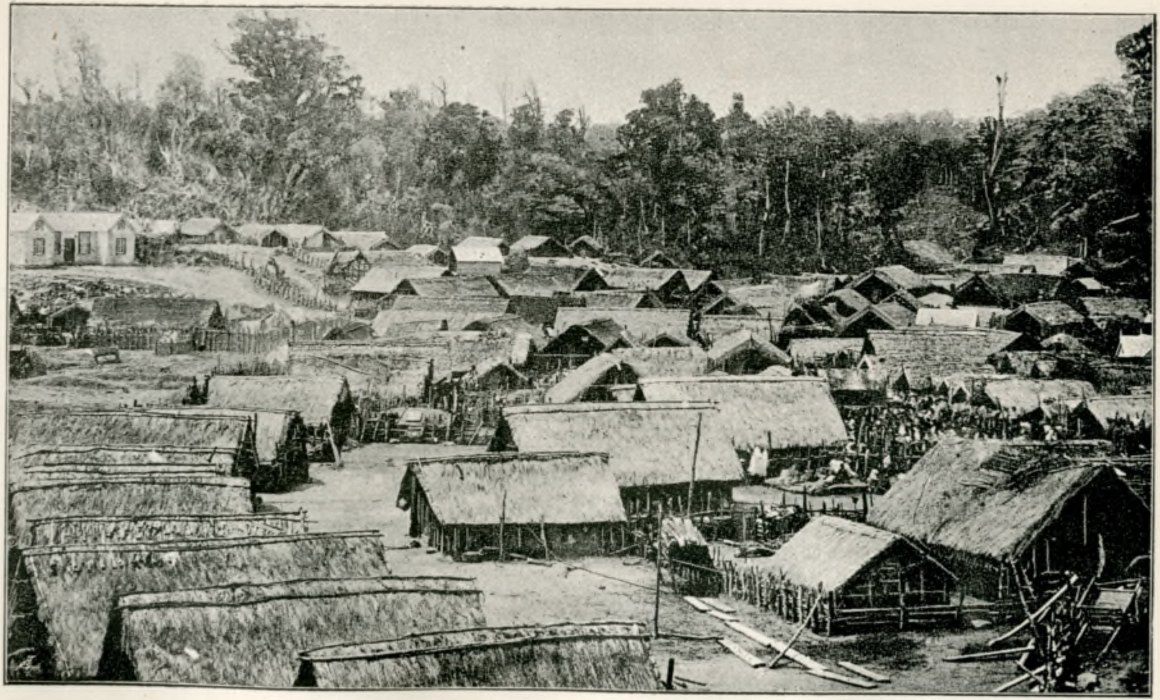
Foy Bros., Thames. N.Z.

XXVI.—Maori Man.

Foy Bros., Thames, N.Z.

XXVII.—MAORI WOMAN.

XXVIII.—Maori Meeting House (Whari-Pani), near Tuhara.
Mr. J. H. Brown in the doorway.



XXIX.—Maori Village—Parihaka, Taranaki.

The **number of Maoris** found in New Zealand (mostly located in the North Island), at the time of its first European occupation, is variously estimated at 120,000 to 150,000.

The number by the last census (1886) amounted to nearly 42,000, or a falling off of over 2,000 from that of 1881.

It is, however, believed, in judging of the alteration in the habits of the people as exemplified in the important locality of which Napier is the centre, that the race is now on the increase. One of the chief causes of death was pulmonary disease. This disease was induced by the change of sites for houses, after the introduction of guns as weapons of war, from the high, dry, and healthy places to low and damp plains.

European vices and excesses also held their sway for a time, but drinking has in recent years been much abandoned, and even smoking, common to both sexes, is considerably curtailed, or reduced to the consumption of cigarettes.

The recent conversion of a large number of Maoris to **Mormonism** has had a healthy influence in restricting excess in the use of both alcoholic spirits and tobacco.

The pronounced form of baptism by dipping, in place of sprinkling, appeals to the sympathies of the Maori mind.

A nephew of Brigham Young, who inherited his uncle's name, died a few years ago at Hawke Bay. His remains were piously transmitted to America for interment.

Previous to the arrival of Europeans, the Maoris can hardly be said to have had a religion: they had fears and superstitions, but no settled creed.

Though largely vegetable feeders when at peace, the Maoris became **cannibals** when they fought, eating certain of their enemies captured during the course of their numerous intertribal wars: other captives they kept as slaves.

As a race they were fond of fighting, and were of undoubted courage in the field of battle.

The practice of **tattooing**, like that of fighting, is practically at an end.

Maoris are naturally indolent and unstable, but they possess decidedly superior mental powers, good memory, and special aptitude to learn. They are extremely sociable, and congregate on great occasions, indulging in oratory and recitation.

A special house of assembly, the *whare runanga* or *whare pani*, is set apart in which to receive and entertain strangers.

The *pah* or dwelling-house possesses no chimney, and in consequence the Maori and his belongings smell strongly of smoke. The beds, which are spread on the floor at night and hung against the wall by day, are mats of thin plaited flax. The Maori village or *pah*, when fortified, is named *wai-o-hiki*.

The men are as tall as the average Englishman, muscular, and strongly built. As compared with Europeans they are long in the bodies and arms and short in the legs.*

The colour of the skin is light brown of various shades, the hair black, the eyes dark and full.

As may be seen from the accompanying plates of typical specimens of the rank and file of the population, the features, although coarse, are in no way repulsive, but, as a whole, attractive, while half-castes are frequently decidedly good-looking.

All things considered, the Maoris stand higher in the matter of mental capabilities than any of the savage races with which the European settler has come in contact, and it is to be hoped they will prove an exception to the general rule that the savage race must of necessity vanish

* "It is curious to notice that, in this respect, the adult Maori approximate more nearly than the European to the skeleton of our young children or of adult apes, both having, proportionally, shorter legs."—J. SHAW.

Williams, Napier.

XXX.—MAORI WHARE-PANI, OR MEETING HOUSE,
WITH REMAINS OF STOCKADE FORTIFICATIONS.

Foy Bros., Thames, N.Z.

XXXI.—GROUP OF TWO MAORIS AND ONE HALF-CASTE.

before the white man. The Negro in the southern states of America has distinctly shown that the rule is not universal.

The Maoris are possessed of a considerable amount of valuable **property** in land ; the young and rising generation is being educated in elementary schools, and there is special State endowed provision for University training for those who are sufficiently advanced to benefit by it.

To give an idea of the superior character of the savages of the South Pacific Islands, from whom the Maoris originally sprang, a plate showing a group of **Samoan warriors** has been here introduced with a short description of the people to whom they belong, written by the author for the Edinburgh University *Student* of 14 Jan. 1891.

The native warriors represented in the plate belong to the Samoan group of three large and six small islands, situated in the Pacific Ocean near to the route of the line of steamships plying between Auckland and San Francisco. The islands are of volcanic origin, and in some places rocky and uneven in surface ;—but the soil is excellent, the climate propitious, and the vegetation luxuriant and abundant. The bread-fruit and coco-nut (usually spelt cocoa) are the main support of the inhabitants, who live an easy and contented existence.

As the poison of European civilisation (?) is already inoculating the masses of the people, and as the high tone and lofty moral principles of the so-called savages are rapidly becoming contaminated by the vice and greed of European and American adventurers, it may be interesting to contemplate the native manners and customs which are doomed to disappear.

The practices of war are somewhat unique. Conducted on native principles, war is not very serious or deadly, though a certain number are usually killed on each side. The battles fought during the recent civil war, which developed through German interference with the liberties of a free people, were more than usually sanguinary in their results—as many as 100 men were killed in one battle, but then it should be understood that there were 10,000 warriors in the field. Bush-fighting is best described as an irregular and rough game in which there are a number of casualties. The heads of common soldiers and the ears of chiefs and officers are cut off by the victors immediately after they fall, and events of this kind are observed and appreciated by all who are within a reasonable distance. When a man shoots an enemy, he rushes forward at the risk of his own life to cut off the head. This he slings on the' hook at the point of his knife, and runs towards his chief, swinging it round his head, and singing, "Here I am, the conqueror or the slayer of So-and-so." The people reply, "Here comes So-and-so," naming the individual who has distinguished himself. The chief compliments the warrior on his pluck, and directs him to go back and gain more glory. The women go with the men into battle—wives with their husbands and daughters with their fathers. Their function is that of attendants. They often carry the gun before active hostilities begin, and also a supply of water, which is bottled in a couple of hollow coco-nut shells. They carry off the wounded, and are assisted by those men who have not a heart for fighting—the cowards. As many as twenty cravens of this kidney have been known to leave the field with a wounded man when there was no necessity to do so. The only barbarous feature of Samoan warfare in the past, has been the habit of sacking the villages and destroying the fruit-trees, but the king now wisely prohibits such extreme conduct, as it leads to famine, after the points of difficulty have been adjusted. Women under ordinary circumstances are not supposed to take part in the battle, and consequently pass unmolested by either side, though they sometimes cause mischief by the reports they carry to their friends. Women are highly respected and kindly treated at all times, but in going into a fight they incur risks which are not diminishing with the substitution of the European weapons for the native war-club.

There arise emergencies when a woman is at liberty to fight, and to take the consequences if she elects to do so, as may be gathered from the following incidents of the recent war already referred to:—Patu, the highest chief in the Apia district (the scene of the terrific storm of 16th March 1889, which ended in the wreck of six German and American war-ships), was accompanied on the occasion of a bush-fight by his daughter, whose massive and magnificent figure may be seen to the right in the foreground of the accompanying plate. Patu had fallen, and one of the enemy came rushing on to cut his ears off; but before the intruder could reach his intended victim, the daughter stepped forward, pulled the revolver from the back of the girdle of her prostrate father, and shot the would-be assassin through the heart.

On another occasion, a number of fighting-men were surprised by the enemy in a corral or stockade built of coco-nut logs, and nearly all were killed one by one as they came out. During the struggle one young chief was caught by two women, who hung on to his arms, and

XXXII.—SAMOAN WARRIORS.

called to their husbands to come. The youth threw one down, shot both, and also one of the husbands, with his revolver, and made good his escape.

There is another side to the picture of Samoan native life, the side of peace, contentment, and happiness, where pauperism is an impossibility, and sexual immorality is almost unknown. Nature is so bountiful that a man can live in affluence by working one hour a day. Among the Samoans there is a sort of family, circumscribed or restricted, communism. Every man, except the chief, is bound to share what he possesses with the various members of his family.

The chief's wealth is estimated by the number of mats of excellent native workmanship which he possesses. Still it is not exclusively his own, as he cannot refuse to give one to any of his people who may ask for it.

The native methods of hospitality to distinguished strangers is unique and interesting. A virgin-princess of great beauty, designated the *Taupou*, is placed in command of all the young girls in the district to which she belongs. When the stranger approaches, it is her duty to direct a detachment of about six of these girls to go to welcome him. They shake hands, and lead the new-comer, decorated with flowers, to their mistress, who extends a cordial welcome. She then disperses the band in various directions, accompanied by men, to aid in securing fruit and food—fowl, fish, or flesh. Kava is brewed for the stranger, the material of which it is made being chewed by the girls in waiting. The chief and his orators next come to the guest's chambers to extend their welcome, and drink kava. The chief and his followers thereafter retire till the evening, when a dance is performed in the visitor's house.

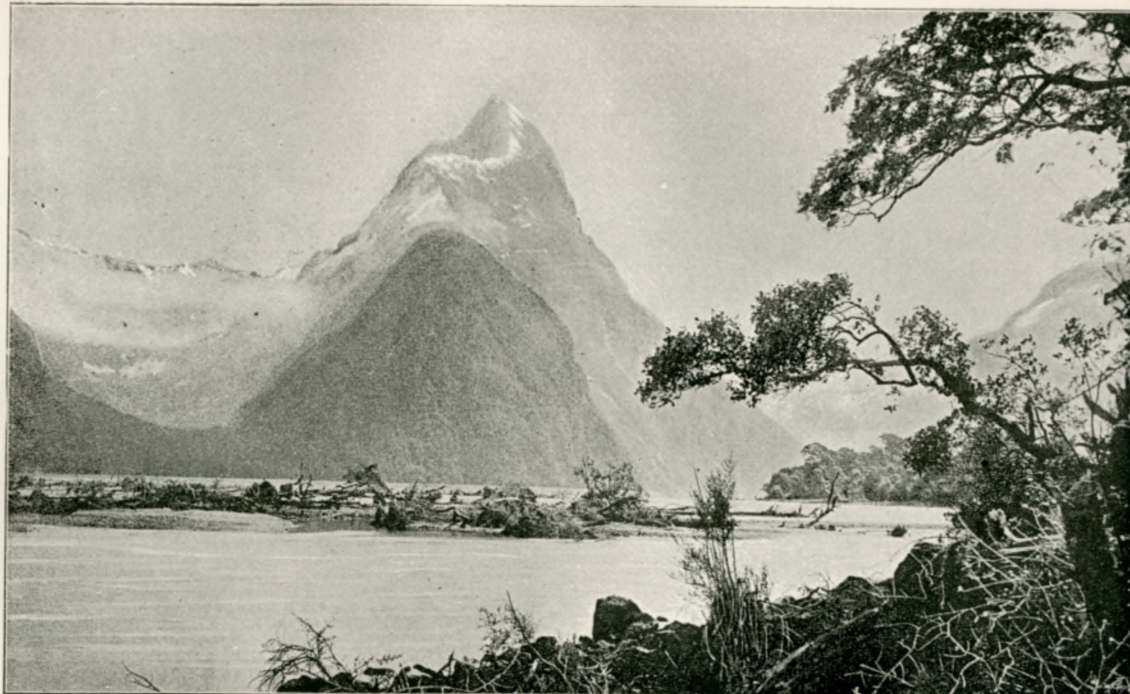
In due time the little girls return with the food, resting on trays of coco-nut leaves. Banana leaves are spread to receive the supplies. The girls remain to attend to the visitor—some fan, others help the food, and prepare it for the eater, and when the repast is over, water is handed to wash the mouth and fingers. The girls subsequently eat at the other end of the apartment, and immediately return to make cigarettes of native tobacco rolled in banana leaves.

The stranger is treated in every respect by the unsophisticated young females as a new and much-beloved brother, and the most perfect precautions are taken by the elder and more experienced portion of the community that the confidence so liberally and so heartily extended cannot be abused.

Lamps are lighted, and dancing begins and goes on till the stranger indicates a wish to retire.

Next morning a return visit is made to the quarters of the chief, where many little presents of native manufacture are offered. It is not expected that anything should be given in return at the time, but any remembrances sent afterwards from the home of the visitor are held in high estimation.

The regrettable fact is that the conditions of this ocean-bound paradise are rapidly passing away. The maiden-like simplicity and innocence of this race of cultured savages are vanishing before the advance of civilisation, which to them would be better named sorrow or desolation.



Burton Bros., Dunedin.

XXXIII.—Mitre Peak, Milford Sound.

CHAPTER XV.

NEW ZEALAND—LAND RECLAMATION.

Physical Characteristics and Climate of New Zealand—The South Island—Land to be secured in the North Island—Method of Looking for Land—Pioneering—The Native Land Court—Dealings with Maories and their Advisers—Native Land Laws—Variety of New Zealand Soil—Three Kinds of Country—Fern-Crushing, "Bush-Falling"—Seeding down to Grass—Stumping and Logging up—Cost of Clearing Land and Sowing down to Grass, (*a*) Bush-Land, (*b*) Fern-Land, (*c*) Swamp-Land—Drainage—Burning off and Sowing Grass Seeds—Stocking with Cattle—Rye-Grass—Water-Supply—Cost of Draining and Laying out Swamp-Land.

New Zealand is usually described as having much of the rugged appearance of the Highlands of Scotland, with something of the climate of the milder regions of the south of England. Within limits, and speaking of those parts that are frequented by travellers or are best known to the bulk of the resident population, the description may be accepted as fairly accurate. The Islands, nevertheless, more than rival Scotland in ruggedness and in the boldness and height of their mountain ranges. Peaks covered with perpetual snow rise to over 8,000 and 10,000 feet * and mountain valleys and ravines are gorged with enormous glaciers which run down as low as 2,000 feet above sea-level.

Below the snow-line a luxuriant growth of ferns and mosses usually occupies the surface till it mingles with the

* Mount Cook, 12,349 feet; Hochstetter, 11,200 feet.

trees and undergrowth peculiar to the various districts of the country.

Extremes are great in the natural phenomena of the islands, and anything like a general statement or description of average conditions in New Zealand as a whole must necessarily be associated with important explanations and exceptions.

In climate the North Island differs materially from the South Island. A reference to the Isothermal **map** indicating the mean December and July (or there, respectively, the mid-summer and mid-winter) temperatures, will show that the greater part of the South Island (leaving out the mountain ranges) lies in the height of summer between the isotherms marking 55° and 60° Fahr., and in mid-winter between those of 40° and 45° Fahr.; also that the north of the South Island and most of the North Island fall between 60° and 65° Fahr. in summer and 45° to 50° Fahr. in winter; while the extreme north and east, embracing Auckland and the Bay of Plenty, falls within the area cut off by the isotherms of 65° and 70° Fahr. in summer and 50° to 55° Fahr. during winter.

The South Island was, in the history of the European occupation, early settled, and to a great extent by Scotch and Irish. Nearly all the good land has already been taken up, so that new settlers acquire the right to their holdings from the pioneers or early possessors, and can approach any part of the country by rail or road with comparatively little difficulty.

In the North Island much of the land is in the possession of the **Maories.** The chief resort of this community of people is in the northern portion of the country, in which are located the Maori reserves, from which all white men, except government officials on duty, are excluded both by law and by the inhabitants themselves.

The available land in the North Island is to be looked for in the hands of—(1) Government, (2) the Maories, (3)

XXXIV.—American Lever Gate, or Snow Gate.
Trelissick Station, West Coast, N.Z.

the pioneers or their successors, who are often ready to sell, but frequently at a price quite above the true market value.

One on the look-out for a place in which to settle should provide himself with a good strong **riding-horse** and a suitable **kit**,* and start on a tour of investigation and inspection, which would probably last for several months. The rate of progress would not exceed 20 miles a day. As a rule, it is wise for the new-comer to select a place which has already been pioneered and partially cleared and broken in, even when these advantages have to be handsomely paid for.

Pioneering, or cutting a place out of the bush and building a log "wharë," is extremely rough and lonely work, and not at all suitable for a beginner, unless he be more than usually enterprising, and a trained and experienced workman besides.

The pioneer secures his land either from the Maories or from Government. If from Government, the title can be got immediately, whether for leasehold or freehold. The extent which one man can secure in freehold is now restricted by law to a section of one mile square or 640 acres of first-class land and 2,000 acres of second-class land. The blocks are valued at a moderate rate and advertised. Should there be more than one applicant, they cast lots. The successful competitor may either buy at once or enter into a perpetual lease, which contains various technical improvement clauses, with power to purchase at any time. Many settlers naturally prefer the lease, as a perpetual leasehold is practically as good as a freehold, while it leaves a settler free to invest his capital in improvements.

* A friend who had himself undergone the experience enumerates the requirements as follows :—A saddle, bridle, tether-rope, couple of blankets, a waterproof cloth to keep the blankets dry, straps to fasten them on the saddle in front, pannikin, tea, sugar, two or three pots of tinned meat, a waterproof coat, two pairs of socks and a clean shirt.

In dealing with Maories it is necessary to be most careful, so much so that it is not advisable for any but old and experienced colonists to attempt to buy land from them at all. Under any circumstances the risks of losing are great. No one should think of taking up a rough Maori leasehold unless the land is good, the number of landlords or grantees small, and consequently a reasonable prospect of a speedy agreement as to purchase. It is illegal and severely punishable to arrange to occupy Maori land until it has gone through the "**native land court**," a tribunal which determines who are the rightful owners of native lands. Twenty years ago the court never permitted on a grant or deed of ownership of a block of land more than ten names, generally those of the heads of families in the adjoining villages or "pahs;" but now, influenced by the decadence of chieftainship and the all-pervading spirit of communism and levelling, the judges admit to be placed upon the deed the names of all and sundry "gentle and simple." One block of 10,000 acres is known to have as many as 1,400 landlords. This complication makes it absolutely impossible for any one to secure a valid title to certain lands either by purchase or by lease. **All terms of agreement** between Europeans and natives are subject to Government inspection, and are invalid if the consent of the "Frauds Commissioners" has not been secured. It is just possible for a man to come to terms in the purchase of a block of land if there are no more than 10 landlords' names on the title; but the negotiations are tedious at the best, and the total cost is usually far beyond what is actually paid as the price of the land, run up by lawyers' and interpreters' fees, blackmail and douceurs to **Pakeha Maories**—*i.e.*, white men who live with Maories.

It is a complaint in New Zealand, as it is in every country where education has been suddenly sprung upon a community, that far too large a number of the population is centred in the towns, and, consequently, the burdens are all the more heavy upon the country settlers. **The middleman** and **blackmailer** both keep their eye upon the country settler—the first, in connection with the man who has got himself thoroughly established and has his annual produce to dispose of—the second, upon him who has got involved in the meshes of a transaction for the purchase of land with a body of joint proprietors.

So prevalent is the system of blackmailing that it has been described by those who have had reluctantly to submit to it, as "one of the industries developed in the Colony within the last ten years."

The action of Government has not tended to simplify matters, but rather to exaggerate and complicate difficulties. **The Maori land question** has, like our own Irish question, been made a political scape-goat. Unfortunately, if the goat carries all the sins, the Europeans who get mixed up in Maori contracts have to bear their full share of the misfortunes and loss resulting from a vacillating policy, or one dictated by sentimental delusion if not by dishonesty.

The South Island settlers, who have had no experience of personal intercourse with the Maori people, have thrown their votes into the scale to complicate matters by the passing of native laws which have retarded the settlement and development of the North Island, and the consequent advancement of the wealth and position of the white and coloured population alike. "**The displacement of the poor Maori** by the white man," in the possession of land, has been made the touching cry of many a blatant sophist, whose enthusiasm was in reality called into existence by other and ulterior aims. Justice and fair play ought unquestionably to be secured to the Maori seller, as well as to the European purchaser, but the attempt to legislate so that it is practically impossible for Maori land to be sold is to revive the ancient system of **land entail**, which has had its day and is fast disappearing in our own country. No community, maintained in an artificial condition in this way, can ever prosper; the attempt is diametrically opposed to the first principles of economics, and its fruits already bear testimony to its being a fallacy. Maoris, who were at one time industrious, have in recent years, after coming into the possession of what can only be termed the unearned increment of certain properties, become lazy and practically worthless either as individuals or as subjects. Not only is this the case, but much of the land also that they at one time cultivated and turned to account in the production of national wealth has been allowed to relapse into a state of nature. The stern logic of facts exposes the weakness and inconsistency of human nature, when we realise that the representatives of the anti-entail party of this country are those who attempt to create a new form of entail on behalf of the "poor Maori." It should be clearly understood that the Maori's right to the possession of the soil is not disputed. All that is contended for is, that he should be at liberty to sell if he chooses, since by the sale the Colony as a rule clearly benefits to the extent of the undeveloped or, rather, unemployed capacity of the land for improvement.

The land was, in the days before our occupation of the country, the means of subsistence to the Maori population, whose ancestors had only a few generations before landed and taken possession of the islands.

Our arrival naturally increased or more correctly instituted a market-value for land, and at the same time gave the native inhabitants the opportunity of adopting the benefits of civilisation. The first encounter of civilised man with native tribes ends usually in being seriously disadvantageous to the aborigines. The Maori, like the Negro and the Red Indian, suffered severely, and their numbers for years continued to decrease rather than increase; but being a distinctly superior people—in fact generally admitted to be the highest in the scale of mental capacity of any uncivilised coloured race—they have overcome the injurious results of sudden contact with so-called civilisation, and are now increasing in numbers and developing in intellectual power.

The land laws, as they at present stand, are calculated to check this progressive advancement of theirs in the scale of civilisation, by withdrawing the necessity and inducement for continued and renewed effort. There is an attempt made, unwittingly no doubt, to create a kind of **Landed aristocracy** of a low order, with no scope for ambition—that quality which, associated with self-respect, has been the guiding star of the aristocracy of Great Britain.

In New Zealand the **variety of soil** is great, and the quality reaches the greatest imaginable extremes, from the worthless pumice soils to the richest black vegetable loams, which are capable, when down in grass and clover, and under good management, of supporting in summer fifteen large sheep per acre, and eight during the winter months. Associated with the great variety of soil which is indicated by the numerous formations represented upon the geological map of the Islands, there is likewise to be considered the difference of climate and of the character and capabilities of soil directly due to difference of elevation.

The natural vegetation, in virtue of the indicated variety of conditions, is also extremely various, not only in kind, but in size and quality. **The pumice-topped land** (which, it is estimated, covers unfortunately about thirty per cent. of the area of the North Island) is, when pure and unmixed with soil of different character, incapable of growing any product of value ; but recent experience has shown that some of the land at one time thought to be derived purely from pumice, contains something else besides, as it is breaking into pasture in a way which has surprised many.

With the exception of certain mountain regions where there is native tussac, the whole country in its native state below the snow-line is covered with fern or trees, large and small, in most cases with dense underscrub.

The land fit for reclamation in New Zealand may be divided into three kinds : (1) The fern country, (2) the bush or wooded country, and (3) the flat or swampy country.

The flat country is in some places covered with dense Manuka or Ti-tri, a handsome scrub bush (which only in rare instances assumes the dimensions of a tree), in foliage and general appearance not unlike the juniper bush in this country. In the beginning of September it was quite beautiful with a profusion of white flowers resembling those of the wild strawberry or raspberry.

Fern crushing. Of the fern country, that upon a limestone formation is the best and the least expensive to break in, and is naturally that to be first attempted by the settler. **The common fern** resembles very closely, if it is not identical in species with, the brake or bracken (*Pteris aquilina*, Linn.) of this country. On poor soil it maintains a miserable existence, growing but a few inches high, but, on deep rich soil, it grows to a height of ten or twelve feet, and forms a thicket in which a man on horseback could be completely hidden.

The tree-fern (*Alsophila*) appears in some places, but it is with the brake-fern that the war of reclamation has to be waged.

Experience has shown that the most suitable area to be taken in hand at one time varies from 400 to 600 acres. The first operation is to erect a ring-fence, and then burn off the fern in January, February, or March, and sow in the end of March with the seeds of cocksfoot (*Dactylis glomerata*, Linn.), ryegrass (*Lolium perenne*), and white clover (*Trifolium repens*) as essentials, along with any other natural grasses that may appear suitable to the soil or situation. After rain comes the land is **stocked heavily with sheep** which top the young fern as it appears above the ground, rolled upon itself or doubled up like a closed fist. Sheep, although not

XXXV.—Mount Egmont.

With Cross-bred Sheep suitable for freezing in the foreground.

particularly fond of fern, will eat it readily at this stage, especially if it grows upon rich land, as it is then sweeter and more palatable than the hard and stunted form which grows and persistently maintains itself on poor soils. After the work of topping down the young fern has been accomplished, the sheep are removed to fresh pasture for a little to recruit, but even on the best land, where fern is most easily crushed, constant attention must be paid for two years to getting it eaten off as soon as it begins to shoot up. After that time, if the management has been proper, good land is pretty safe from fern growth, and the fences, with the exception of those necessary for subdivisions and boundaries, may then be removed. In the New Zealand climate fern-crushed pasture-land of good and medium quality will support one to three sheep per acre.

Papa* and other clay formations take longer than limestone soils to break in from fern, three or even four years being required. **Inferior soils** take a still longer time, and on real pumice-topped soil, the settler will starve his sheep to death before he can destroy the fern.

A moderate amount of fern in a pasture is not objectionable, as it acts as a shelter and protection to the grass.

Bush "falling." In the case of bush country the trees require to be "fallen," and the under-scrub cut, and, finally, both are burnt together when dry. **New Zealand bush** has usually a very dense undergrowth of vines, creepers, supplejacks, and small saplings. These require to be carefully cut by slash-hooks in an initial operation, which in the case of clinging plants involves a low cut at the surface of the ground and a high cut above the head; an amount of small wood is thus secured to guarantee a "good burn," when after the large trees have been "fallen" and the proper time arrives, it is set on fire. Much skill can be displayed in the way the heavy wood is made to fall, to secure that it will burn

* The term "Papa" is applied in the South Island, not to clay or heavy soil, but to a porous, brittle limestone rock.

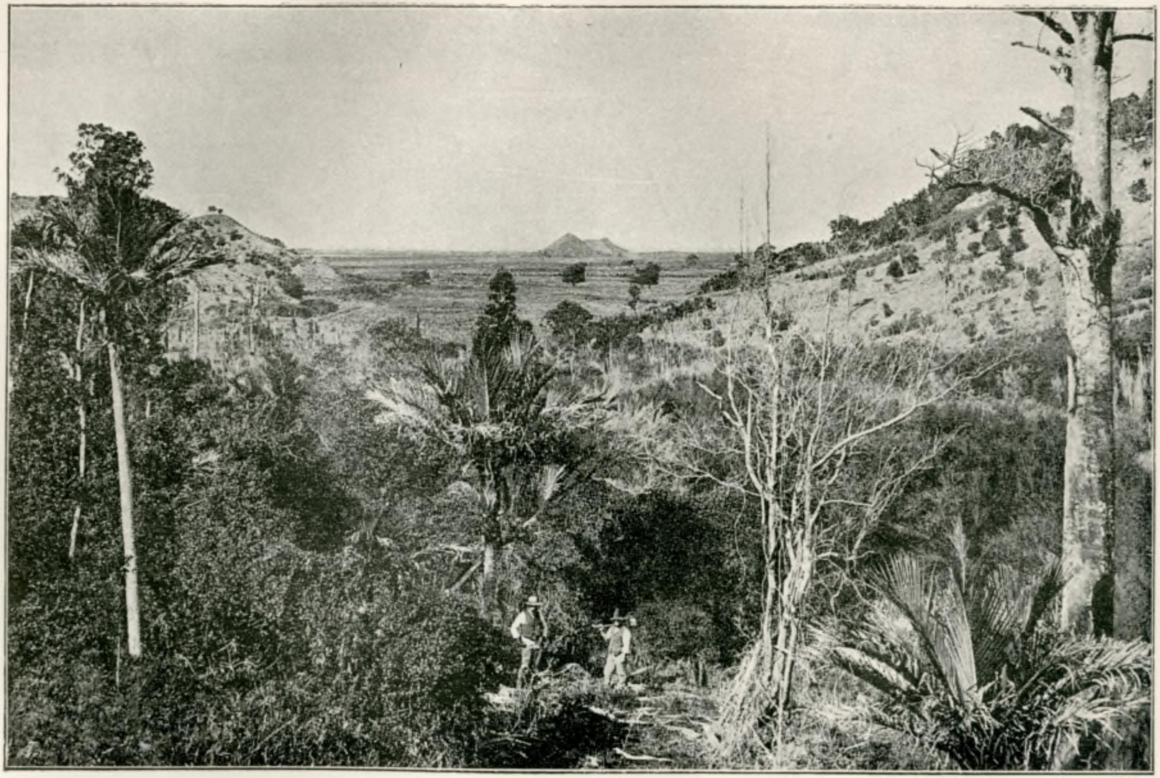
properly. **Falling** is done in winter, and burning off in the middle or end of summer, when everything is withered and the weather dry.

Seeding down is performed in autumn upon the ashes of the recent fire, and among the charred remains of logs and limbs that have been only partially consumed.

The work is usually let by contract, and paid for according to the nature of the bush—that is heavy and dense, or light and clear—at the rate of £2 down to 15*s.* per acre. This contract work has to be carefully supervised and twenty-five per cent of the contract-money kept in hand till the burning is accomplished, as a "**bad burn**" is **a disaster.** When the burning is badly done the seed cannot be properly sown; the rubbish lies thick over the ground and the whole has to be gone over again and "logged-up," else the land is thrown temporarily out of use, and the interest of the money expended upon clearing lost, while the owner waits for the remaining rubbish to decay. Meanwhile weeds spring up and are often more difficult to get rid of than the original bush. In some of the more humid parts, in wet seasons such as 1889–90, the "fallen" bush is never in a condition to burn, but the results are not then so serious as when burning has only been partially successful.

In the case of Ti-tri Scrub, especially where it is small and close, it is advisable to let it lie after cutting till the next year, when a second crop of young ti-tri grows up through the "fallen" stuff; then the whole can be easily and effectually burnt in dry weather. It is not likely to give much trouble in the succeeding pasture after this treatment.

In the north of the North Island—in the neighbourhood of Auckland for example—where the summer climate is not only warmer but also drier than it is a little further south, Indian Dúb—the couch grass of Australia (*Cynodon dactylon*)—along with prairie grasses and rat-tail grass, is associated with the common English species generally



Williams, Napier.

XXXVI.—Natural Bush, with Nikau Palms in a Gully, Whakaki.

adopted for seeding down to pasture in New Zealand. Only in this part of the country can the **native-grass pastures** be at all compared for excellence of quality with land laid down with English grasses and clovers. A large area of sheep country under native grasses can be seen on the west of the Island from the railway going in the direction of New Plymouth; but when broken up and sown with an English "seeds" mixture, it is vastly improved in quality and in stock-carrying power.

After burning off the bush, about two bushels of pasture "seeds" are sown per acre, rather less seed being required than in the case of fern-crushed land, as the **potashes** which remain from the fire encourage the growth and vigour of the young grasses. In Hawke Bay, where clearing has been going on extensively in recent years, ryegrass, cocksfoot, and white clover are found to be most suitable for the hills. In time, no doubt, some others of the good natural grasses will be found advantageous. It is advisable to **stock lightly** for the first year, as sheep when overcrowded and made to bite close while feeding, are apt to pull the young grass up by the roots from amongst the loose ashes.

The soil on steep hillsides which have been cleared of the natural growth is liable to slip down in large quantities after heavy rains. This does not usually take place for a few years after breaking in—in fact not till time has been allowed for the roots to decay and consequently to relax their binding influence.

Stumping and logging-up the remaining trunks and stumps of trees is a common practice in good country when pasture-land becomes more valuable. This work costs fifteen shillings to one pound per acre, and is mostly seen in low-lying land which is about to be broken in for crop.

Roughly, Hill Bush Land costs about thirty-five shillings per acre, and fern country about thirty shillings per acre, to lay down to grass from a state of nature.

Bush-covered soil is slightly more expensive than **fern-land** to break in ; but, being so much surer and quicker in developing a thick sole of grass, and thus giving a quicker return on the capital expended, it is now preferred by settlers to fern-land.

The following calculations show approximate estimates of the cost of breaking in (*a*) bush and (*b*) fern country on average good hilly land such as can still be secured by settlers going to the unoccupied portion of the North Island :—

APPPROXIMATE ESTIMATE OF BUSH FALLING—
500 ACRES OF HILL BUSH.

	£
(1) "Falling" and burning off 500 acres, at £1 per acre	500
(2) Interest on outlay of £500 for 1 year at 7 per cent. .	35
(3) Interest on the price of the land for 1 year, as nothing, as a rule, can be got off it till fallen ; say original price, £1 per acre = £500 at 7 per cent.	35
(4) Two bushels seed for each acre, and the carriage ; say at an average cost of 5*s*. per bushel = 10*s*. per acre . . , ...	250
(5) Labour of sowing 500 acres	30
(6) Logging up, badly burnt parts, &c. . .	25
At 35*s*. per acre	£875

APPROXIMATE ESTIMATE OF COST OF LAYING DOWN IN GRASS 500 ACRES OF FERN LAND.

	£	*s.*	*d.*
Burning off 500 acres of fern			
(1) Necessary temporary fencing beyond what may be required for permanent use, 3 miles at £50	150	0	0
(2) Seed, 2½ bushels to the acre,—½ bushel more being required for fern than bush, as there is not so much ash to cover the seed, and birds pick up more of it,—at 5*s*. per bushel.	312	10	0
Carried forward	462	10	0

Williams, Napier.

XXXVII.—MAORIS DRAINING A SWAMP AT WHAKAKI.

APPROXIMATE COST OF LAYING DOWN IN GRASS *etc.* (*cont.*)

		£	s.	d.
Brought forward		462	10	0
(3) Labour, sowing the above		30	0	0
(4) Original cost of 500 acres at £1	£500 0 0			
Outlay as above	£492 10 0			
Interest on £992 10*s.* (outlay plus original cost) for first year at 7 per cent.		69	9	6
Interest on £1,061 19*s.* 6*d.* (£992 10*s.* + £69 9*s.* 6*d.*) for second year at 7 per cent.		74	6	9
(5) Deterioration of stock in crushing fern		70	0	0
(6) Sundry minor expenses		40	0	0
At nearly 30*s.* per acre		£746	6	3

The third class of land capable of reclamation is the **swamps** or low-lying country occupying the valleys, and often spreading out to areas of a thousand acres or more in one compact block. Some swamps are not worth reclaiming, being only in the initial stage of the formation of good soil. These, on being drained, sink sometimes as much as six feet, and, when cut into, the soil resembles a newly-formed peat, not only in appearance but also in worthlessness. Some reclaimed swamps, however, notably those in the vicinity of Hawke Bay, possess the finest, deep, rich, black vegetable loams. These have been formed by the accumulated remains of many generations of large-growthed moisture-loving plants, together with the silt washed down from the adjoining hills ; and, on this account, the nature of the formation of the hills surrounding a swamp is so far a valuable indication of the nature of the land that will be left after a swamp is drained.

Swamps in their natural condition are generally covered with raupo (*Typha angustifolia*), a large-growthed bulrush-like plant, the flower-spikes and leaves of which may be seen forming part of the dense and tangled growth in Plate XXXVII., but in some places flax (*Phormium tenax*) and reeds are also present. On good soil the growth is often ten to sixteen feet high and is difficult to penetrate.

Arterial drains are run through at wide intervals, while in a narrow valley, one drain close to the bottom of the hill on each side to prevent the upland water from spreading over the flat below is sufficient. If the swamp be very wet and soft, it may be possible to cut the ditches for the first time only four or five feet wide and four feet deep, the drainers standing upon planks to keep them from sinking through the shaking bog. These pioneer drains permit of the escape of surface water and empty stagnant pools ; air is also let into the ground, and the soil solidifies and settles. In the following summer the drains, which meanwhile have almost closed up, are then made eight to ten feet wide and six feet deep, and where necessary smaller side drains may also be thrown out. **The withered vegetation is burnt** off in September and the "seeds" sown in October, or both operations may be put off till the following spring. The surface is sown with at most two bushels of seed to the acre ; a bushel and a half per acre is enough if the soil is good, as the young grasses soon spread and occupy the surface, and especially so in the northern parts, if the seed is sown in autumn. **Fenced** into paddocks of five hundred acres each, the land is, soon after sowing, heavily **stocked with cattle** to eat down the young raupo. It grows so strongly and so quickly that sheep cannot cope with it. With careful management in the matter of keeping a full stock of cattle on the land, the raupo should be extirpated in two or at most three years, and an excellent sward of grass secured capable of supporting at least ten sheep per acre all the year round.

The flax also disappears before the cattle. Flax, as a rule, will not burn in spring. In autumn it will do so, but at that time great care is necessary to prevent the dry vegetable top-soil from taking fire. Now that the manufacture of New Zealand flax has come to the front as an

Williams Napier

XXXVIII.—SLEDGE AND GROUP.

WITH TWO MAORIS IN THE FOREGROUND.

industry, many swamps growing flax are left in a state of nature. **Rye-grass** alone is usually sown on reclaimed swamp-land, as it there assumes its best and most permanent character. There is no doubt but that it would give better results if sown along with white and red clovers.

During summer the drains are very liable to get choked up by raupo, and also by watercresses, which grow usually in great profusion. As it is not advisable to let cattle into the ditches, it is best to cut the main drains off by a fence erected half a chain or more from each side of a drain, and to plant weeping-willows or other suitable trees along the banks. These grow up, and by shading the drain prevent rapid vegetable growth, whilst they also afford shade and shelter to stock and give a civilised aspect to the landscape.

A water-supply is in places derived from artesian wells. In some parts wells and windmills have to be resorted to, and in others the water is obtained by gravitation from the hills.

The following figures show the approximate cost of draining and reclaiming one thousand acres of swamp in Hawke Bay, the work having been mostly let by contract and accomplished by Maori labour :—

APPROXIMATE COST OF BREAKING IN 1000 ACRES OF SWAMP.

	£	s.	d.
(1) Main drains, 400 chains from first to last, say average cost of £2 per chain . .	800	0	0
(2) Side drains, 300 chains at an average of 10*s*.	150	0	0
(3) 2000 bushels of seed, 2 bushels to the acre, at 5*s*. per bushel. . . .	500	0	0
(4) Sowing (labour) easier than hill and bush sowing	50	0	0
(5) Fencing, say 7 miles, £50 per mile .	350	0	0
(6) Sundries, bridges, planting, etc. . .	200	0	0
Total outlay in improvements .	2,050	0	0

APPROXIMATE COST OF BREAKING IN 1000 ACRES OF SWAMP (*continued*).

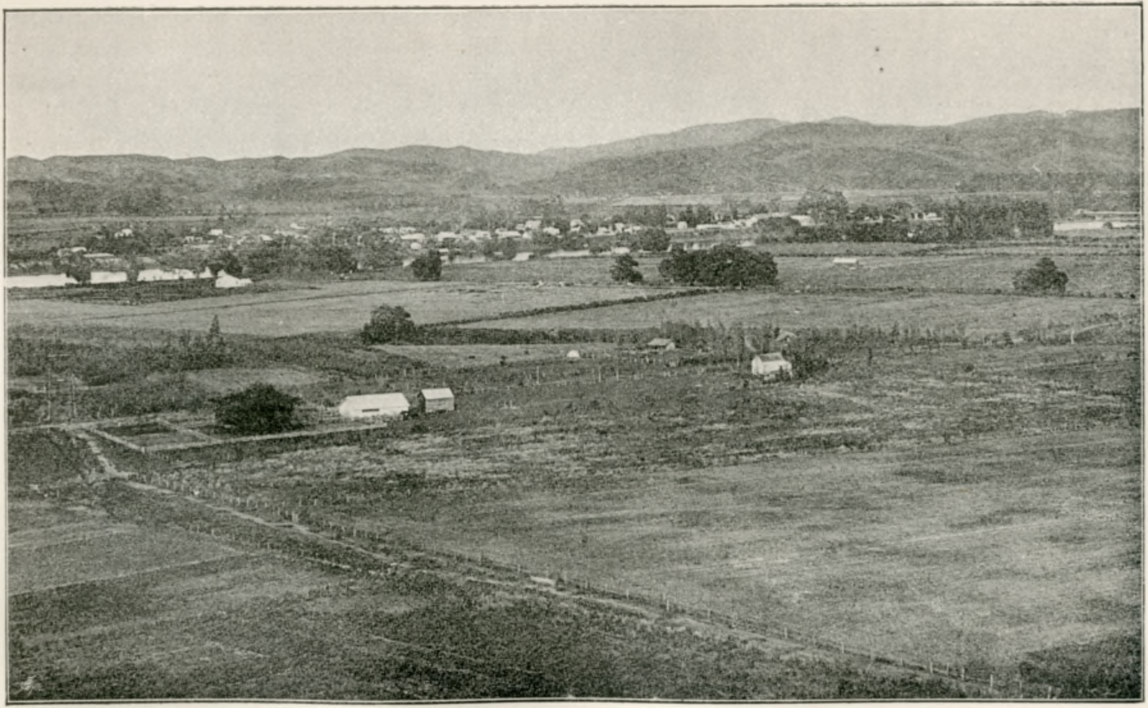
	£	s.	d.
Brought forward	2,050	0	0
Original cost of land, 1000 acres at 10*s*. .	500	0	0
*Interest for one year at 7 per cent. on the price of the land or £2 11*s*. per acre .	178	10	0
Grand Total . .	£2,728	10	0

* Interest is only charged for one year, as the cattle ought to pay interest as soon as put on.

Williams, Napier.

XXXIX.—WAIROA (NO. 1) WITH SAND-BAR—EASTERN PORTION.

Forms a panoramic view with the next plate.



Williams, Napier.

XL.—WAIROA (NO. 2) FROM THE NORTH—WESTERN PORTION.

CHAPTER XVI.

A VISIT TO WHAKAKI STATION IN THE HAWKE BAY DISTRICT OF THE NORTH ISLAND OF NEW ZEALAND.

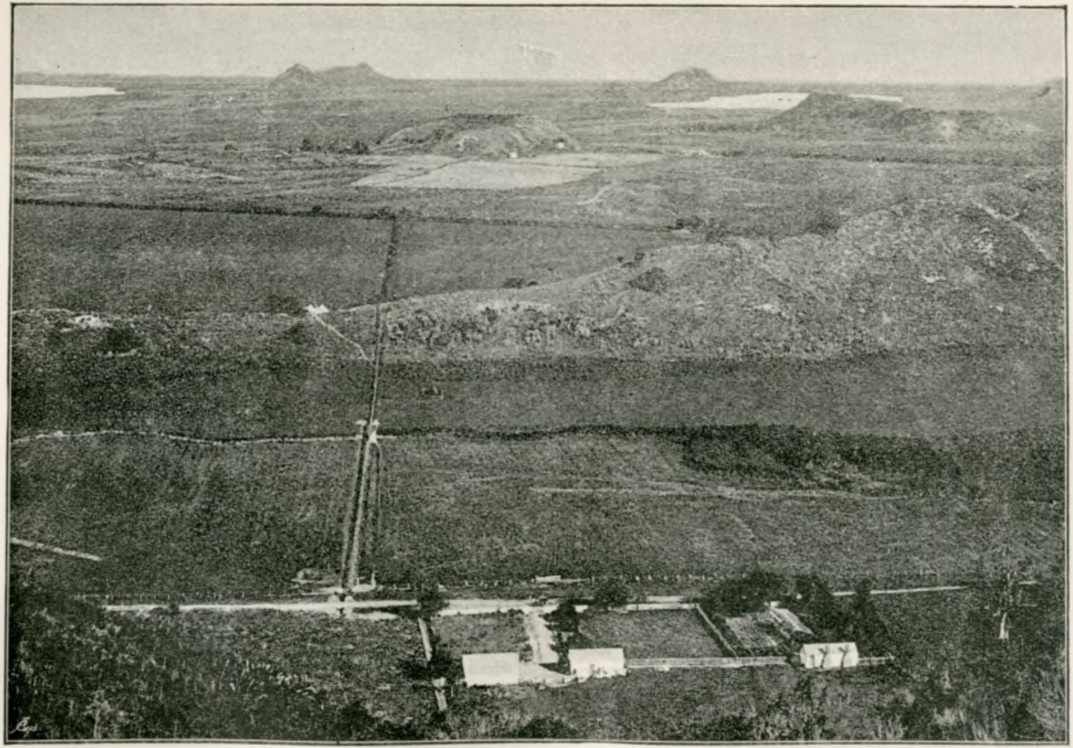
The Journey to Whakaki Station—Hawke Bay—Entrance to the Wairoa River—The Sand-Bank and Sand-Bar—Experiences Crossing the Bar—Ride to Tuhara—The Flora of the District and Scenery by the Way—Tuhara Flat—Weeds of Reclaimed Land—Extent of Station—Meaning of "Whakaki"—A Native Canoe—The Floating Island—The Live Stock—Quality and Nature of the Land for Sheep—The Romney Marsh Flock—Health of the Sheep—Lambing Time—Sheep-Shearing Time—Prices of Sheep—Yield and Prices of Wool—Dipping—Skin Parasites—Maggot Flies and Maggots—The Dipper—Disposal of the Live Stock—Prospect of a Freezing work at Wairoa—Plates of Whakaki.

The journey from Napier to Whakaki was made by the author in company with his debonair and entertaining host Mr. John Hunter Brown, the owner of the property.

The means of conveyance, in the first instance, was by a handsome little coasting **steamer** of forty-five tons burden, under the command of Captain Anderson. The sail across the bay to Wairoa (Clyde township) on the banks of the Wairoa River about three miles from its mouth, occupied four hours ; but the difficulties encountered in approaching that thriving and also beautiful little town (as may be seen from views of it reproduced in plates XXXIX. and XL.) are something more than usual, and if not more than natural, they are certainly unique.

A strong ocean current sweeps round the shores of the bay, carrying with it sand and gravel which are deposited in protected nooks along its course. As fate would have it, a quiet settling spot exists in the indentation of the shore-line at the mouth of the Wairoa River, and an immense **barrier** of sand and gravel has been thrown across the mouth of the river, damming it back and forcing it to find, as it were, a compromise of the situation in the form of a side outlet. This it does at the south extremity of the barrier, where there is a low and shifting sand-bar over which the waters of the river flow and upon which the waves of high tide break and foam, and maintain an entrance for small craft plying between Napier and Wairoa. **The sand-bar** connects the sand-bank which stretches across the mouth of the river with a high precipitous rock on the shore, upon which the river **pilot** stands and, by signs made by means of two large balls—one held in each hand—guides the captain of a boat as it approaches (which it only attempts to do at full tide) to that part of the bar where the water is deepest. Although the sand-bar is not represented, yet the position of the pilot's vantage-ground can be determined by an examination of plate XXXIX. **The Wairoa River** is seen from the north bank ; the sand-bank across its mouth lies to the left, and the imagination can place the interesting sand-bar a little round the corner from the point where the sand-bank appears to touch the south shore of the river.

The little steam craft is timed to sail at an hour of the night or day which suits the tide. On the morning in question, the 1st of September, 1889, she experienced favourable weather, and, having arrived before there was enough of water on the bar to admit of passing it, had to lie off at a convenient distance and wait for the signal of the pilot whose figure and movements, perched as he was upon his rock, could be easily seen. On receiving the signal from the shore, the boat was headed towards the centre of the breakers which rose close to the



Williams, Napier.

XLI.—Hill View of Tuhara-Flat, with the Flax Mill in the distance and Tynron (Porter's House) in the foreground.

bottom of the cliff; and the command from the captain—"full speed ahead"—was immediately followed by the order, "all astern." Some thirty whites and Maories together, accustomed to the local method of navigation, threw their weight on to the after-deck, to allow the prow of the boat at the first impact to rise and reach as far over the sand-bar as possible. The bar was high, and the amount of water was not equal to the occasion. The attempt was one of the least successful of the season. The little steamer stuck fast in the shifting sand of the bar, and rocked about as each wave struck her astern like a seal rolling upon a shelving rock; gradually, wave by wave, she wormed herself forward until half way across the bar; then, in obedience to the order, "all hands forward," the passengers flocked to the prow. The stern, thus lightened, soon wriggled away from the sand-bar, and, in five or six minutes from the time she first touched the sand, the boat had emerged into the still waters of the dammed-up mouth of the Wairoa River, which resembled a charming inland lake of striking beauty even at this early period of spring.

The next six miles of the way—Wairoa to **Tuhara**, the first station-house and resting-place on the property—were covered on horse-back. The road wound among rugged hills, only partially cleared, with undrained swamps in the valleys between. It was merely a bridle-path lying along the dry land near the bases of the hills, and only descending into the swamps, where it was impossible to find an alternative course. **A road** for wheeled carts or waggons in such a country is gradually formed in this way. At first a track is made on the side of the base of a hill by digging out a few sods along the line determined upon, and building these against the under-side of the cutting. From time to time, as the earth falls by the action of the weather from the upper side of the scar, it is thrown over the bank on the lower side until the track ultimately becomes wide enough for a cart. The swamps are usually crossed at this stage by wading, an operation which requires both judgment and experience. In the end these are drained, and in the most boggy places a surface is secured to hold the metal when the time comes by laying down bundles of branches. The metalling of a local district road is a luxury which need only be looked for after the country is well filled up with settlers. The road from Wairoa was in the early stages of formation, and although the ride was rough, yet the climate was perfect, and the scenery in its own wild way varied and beautiful.

In the swamps were to be seen the abundant and familiar raupo (*Typha angustifolia*), the flag-like flax of the country; the cape gooseberry, which here yields two crops of fruit in the season, from which jam is made; and among a profusion of minor and less important herbage the giant toi-toi (*Arundo conspicua*), with its graceful feathery heads of flowers, almost identical with those of the American pampas grass, but more one-sided, more drooping, and even more beautiful.

On the drier flat country, and also on the hill sides, were here and there dense patches of Ti-tri or Manuka scrub in full blossom. The tree fern and the common Nikau **Palm** of the country dotted the hill-sides and gave, in conjunction with the dense and clinging growth of the underwood of the bush country, a semi-tropical appearance to the landscape. An unusually tall, and also a little, specimen of the palm referred to may be seen in Plate XLII.; and a close study of the background of this plate—taken from a photograph of a part of the country passed through—will give a good idea of the character of the natural bush-land of medium height and medium density.

The Nikau Palm strongly resembles the areca-nut palm of India in the clear appearance and slender form of its stem. The leaves, though more erect, are not unlike those of the coco-nut. The fruit may be distinctly seen in the

Williams, Napier

XLII.—NATURAL BUSH WITH A TALL NIKAU PALM,
BY THE ROADWAY, NEAR TUHARA.

XLIII.—After a Burn.

Williams, Napier.

XLIV.—TUHARA HOUSE (WILSON'S), WHAKAKI.

small specimen depending from the trunk a little way down from the base of the lower leaf stalks.

The beauty and harmony of the rich and varied **scenery** was now and then marred by the recent tracks of one of the most potent engines of civilisation—fire—called to the aid of the woodman whose work of devastation in the interests of sheep and cattle have already been described. His handiwork in this district may be imagined by a reference to Plate XLIII. which exhibits the desolate appearance of a heavy lowland bush which has been cut over and burned.

Emerging from the natural scenery along the road, riders made a debouch upon the splendid alluvial flat of over 1,000 acres of rich, black soil recently reclaimed from under water, and growing a close sward of English grasses and clovers, which supported, in addition to a herd of cattle, ten sheep per acre. In some parts **flax** had gone quite beyond the reach of the cattle and had grown to an immense size, towering far above the head of a pedestrian. With a flax mill on the ground, this superabundant growth was treasured as a source of wealth, likely to return an additional annual income.

The two most objectionable **weeds** by far on such land are (1) the Sedge Toi-toi (*Cyperus ustulatus*), a tufty or tussocky plant with very sharp leaves, which naturally grows on the rich dry land surrounding swamps; and (2) the common rush (*Juncus communis*, Mey), which is a familiar and objectionable weed in damp clay-bottomed soil in this country. Both of these pests tend to spread after draining even on the best quality of improved swampland, and can only be kept in check by close and regular cutting when in full vigour of growth. To attempt to plough land for the purpose of eradicating them is not only expensive but unsatisfactory.

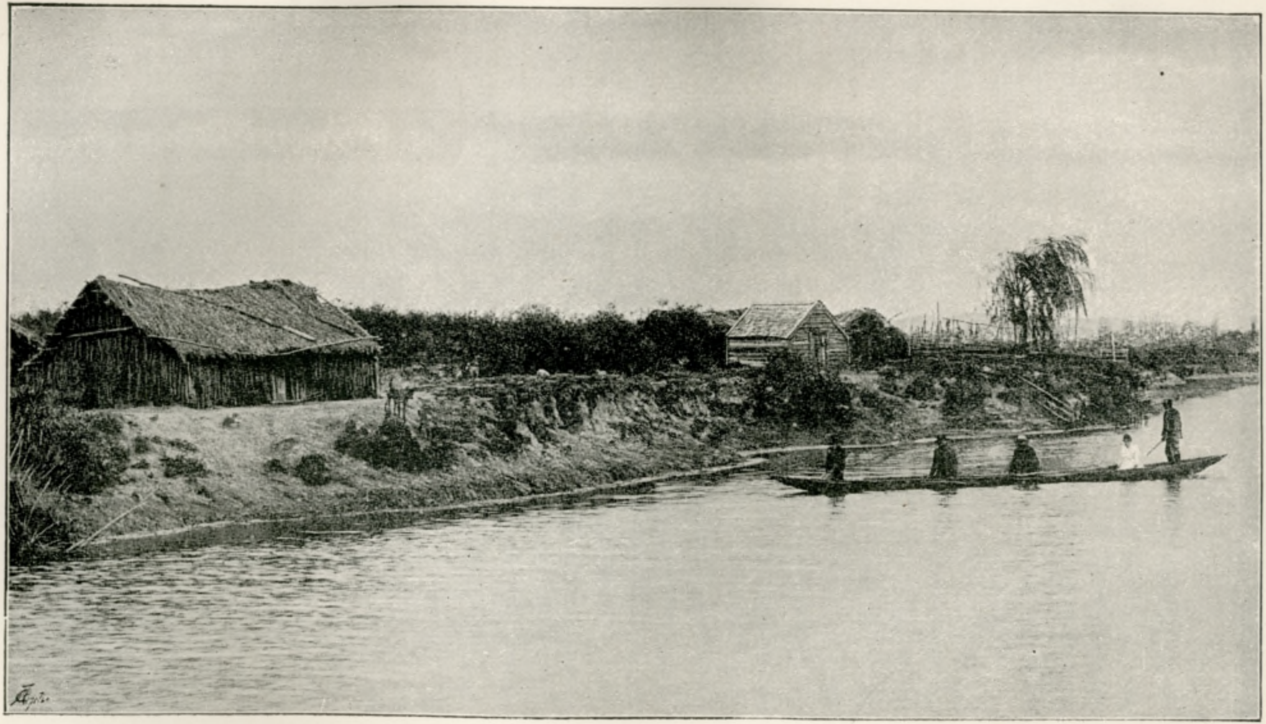
The Whakaki station lies to the north-east of Wairoa, and extends to nearly 20,000 imperial acres, of which

13,000 acres which had been purchased from time to time at 10*s.* to £1 per acre are freehold, and the remainder is held under long leases from the Maories. It embraces an unusually large amount of swamp-land of the finest quality only yet partially reclaimed, stretching along the coast-line and running up the numerous valleys intersecting ranges of rugged and irregular bush and fern-clad hills. **The name** "Whakaki" means a well-filled canoe, and was given to the place because the swampy land at one time was a good place for fishing for eels, and the Maories got their canoes well filled.

By the side of a magnificent meadow of 1,000 acres in extent, covered with a dense carpet of English grasses and red clover, a gently shelving bank, an old lake beach, is pointed out, which in the memory of Archdeacon Williams was the landing-place of the fishing canoes.

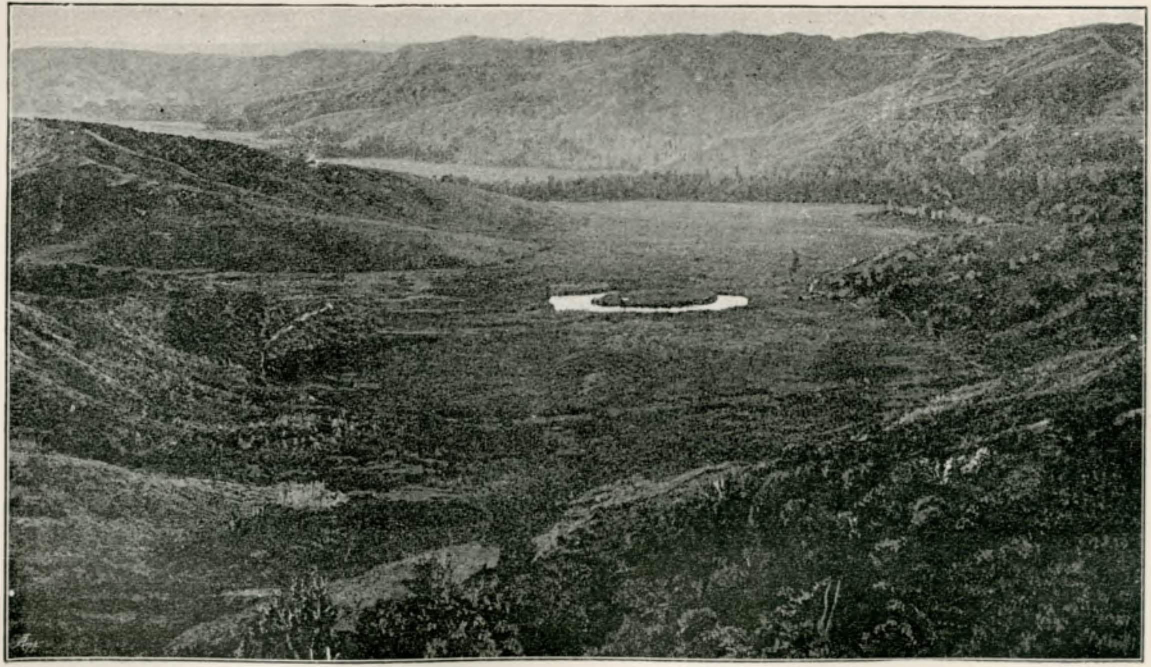
A native canoe is formed by hollowing out the trunk of a tree about three feet in diameter. Plate XLV. represents a typical form afloat on one of the large drainage canals of the district, on the bank of which may be seen the familiar native *whare* and its surroundings.

In one of the valleys above referred to is located a most unusual and interesting natural feature,—**a floating island** of quite an acre in extent, in a lake of about four acres. Plate XLVI. shows the island at the distance of one mile and gives a good indication of the nature of the surrounding unimproved Whakaki country. The island is rounded in form, and, in the matter of soil and vegetation, seems to be identical with the shores of the lake. Its solidity and safety are undeniable and undoubted, as it has comfortably carried a picnic party of twenty people and a permanent hut has recently been erected upon it. Its position is frequently changed by the wind, and when this has been pretty strong from any given direction, it usually rests against the opposite shore, as seen in the Plates, until the wind changes and blows it to the other



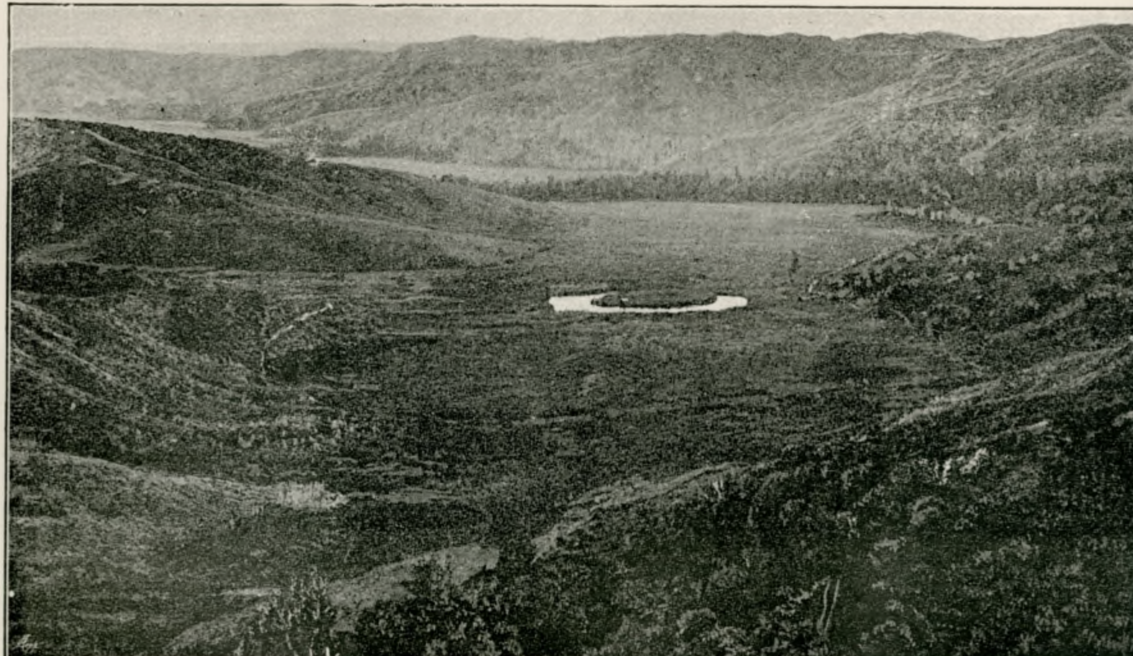
Williams, Napier.

XLV.—MAORI PAHS AND A MAORI CANOE
ON THE MAIN DRAINAGE CANAL, WHAKAKI.



XLVI.—Distant View of the Floating Island, Whakaki.

Natural Flat Land and Hill Land shown.



XLVI.—Distant View of the Floating Island, Whakaki.

Natural Flat Land and Hill Land shown.

William Napier.

XLVII.—THE FLOATING ISLAND — WHAKAKI.

Area of Island, one acre; Lake, four acres.

side of the lake or rolls it round the shore. It is this rolling action that gives the edge of the island and the edge of the lake the clean-cut-off, finished appearance so conspicuous in Plate XLVII. The figures of people seen on the lake shore, in the boat, and on the island, form for the observer a standard for comparison, in the matter of dimensions, of the natural growth in their immediate neighbourhood. The size of the island in the foreground of this plate, owing to the perspective of the picture, is somewhat liable to mislead one as to the extent of the lake, which is there represented rather at a disadvantage.

The live stock of the station, after the land has all been broken in, will most probably be almost exclusively **Sheep**; and it is estimated that it should carry over 40,000, although there are only about 20,000 at present. **Cattle** are required for jungle or fern-crushing and number 1,000 head, an equivalent to 4,000 sheep.

This, in its improved condition, is the **best sheep country** that the writer has seen in any part of the world, although in its original wild state sheep would not live upon it. There is, between hill and dale, the variety of pasture which sheep require and appreciate—the low-lying rich and prolific meadows upon which sheep feed by day, and the hill-sides close at hand to which they can retire at night and thereby follow their natural instinct to climb as night closes in. The change is also beneficial to the feet, which, if animals are closely confined on rich, level plains, are liable to become scalded or affected with foot-rot, especially in wet seasons. By moving from the good grass-land of the hollows the sheep keep the best of their pasture comparatively clean, and by leaving more than the due proportion of droppings on the high land, which is naturally much poorer than that below, there is a gradual increase of fertility on these parts. The low-lying land is so rich that it is none the worse, indeed all the better, for the loss.

Breeding ewes actually get too fat to breed if kept on the best of this land. The stud ewes, although they get nothing but the grass they pull, have at times to be starved on poor pasture for a time before they will conceive.

A record of as many as ten sheep to the acre all the year round has been made on a few choice spots in a favourable season. Another record of fifteen sheep per imperial acre in summer and eight in winter was made. When it is remembered that the sheep do not belong to the smaller mountain breeds, but are sheep of large size, the wonderfully rich character of the soil will be fully appreciated. It was on this land that common red clover (*Trifolium pratense*), was found growing year after year like a perennial plant. The existing stock of sheep was crossed into a high-grade Romney Marsh or Kent flock by the repeated use of pure-bred Kent rams.

The exceptionally healthy nature of the country may be estimated by the fact that, for eight or nine months from weaning time (the new year) till the beginning of September, only fifteen deaths had occurred in a lot of 4,700 hoggets. Care of the hoggets is the most important part of the shepherd's duty. If the young sheep are kept alive and in thriving condition, the remainder practically herd themselves. For some years, until the method of treating sheep on this unusually rich, flat land was found out, the mortality was quite appalling and ruinous.

The lambing time begins in the middle of August, and the number of lambs to ewes in a good season sometimes considerably exceeds cent. per cent.

Sheep shearing time in the North Island is usually the month of November. Sheep for freezing are shorn in October. Wether hoggets off the shears, were worth about nine shillings each in 1889. A Romney Marsh flock of various ages running on grass will **yield** an average of seven pounds of wool each ; a Lincoln flock, under similar treatment, about eight pounds each.

Williams, Napier.

XLVIII.—Wool-shed at Whakaki.

The wool from Whakaki is shipped to London in compressed bales weighing about 3 cwts. each, and has for two years realised (unwashed) from 9*d.* to 11*d.* per pound. In some parts of the North Island the lambs are shorn the first year, and their wool in recent years has been worth about 1½*d.* per pound less than the higher quality averages of the older sheep.

All "dry" sheep (those not giving milk) are **dipped** annually, and ewes every second year. Sheep do so well that **skin parasites** are not usually abundant. The most common British species, the Scotch kade or English tick (*Melophagus ovinus*), does not usually thrive in a climate so warm as that in this part of the country. The materials used are **arsenic** and **sulphur**, if the dipping is performed as the sheep come from the shears, and there is no wool to be injured by the hardening action of the arsenic. If there is a growth of wool, then a little tallow is boiled with soda to form a soap, which is added to the chemicals.

Arsenic is destructive of all the mature forms of parasitic life, while sulphur lies as it were in wait for the development of the larval forms, and also acts as a deterrent to the various species of blow-fly or **maggot-fly**. These are so abundant, that a dead sheep if left in the open is with the exception of the bones, wool, and fragments of skin and sinew, within a few days, wholly consumed by the maggots which the flies produce; yet the climate is such that maggots rarely attack live sheep (as they do in this country), if the young rough sheep are carefully **breeched**, viz., the long wool cut away on the inner thighs and about the tail. The hoggets thrive better when this is performed, and the wool cut away, which would otherwise be lost, pays the expense of the operation.

The dipper used is of the most approved and most recent pattern, and consists of a narrow well or trough of masonry, fifty-six feet long, two feet three inches wide at the top, narrowing to nine inches at the bottom, at one end six feet deep and, for a few feet, gradually shelving up till it becomes quite shallow at the other end. The sheep are plunged in head first at the deep end, and while swimming through get thoroughly soaked.

Dipping in Australia is done on a larger scale than in New Zealand. The sheep are decoyed up an open sparred or battened gangway (through which their droppings fall) and on to a trap-door, which is then let go, and fifteen or sixteen sheep slide quietly down into a tank or bath about four feet six inches wide, of similar depth, and twenty-six feet long. Two men are able to carry on the work, and pass some thousands of sheep through in a day. This is very different from the condition of things in the early days, when dipping was done in the Colonies in the green hides of bullocks.

The live sheep from Whakaki are shipped at Wairoa for Napier, or driven round by road, much to their injury. The Wairoa district is such an important and thriving one, that **a freezing company**—possibly one of the existing prosperous and enterprising companies in or near Napier—will no doubt within a short time erect works, or branch works at Wairoa. The success of the one at Gisbourne, a little further north, is a sufficient inducement for the promotion of such a scheme.

Further description of Mr. Brown's charming property is unnecessary. It is left to the numerous plates reproduced from an excellent series of photographs by Mr. W. Williams, of Napier, to do what is necessary to complete the conception of it in the mind of the reader.

CHAPTER XVII.

NEW ZEALAND FLAX.

New Zealand Flax or Phormium Fibre—Various Species—Habit of Growth—Cutting the Crop—Method of Manufacture—The Product—Flax made by the Maories—Dr. (now Sir James) Hector's Treatise on *Phormium tenax.*

New Zealand flax or Phormium fibre, designated in the home-market as New Zealand hemp, is the product of *Phormium tenax,* (Forst.), a large and luxuriant iris-like plant, the leaves of which grow to the maximum height of fourteen to fifteen feet on rich, level, alluvial land, where there is an abundance but not an excess of soil moisture. A swamp which has been drained is a favourite locality for flax to spring spontaneously.

There are **several varieties** which require different conditions of soil, climate and elevation, from those of the large flax-producing plant; the flowers of which are red and the seed-pods erect or slightly inclined and three inches or less in length.

There is another species of this plant, the *Phormium Colensoi* (Hook.), also represented by a number of varieties, which it is important to distinguish from the useful *Phormium tenax,* as the leaves are frequently brittle and the fibre weak. The flowers are red, yellow, or greenish; the seed-pods pendulous and from three to seven inches long.

Phormium grows in bunches or groups of shoots. Each bunch may have ten shoots, with five leaves to each shoot, making a total of fifty leaves in the bunch, arranged like so many fans.

In cutting the crop for manufacture, the centre leaves should be carefully left to maintain the growth and vigour of the plant. If wholesale and unreserved cutting of the entire bunch is practised the plant suffers in exactly the same way as raupo, toitoi, or rushes, which are ultimately destroyed by frequent cutting. Where proper precautions are adopted, and say four leaves removed from the sides of each fan, cutting may be done every year. The fan which bears the flower-stalk dies after it has performed its important functions, and may then be totally removed. Cutting should not take place after the flowering-stalk shoots, until it dies, as during that time the fibre is brittle and inferior.

The plant **grows at all seasons** of the year, but slowly in autumn and winter. **It is propagated** by seed and by lateral root-budding, little fans being thrown out from the parent fans. These may be separated and transplanted in the artificial cultivation of flax as a crop, but as the growth is extremely slow in the early stages of development, the work of cultivation at current prices for the produce is too expensive to be of value to the trade.

The method of manufacture in the mill which is shown in the accompanying plate, is that detailed below.

The flax used is the product of natural growth, and the right to cut it is contracted for by the mill-owners at the rate of 30*s.* per ton of royalty paid for finished produce.

(1) The green leaves are passed through a stripping machine. They are entered between a pair of feed-rollers about two feet long, revolving 400 times per minute, and held so that they are acted upon by a beating bar, eighteen inches in diameter, with a speed of 1,700 revolutions per minute.

(2) After passing from the beating machine, the flax is

Williams, Napier.

XLIX.—THE FLAX MILL, WHAKAKI.

FLAX FIBRE, in the oreground, bleaching.

Williams, Napier

L.—A Bullock Team Loaded with Flax, and Flax spread for Bleaching.

washed, to remove the soft green material which has been separated from the fibre in the beater.

(3) It is carted out and spread on a field to bleach; care being taken to keep the fibre straight and free from entanglement. With this end in view a boy receives the fibre from the stripping machine and "leases" it over his knee in small bundles or bunches like hanks of yarn about as thick as a man's wrist, a size which is found to be convenient to hold during the subsequent operation of "skutching." Throughout the whole process of manufacture those small bundles maintain their individuality; they are turned at the end of six or eight days so that both sides may receive similar treatment. From the field the flax is taken in bundles into the mill, each length being twisted upon itself for convenience, like a hank of yarn.

(4) The dried flax is taken in the handfuls or bundles described, to be "skutched" and the fibre cleaned by holding first one end of the fibre and then the next, within the sphere of action of a large wooden beater, with a diameter of 5 and a length of 6 feet, if three men are employed to work it. The concave, or riddle, surrounding the drum is set at a good distance from the "skutcher."

The product is thereafter twisted into large hanks and baled for the British market, where it is worth £20 to £27 per ton.* It is estimated that it could be produced at a cost of £12 per ton, which leaves a good margin for profit and cost of transit. It is used for rope and twine making.

The Maories make their flax by scraping it with a shell without breaking the fibre. The finest quality is produced by prolonged hand-labour, and the yield is only about one ton of fibre from forty tons of green flax; 2 lbs. to 3 lbs. per day being the produce of one person at work. The

* Messrs. W. Weddel and Co.'s Circular, January, 1891, says: Hemp—Fine Auckland, £26 to £27; good Lyttelton, £24 to £26; fair Wellington, £22 10*s.*; common, £20; tow, £7 to £7 10*s.* per ton.

value of the finished product is, however, from £70 to £100 per ton. When thus carefully prepared the fibre of Phormium is one of the finest that exists. It is so fine in texture, and it takes on dye so well, that it can be mixed with silk in the manufacture of fancy goods. As a product of the European process, it is distinctly a coarse fibre, but of considerable strength. So far no mechanical process has yet been discovered which can accomplish the work of hand-scraping.

A chemical process, viz. saturating the green leaves with sulphite of soda has been found to yield 26·41 per cent. of good flax, while the "skutching" method yields less than 24 per cent. As a bye-product of manufacture tow is made, and in weight it is about equal to the yield of dressed fibre.

A second edition of a concise and interesting account of *Phormium tenax* as a fibre-plant, has been published (1889) in the form of a pamphlet of about 100 pages, under the editorship of Sir James Hector, K.C.M.G., and should be referred to if further details are wanted. The course of the trade, which has fluctuated extremely within the last quarter of a century, is therein discussed.

CHAPTER XVIII.

THE NEW ZEALAND AND AUSTRALIAN LAND COMPANY.

Origin of the Company—Staple Products—Statistics—The Company's four Australian Estates—The New Zealand Properties—Method of Feeding Sheep and Cattle—Cultivation of Oats—Land under Various Crops—Cost of Turnip Cultivation—Cost of Wheat Growing—Average Yield—Oats—Sheep on the New Zealand Estates—Stud Flocks—Half-Breds—Lambing Averages—The Annual Death-Rate—Land Selling.

THE New Zealand and Australian Land Company, Limited, of Edinburgh, has for upwards of twenty-five years been identified with New Zealand and Australia. It was formed by the amalgamation of a number of small associations which had purchased land in the Colonies, and it has thus grown until it is now the largest Agricultural and Pastoral Company in the world.

The methodical system of farming and management adopted, is an excellent ideal of the possibilities of Colonial agricultural and pastoral operations on an extensive scale. In connection with the development and the working of its New Zealand properties, the Company has, like most early settlers in the Colonies, had to encounter many difficulties, both because of the rapid changes in the surroundings and because of the extreme fluctuations in the values of farm produce.

In its endeavours to render its lands more profitable, the Company has also acted as a pioneer in the Frozen Meat Trade and in Dairying, receiving in both instances from Government the proffered bonus of £500 for so doing.

The **staple products** of the Company are wool and mutton. This year (1890–91) the wool clip will amount to about 14,000 bales, valued at about £200,000, and to produce this about 1,100,000 sheep and lambs are required, of which about 382,000 are maintained in New Zealand, and 718,000 in Australia.

In addition to the flocks, about 9,500 head of cattle are kept to occupy country not well-suited for sheep; and 1,840 horses are required for farm-work.

In Australia the Land Company's business is entirely a pastoral one, and agricultural operations are not entered upon.

In New Zealand cultivation is undertaken on a very extensive scale.

The Company's **stock and crop statistics**, which are carefully prepared for each year, were placed at the author's disposal by the courtesy of his friends, Mr. James Melvin, one of the Directors of the Company, and Mr. W. S. Davidson, its able General Manager. No better illustration of the position and possibilities of the agricultural and grazing resources of the Colonies could be given than the vast amount of carefully collated material to be found in the elaborate books and records which are kept by this Company. It has also the advantage of extending over a long series of years, and of being applicable to numerous districts varying much in quality of soil and climate.

In Australia, the Company holds four estates: Bundure, Walhallow, and Till Till in New South Wales, and Wellshot in Queensland.

Bundure is a freehold containing upwards of 117,000 acres, situated near Jerilderie in the Riverina District. There is no cultivation, but the natural grasses can easily support 70,000 Merino sheep yielding fleeces which average 8½ lbs. of wool and last year netted 6*s.* 10¾*d.* each on the station. The lambs from the 35,000 to 40,000 ewes in the breeding-flock generally number from 25,000 to 30,000.

The surplus stock are sold as "stores" early in each season, to make room for the lambs, and no attempt is made to fatten sheep.

Walhallow Estate is situated near the railway on the Liverpool Plains, and embraces about 105,000 acres of freehold and secured lands, and 80,000 acres of leasehold. It differs from Bundure in so far that it is largely used for fattening purposes, and a "flying" stock is maintained in addition to the regular and permanent station flock. The natural grasses and other plants are very fattening, and it is calculated that about 30,000 sheep can be bought in and fattened in an ordinary season, in addition to grazing about 130,000 of a regular flock.

The rainfall is in most seasons sufficient for the pastures, but, as is the case over most of Australia, the district is, now and then, subject to severe droughts which for the time dry up all vegetation and sometimes cause heavy losses among sheep.

The **Till Till** run lies about eighty miles north of Balranald, and contains 365,000 acres of leasehold and 8,000 acres of freehold. Droughts are severe, and the losses of sheep are correspondingly great. The food is largely derived from "salt bush" which sustains stock in a marvellous way, but even this hardy plant cannot withstand the effects of years of dry weather, in addition to the close eating of starving sheep, and it is in many places dying out. . . . . .

Rabbits are very destructive on Till Till, and it has cost about £1,000 per annum to keep them in check.

The run is amply watered with tanks and wells, and about 90,000 sheep can be kept if the season is at all favourable for the growth of food.

The **Wellshot Run** in Queensland, carries about 350,000 Merino sheep, and is an excellent pastoral property situated on the railway 400 miles inland from the town and port of Rockhampton.

There are upwards of 1,000,000 acres of leasehold rented from the Crown, and to secure the safety of the stock, the Company has expended £70,000 on water storage, buildings, and fences during the past ten years.

Some of the **dams** made for the storage of water are very large, and cost about £3,000. Without a good artificial supply of water the run could not be occupied, and no reservoir is considered permanent unless it holds water for two years without any addition.

Upwards of 80,000 lambs are bred each year, and there, as is also the case on Bundure, a good stud flock is kept to provide the rams necessary for the breeding flocks.

In **New Zealand the Company's land** is all situated in the South Island, in the Provincial Districts of Canterbury, Otago and Southland, and the following are the estates with their acreages, named in order of geographical position beginning with the most northerly.

—	Freehold.	Leasehold.
Acton, near Rakaia, Canterbury Province . .	15,162	2,520
The Levels, near Timaru " " . .	60,233	11,605
Pareora " " " " . .	17,413	
Hakateramea (inland) " " . .	24,327	70,300
Ardgowan, near Oamaru, Otago " . .	4,480	
Totara " " " " . .	10,613	158
Moeraki " Hampden " " . .	6,666	49,355
Clydevale " Balclutha " " . .	36,496	7,115
Kawarau " L. Wakatipu " . " . .	454	206,910
Edendale, " Invercargill, Southland " . .	54,214	872
Sundry small properties . . . " . .	4,119	
	234,177	348,835

The **Acton Estate** situated on the seaboard and having frontage on the Rakaia River, carries from 23,000 to 25,000 sheep.

There are about 12,000 acres of English grass, and a large number of sheep are annually fattened off on turnips. The whole of the land is perfectly flat, and the soil is good useful agricultural loam capable of growing almost any description of agricultural produce. The ease and rapidity with which all operations can be carried out render it the most cheaply worked property in the hands of the Company; for example, at harvest each reaping and binding machine, drawn by two pairs of horses working in spells of three hours each pair, cuts on an average 20 acres of crop daily. In one day, 300 acres of wheat have been cut by 15 binders and 60 horses, and in six working days as much as 1,500 acres of grain have been reaped.

A large portion of Acton has been sold, and the freehold is being still further reduced each year.

Being only thirty miles south of Christchurch and on the main line of railway, it is easily accessible to settlers.

The Levels Estate is in the vicinity of the town and harbour of Timaru. There the land is a heavier loam than that at Acton and rests partly upon limestone and partly upon a porous clay subsoil. There are 35,000 acres sown in English grasses, and the estate carries about 100,000 sheep, almost all "cross-breds."

Turnips are a reliable crop on this property, and on these and the English grasses about 20,000 to 23,000 sheep are annually fattened off; in addition a large number of cast ewes are sold to small farmers.

From 32,000 to 34,000 lambs are annually bred, and as a whole the Levels is one of the most remunerative estates held by the Company in New Zealand, while its total value, amounting to upwards of £525,000, renders it one of the most valuable properties in the Colony.

The Pareora Estate lies about ten miles to the south of Timaru on the main line of railway; it is specially suitable for cultivation, and, like the Levels, contains some of the best farming land in New Zealand.

About 28,000 cross-bred sheep are kept, and a large number are annually fattened for export and home consumption.

The Hakateramea Estate lies inland, and possesses frontage on the Waitaki River.

This is used more as a pastoral than as an agricultural property, the altitude being higher and the climate colder than is the case with the land near the coast. The leasehold land amounting to 70,000 acres, is of hilly country. About 65,000 sheep are kept, the majority of which are pure Merinos. On the low ground the sheep are cross-bred. Sheep are very healthy, and the chief drawback is a snowy winter now and then, which causes an increased death-rate.

Totara estate may be classed as a "fancy property," from the superior character of its soil. In April 1879, a portion of the land was cut into farms and offered at auction, when 2,764 acres found purchasers at an average price of £22 16*s.* 3*d.* per acre, being the highest price ever attained in New Zealand for so large an area.

The best soil on the estate is a black sticky loam, locally termed "tarry soil," and where this rests upon limestone, it is specially suitable for potato culture, and is let for this purpose in small areas to croppers, who pay a rent of £3 per acre for one crop.

There are 6,500 acres of English grass on Totara.

Moeraki is situated on the main line of railway, 20 miles south of Oamaru and 57 north of Dunedin.

It is there that the Company's best Lincoln sheep are bred.

The freehold is a belt of rich soil next the sea, but this becomes poorer as the neighbouring hills are reached, and the highest ground is mountainous, and only available for Merino sheep. With so much variety of ground, the sheep are healthy. The cultivated lands produce excellent crops of all descriptions.

Clydevale is situated between the Molyneux and Pomahaka Rivers. It contains 36,496 acres of agricultural country, some of which along the Molyneux River is very rich in alluvial deposits, while the remainder of the land is rather colder, being a clay loam resting upon a stiff clay subsoil.

Upwards of 20,000 acres are under grass and cultivation, and about 49,000 sheep and 600 head of cattle are grazed.

The wool is always in specially good condition and fetches the highest current prices. In 1890, the better portion of the greasy quarter-bred wool fetched 1*s.* 2½*d.* per lb. in London, and the half-bred 1*s.* 1½*d.* per lb.

This is the only freehold estate which is not directly in touch with the railway system, but the want is supplied by a river steamer, which conveys goods to Balclutha, a railway station about 20 miles down the Molyneux River.

The **Kawarau Run** is a leasehold property rented from the Crown, and is situated in the wild "Lake Country," near Queenstown, on Lake Wakatipu. It contains, along with the Hawkesburn station lately added to it, about 200,000 acres, and can carry about 50,000 Merino sheep. There are no cross-bred sheep, as no cultivation is possible, and they would not thrive on the sparse native grasses of the mountains. The nature of this country has already been described in Chapter VI.

Edendale estate is situated in Southland about twenty miles north of Invercargill.

At one time this estate embraced 620,000 acres of freehold, but this area has been reduced by sales to 54,214 acres, of which 8,400 acres are let on lease mostly to dairy tenants. This property lies so far south that it is affected by the more humid climate which there prevails, and it is worked in a different manner from the drier and warmer parts in North Otago and Canterbury. The sheep kept are largely a "flying" or bought-in stock for fattening and marketing. About 10,000 sheep are annually fattened, and frequently this number is exceeded; in addition 4,000 head of cattle are sold for beef.

In bygone years there was a difficulty in bringing the sheep safely through the cold, wet winters, but it has been discovered by experience that if they are assisted by turnip feeding and especially with chaffed oaten sheaves, they thrive and fatten quite satisfactorily. Chaffed straw is fed to the sheep in large boxes, capable of holding twenty sacks at a time, the feeding-troughs on each side of the boxes being kept automatically filled with chaff, through apertures of about two inches in width all along the troughs. Salt is also supplied to all stock during the winter months.

The **bullocks** and speyed heifers go on "native" or "tussock" land till they are three years old, when they are run on cultivated English grasses for a year, and attain a live weight of 700 lbs. to 750 lbs. and 600 lbs. respectively.

After this they are finished for the butcher, either on turnips or on grass, and in a second year get up to 900 or 1,000 lbs. live weight, the beef being worth about 20*s.* per 100 lbs.—a price which pays the producer.

There are about 16,000 acres of English grass and cultivated land on Edendale, and the soil varies from a deep rich alluvial loam along the Mataura River Flats, to the cold and poor soils on the higher ground. There is apparently a want of lime in its composition, as has lately been proved by the success which has attended the liming of turnip-land.

Turnips and oats grow well. The Sparrow-bill Oat is the one most commonly grown. This is a short plump variety, and when well developed it resembles the potato oat in having a "bosom pickle" or small adventitious seed attached to each main well-developed oat seed, but when the crop is grown under adverse circumstances an abortive flower remains in place of the "bosom pickle." This oat does not "shake" with wind, or shed easily, but it is liable to get dark in bad weather, and the straw is not so long or of such good quality as the straw of the Tartary Oat.

LI.—MANAGERS OF THE ESTATES OF THE NEW ZEALAND AND AUSTRALIAN LAND COMPANY.

The long and short white Tartarian varieties are also grown on land of superior quality and are favoured by the millers, but are not such heavy croppers as the Sparrow Bill.

The quality of straw is now an important matter, as it is so largely supplied to cattle and sheep, and for this the Sutherland Oat is to be recommended, as it yields well, and, while long and thin in form, is a good milling oat, though it is rather liable to "shake." **Wheat** is not a satisfactory crop here, as it ripens too late to be safe from early frosts.

It is at the thriving township of Edendale on this estate that the Company's dairy factory has been erected.

The Freehold Estates are rendered accessible by railways and all are within a few hours' journey from Dunedin.

The **Managers** are men of wide practical experience and their operations are controlled by the Company's Superintendent in the Colony, Mr. Thomas Brydone. The General Manager also visits the Colonies every few years, and inspects all the estates, thus bringing the whole business and management well within touch of the Board in Edinburgh.

Upwards of £50,000 are expended on cultivation each year, the area dealt with being generally about 40,500 acres distributed as follows:—Laying down in English grasses, 14,000 acres; turnip and other root and green crops for stock feed, 15,500 acres; wheat, 5,500 acres; oats, 4,700 acres; and barley, 800 acres.

The **cost of turnip cultivation** is kept at a low figure by the labour-saving implements used. For instance, on the Company's Acton estate, the expense of growing turnips is only 7*s.* 6*d.* per acre. On other estates, such as the Levels and Pareora, where the land is not so easily worked, the cost ranges from 9*s.* to 11*s.* 6*d.*; while further south, where the land requires more cultivation, the expense is rather more.

The cost per acre of contract work may be given as follows: —

	s.	*d.*
Ploughing four or five inches deep	5	6
Disc harrowing 1*s.* each time (one or two times)	2	0
Harrowing with the ordinary toothed harrow	1	0
Seed and sowing, including rolling and covering	1	6
Total cost per acre	10	0

Green-top-yellows are planted for spring use and purple-tops for early winter, and under favourable circumstances with a dressing of only two cwts. of bone dust, crops of thirty tons per acre are got. The Devonshire Grey Stone turnips are also largely used, and Swedes are grown to supply winter food for pigs, being generally sown in drills with manure. About one pound of seed is sown per acre, or even a half-pound if small birds are not numerous, distributed from a sowing-box placed behind a Cambridge roller and covered by a chain harrow also fastened on behind.

The crop is as a rule fed off on the ground, but a turnip-cutting implement of recent invention is sometimes fitted to an ordinary dray at a cost of about £8, and a number of sheep are fed while they still remain on the pastures.

Mangels are grown to a limited extent for use at the homesteads, and rape is often a paying crop, especially for fattening old sheep.

Wheat. Before the introduction of the reaping and binding machines, the limited and unsatisfactory supply of labour rendered the growing of grain on a large scale a very hazardous venture, but now that it is possible to cut and tie large areas of crop with only a few hands, the Company can safely extend their operations, with a view to making the profits from grain pay for the sowing out and maintenance of the English grass pastures.

The prevailing price for wheat has during the past few years been rather low for New Zealand farmers; but, even at the reduced price of 3*s.* 3*d.* per bushel, a fair return is secured. It costs the Company under ordinary circumstances about 46*s.* 6*d.* per acre, to grow, harvest, thresh and deliver a crop on rail. For example, the **actual expense of growing** the 1889 crop on Pareora Estate was:—

	£	s.	d.	£	s.	d.
For 1283 acres of Wheat, yielding 34,644 bushels—						
Cost of one ploughing, seed, pickling, sowing, harrowing, rolling, and harvesting, stacking, and thatching				1,824	16	10
Half cost of breaking up the lea				178	10	0
Repairs to implements				140	5	5
General outlay of all kinds, including cost of supervision, shifting camps, etc., etc.				223	3	8
Insurance				60	19	6
Cost of threshing 34,644 bushels				381	11	8
Carting coals				1	10	5
Sundries, twine, etc.				3	16	9
Actual cost of producing 34,644 bushels @ 1*s.* 7*d.*				£2,814	14	3
Cost of delivery, cartage	150	15	11			
Loading into railway trucks and receiving into store	25	11	5			
Grading	1	14	7			
				178	1	11
Total cost of growing and delivering on railway 34,644 bushels				£2,992	16	2

Say 1*s.* 8¾*d.* per bushel, or £2 6*s.* 8*d.* per acre.

With the yield of twenty-seven bushels, sold at 4*s.* per bushel, the nett gain amounted to £3 per acre, in addition to which the land was cultivated and the straw which was left was of some value.

On the Acton Estate the Company can produce wheat at a cost of about £1 7*s.* 9*d.* per acre if the work is done entirely with its own teams and plant. The following was the actual expense of growing 1,570 acres of wheat in 1890:—

ACTON WHEAT, 1890. CROP OF 1570 ACRES.

	£	s.	d.
Cost of seed, pickling, and all cultivation, amounted to 12s. 3d. per acre	959	10	5
Cost of harvesting, including stacking, thatching, and fire insurances	714	1	2
Threshing 33,391 bushels at 2¾d.	382	12	1
Carting coals, etc.	17	1	6
Carting wheat to grain shed at railway	70	8	4
Stowing wheat in grain shed	23	13	3
Fire insurances	10	6	10
Total expense of producing 33,391 bushels	£2,177	13	7

The yield was 21¼ bushels of dressed wheat per acre, and the cost in store a little over 1*s.* 3½*d.* per bushel. At the price of 3*s.* 3*d.* per bushel the nett profit per acre was £2 1*s.* 4*d.*

On the more southern estates, at Timaru and Oamaru, twenty-seven to thirty bushels can be reckoned as a **fair average yield**. On the Totara Estate, which contains some of the best wheat-land in New Zealand, the yield over large areas often reaches sixty to sixty-five bushels of wheat per acre.

It must be a beautiful sight to see **harvest work** on the Company's estates, where sometimes upwards of a dozen American reaping and binding machines are formed in procession, and speedily cut down the crops, which are grown in fields of about 400 acres in extent.

The varieties of wheat grown are generally Tuscan, Velvet, Red Chaff, and Squarehead.

Oats. The cost of growing oats is about the same as wheat, excepting that the seed is cheaper by about 2*s.* to 3*s.* per acre.

The Victorians having meanwhile shut the Melbourne market against New Zealand growers of oats by the im-

LII.—Wheat Harvest in New Zealand.

On the property of the New Zealand and Australian Land Company at Pareora.

position of an almost prohibitive duty, the Company confines the growing of this description of grain to its own requirements for horse feed and hay for sheep. The chaffed hay is charged to the sheep at 38*s*. per ton; the cost of the hay being reckoned at 28*s*., cutting into chaff 7*s*., and distributing 3*s*.

The yield of oats varies from thirty-five to sixty bushels over the whole estates, but on Edendale, some specially fine crops have been harvested; in 1879, a field of 440 acres produced over eighty bushels per acre.

Upwards of thirty years ago the **first Leicester sheep** were sent out from the flocks of the Duke of Buccleuch and Mr. Melvin, Bonnington.

Of the 381,935 sheep on the Company's New Zealand estates at March 1890, 15,820 were classed as pure Lincolns, Leicesters, and Romneys, while the balance was made up of about 100,000 Merinos, and 266,115 Cross-breds.

The Merino sheep are confined to the mountainous country on Kawarau, and to portions of the Hakateramea and Moeraki estates, where they thrive well on the natural grasses. On the cultivated lands none but long-wool and cross-bred sheep are bred, as they are the most profitable.

Stud flocks. The best stud Lincoln flocks are at Moeraki and Totara; about 1,500 being at Moeraki, and 1,100 on Totara.

The rams clip on an average from 13½ to 15 lbs. of wool, and the ewes from 10¾ to 13 lbs.

There are two stud Leicester flocks kept on Clydevale and Moeraki, each numbering about 1,500. The rams yield on an average from 9½ to 10½ lbs. wool, and the ewes about the same weight.

A small Romney stud flock numbering about 500 is kept at the Levels. The flock yields an average clip of about 8 lbs.

The **half-bred sheep**, being the various crosses between

Merino ewes and long-woolled rams, yield on an average 8 lbs. of wool for the ewes and $8\frac{1}{4}$ lbs. for wethers.

The half-breds, or first cross, are the most profitable sheep, as they produce the best and most valuable fleeces, and their mutton cannot be surpassed, while their robustness of constitution is remarkable. They do not require the same attention and high feeding as the crosses more nearly approaching the pure long-woolled sheep.

With a view to establishing **a new type** of sheep, Mr. Davidson about fourteen years ago, put 1,000 pure stud Merino ewes to pure Lincoln rams. At first about sixty per cent. of the produce were discarded, and since then the flock has been kept perfectly distinct, the rams used having been bred within the flock itself. A pure half-bred flock of over 2,000 hardy ewes, yielding fully 8 lbs. of wool each, has thus been established. Every care is taken to preserve the purity of this flock, and very little culling is now necessary to maintain its evenness. The wethers weigh from 60 to 62 lbs., and are in every way suitable for the Home markets.

As a rule, the **lambings** on the Company's estates may be estimated at 100 to 125 per cent. for pure long-wool ewes; eighty-five to ninety per cent. for cross-breds, and seventy to eighty per cent for pure Merinos.

Each year upwards of 100,000 lambs are bred by the Company in New Zealand, and from 30,000 to 40,000 sheep are generally purchased. Their sales amount to over 100,000 sheep, of which about 70,000 are turned off fat and are either shipped as frozen mutton or sold in the local markets.

The annual **death-rate** is small, varying over the estates from about four to seven per cent.

Land-selling.—The Company has been, with the exception of the Crown, the largest seller of land in New Zealand, and it is still anxious to reduce its holdings by selling and leasing farms. The main object in disposing of portions of its estates is to promote settlement, as it is felt that nothing else will so well maintain the value of the properties it continues to hold: and it is desirable to reduce the freeholds to a smaller area, with a view to concentrating its operations.

Since the year 1878, the Company has sold 112,572 acres of Freehold to 780 purchasers, the average price being about £6 per acre, and in addition to the above, 12,789 acres have been let to fifty-seven farmers who have the right of purchase at any time during their leases.

In selling land the Company requires a deposit of thirty per cent. of the price in cash, twenty per cent. in two years, and the balance to be paid at any time within seven years from the date of purchase, interest at the rate of five or six per cent. per annum being meanwhile charged on the unpaid balance of purchase-money.

It is sometimes a complaint amongst the Colonists that the progress of New Zealand has been hampered by the locking up of large areas of land in the hands of Companies and Banks, but this charge cannot be brought against the New Zealand and Australian Land Company when one considers the vast area of country disposed of during the past twelve years.

The Company has been perhaps the best pioneer the colony has had, and the outlay from first to last in the development of the estates has been enormous, the chief expenditure of capital taking place at a time when it was most beneficial to the country, while now upwards of £100,000 per annum is spent in working the New Zealand Properties.

CHAPTER XIX.

IMPORTANT IMPLEMENTS AND MACHINES.

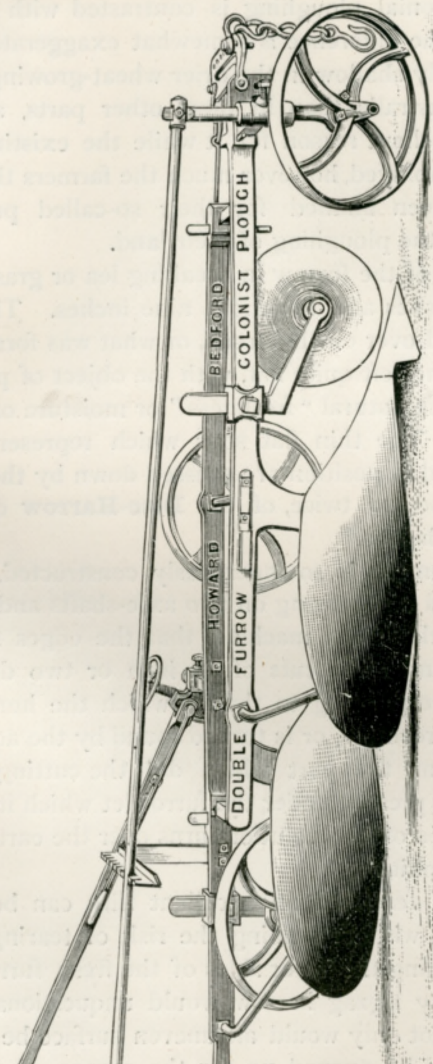
The Double-furrow Plough in the Colonies—Amount of Work done——Depth—Thin Furrow-Slices Pressed with Disc Harrow—Cost of Ploughing—Howard's Digging Plough and the Nature of its Work—The Stump-Jumping Plough—Its Advantages and Disadvantages—The Bullock Breaking-up Plough—The Steam Plough—The New American Steam-Digger or Plough—Hop Washing Engines—The Strawsonizer.

As the common single-furrow swing-plough is the national plough of Scotland and the single-furrow wheel-plough is that of England, so the **Double-furrow Plough** drawn by four horses yoked in pairs the one before the other, is the one in almost universal use in the Colonies. As shown in one of the plates, the draught is equalized as regards the two pairs or triplets by the draught-chains passing round single pulleys on the ends of the swingles of the last horses, one end of each chain being fastened to the collar of the rear horse and the other to that of its leader.

The **Three-furrow Plough** is sometimes employed on light land with five horses to draw it. It will turn about four acres, and the two-furrow plough about three acres per day on free-working soil. **The depth** at which ploughing is done and also the cost per acre varies considerably in the different Colonies; but as a rule the depth is not quite so great as in Britain, although the difference is not so much, in many cases, as is generally supposed.

The general belief is that ploughing is deeper in this

LIII.—STUMP-JUMPING PLOUGH WORKED BY SIX HORSES,
AT ROSEWORTHY AGRICULTURAL COLLEGE.



Double-Furrow Plough.

country than it really is, and consequently when the actual depth of Colonial ploughing is contrasted with the ideal depth here, the difference is somewhat exaggerated. It is more generally shallow in the drier wheat-growing districts of South Australia than in most other parts, and there exists an excellent reason for it while the existing implements are employed, however much the farmers themselves may have been blamed for their so-called practice of "scamping" the ploughing of their land.

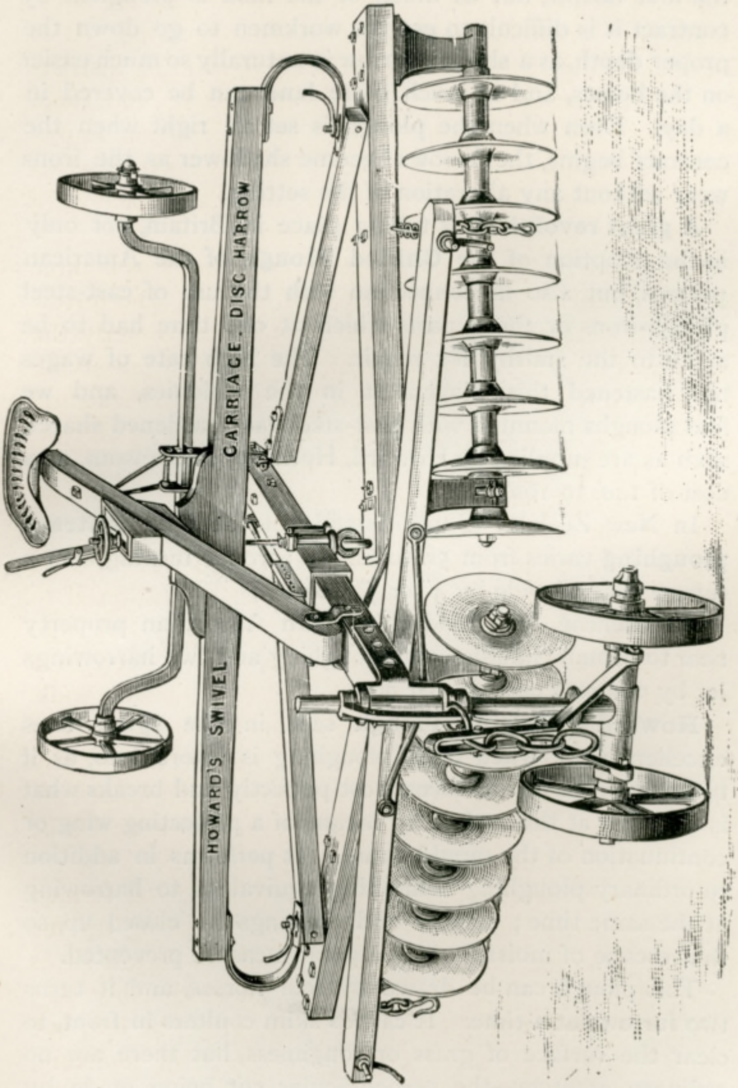
The depth of the furrow in breaking lea or grass is three and a half inches and the width nine inches. The furrow slice is turned over on the green, or what was formerly the upper side, and left quite flat, with the object of preserving as much of the natural "freshness" or moisture of the soil as possible. The thin flat sods which represent furrow slices once laid in position are pressed down by the passage over them, once or twice, of the **Disc-Harrow** drawn by three or four horses.*

This implement is so ingeniously constructed, with its saucer-shaped discs strung on two axle-shafts and fixed to the framework of the machine, that the edges sink into the ground and make cuts of an inch or two deep in a direction corresponding to that in which the horses walk. As each disc revolves, or is turned round by the advance of the implement, the part which did the cutting at any given place is pressed under the furrowlet which it cuts off. The completion of its revolution turns over the earth, if it be in a friable condition.

In the way described an excellent tilth can be formed for a seed-bed without running the risk of tearing up the thin sods forming the lower sides of the fresh furrow slices as an ordinary zigzag harrow would unquestionably do; and besides not only would an uneven surface be left, but the soil would be opened up for the escape of moisture, which is there so valuable.

* Cost about £8 10*s*. Manufactured by La Dow, Howard, and others.

When the land is ploughed a second time, in those



Disc-Harrow. Front view.

districts more especially where roots are grown, the plough is intended to go one and a half to two inches deeper than the first furrow, but as much of the land is ploughed by contract it is difficult to get the workmen to go down the proper depth, as a shallow furrow is naturally so much easier on the horses, and so much more land can be covered in a day. Even when the plough is set all right when the contract begins, the furrows become shallower as the irons wear without any alteration of the setting.

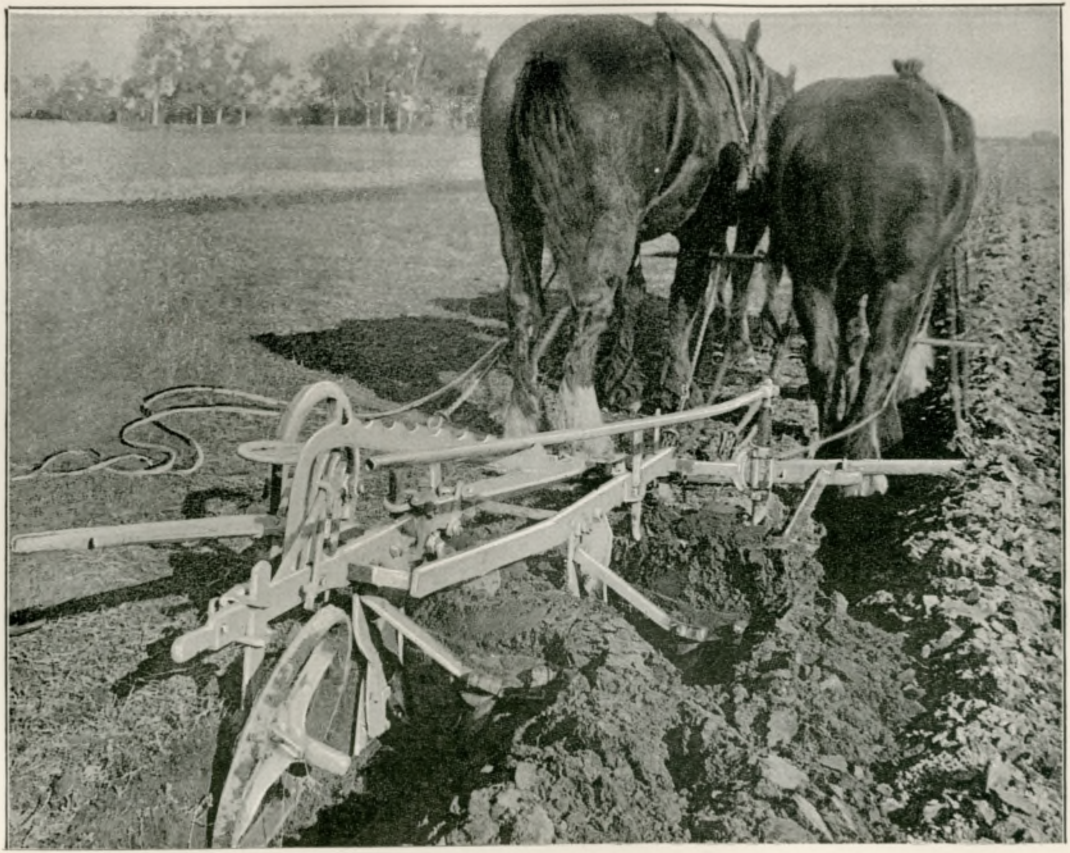
A great revolution is taking place in Britain, not only in the adoption of the **Chilled Plough** of the American pattern, but also in connection with the use of cast-steel plough-irons or those parts which at one time had to be taken to the smithy for repair. The high rate of wages has hastened this movement in the Colonies, and we find ploughs mounted with cast-steel case-hardened shares, such as are supplied by Howard, Hornsby, or Ransom, at a cost of 14*d.* to 16*d.* each.

In New Zealand (South Island) the **cost of contract ploughing** varies from 5*s.* to 6*s.* per acre for turning over a furrow slice 9″ wide by 4″ or 5″ deep.

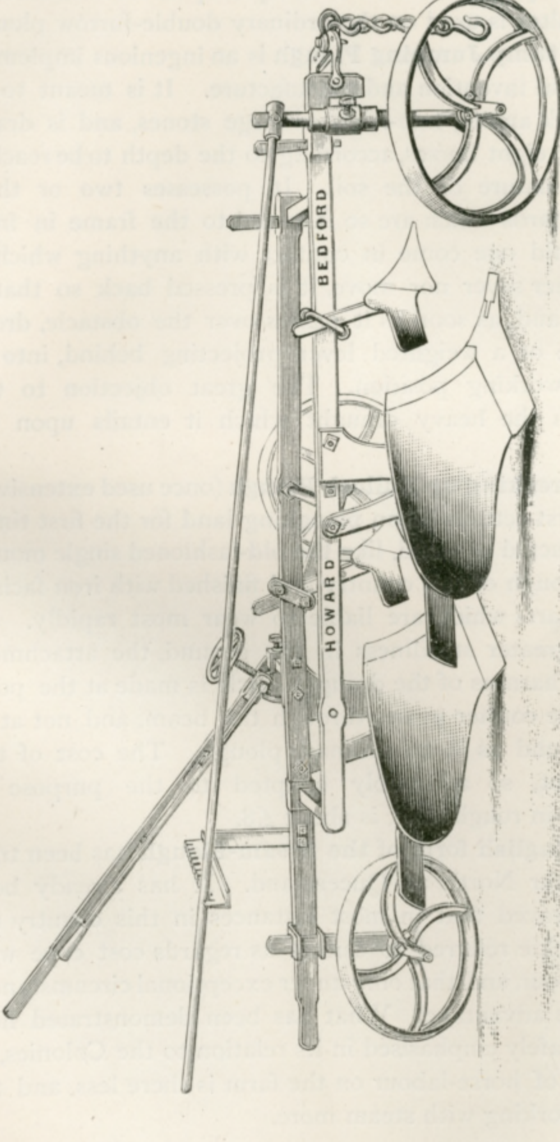
At Glencoe, Mr. Riddoch's South Australian property near to Mount Gambier, one ploughing and two harrowings let by contract cost 9*s.* per acre.

Howard's Digging Plough seen in the figure does excellent work when deep ploughing is resorted to, as it turns over the furrow slices most perfectly and breaks what is then left at the surface by means of a projecting wing or continuation of the mould-board. It performs in addition to ordinary ploughing something equivalent to harrowing at the same time; cavities and openings are closed up, so that escape of moisture is in a great measure prevented.

This plough can be drawn by four horses, and it turns two furrows at a time. It carries skim coulters in front, to clear the surface of grass or roughness, but there are no ordinary coulters—the perpendicular cut being made by the sharpened forward edge of the mould-board as in the



LIV.—Howard's Two-Furrow Digging Plough and Four Horses at Lincoln Agricultural College, New Zealand.



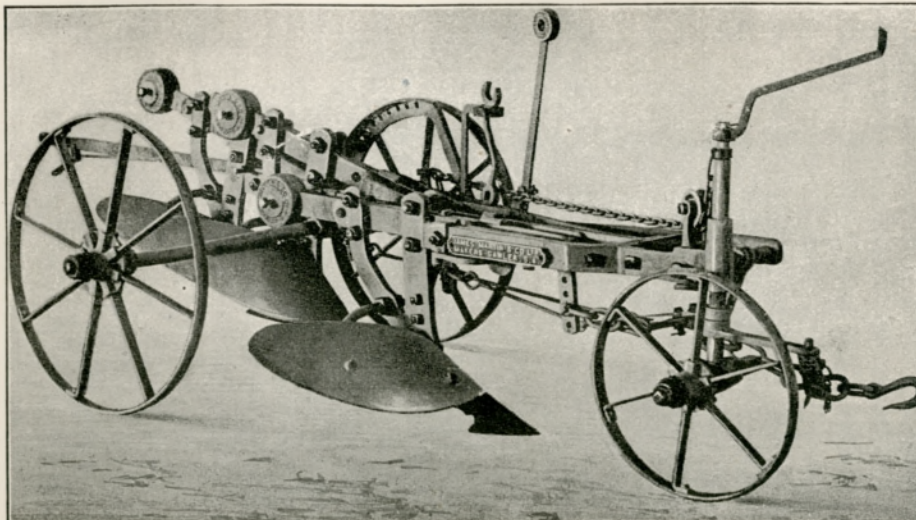
Double-Furrow Digging Plough.

case of American chilled ploughs. In ploughing down stubble in preparation for a turnip-crop in New Zealand, a skim coulter is used on the ordinary double-furrow plough.

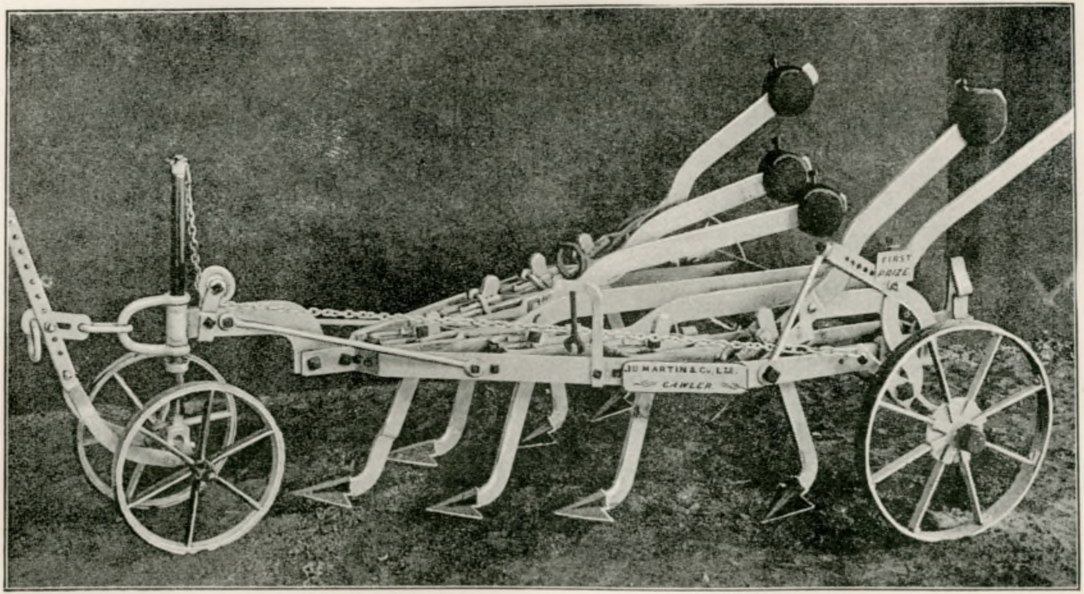
The Stump-Jumping Plough is an ingenious implement of colonial invention and manufacture. It is meant to do deep work among tree-roots or large stones, and is drawn by six or eight horses, according to the depth to be reached and the nature of the soil. It possesses two or three mould-boards which are so fastened to the frame in front that should one come in contact with anything which it can neither sever nor move, it is pressed back so that it rises up, and, as soon as it passes over the obstacle, drops, by virtue of a weighted lever projecting behind, into its natural working position. The great objection to this plough is the heavy draught which it entails upon the horses.

The Breaking-up Bullock Plough (once used extensively by the first settlers when ploughing land for the first time), is constructed of wood, like the old-fashioned single mould-board plough of this country and finished with iron facings on the parts which are liable to wear most rapidly. To give it greater steadiness in the ground, the attachment with the harness of the draught-cattle is made at the point where the coulter passes through the beam, and not at its anterior end as in an ordinary plough. The cost of this implement, so admirably adapted to the purpose of breaking-in rough land, is about £8.

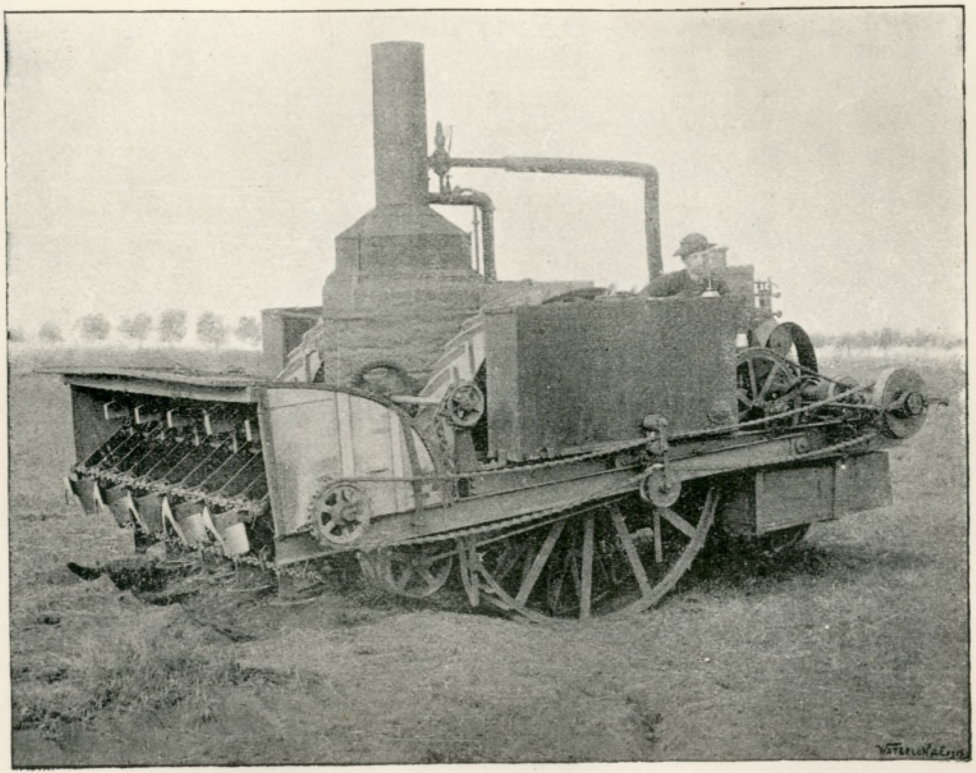
The English form of the Steam-Plough has been tried even as far North as Queensland. It has already been clearly proved that in most instances in this country the steam-tackle referred to cannot as regards cost cope with horse-labour, and that only under exceptional circumstances has it an advantage. What has been demonstrated here may be safely emphasised in its relation to the Colonies, as the cost of horse-labour on the farm is there less, and the cost of working with steam more.



LV.—Stump-Jumping Plough.



LVI.—STUMP-JUMPING SCARIFIER, OR CULTIVATOR.



LVII.—Mr. Roy Stone's American Centrifugal Digging Plough.

The American Steam-Plough or Centrifugal Digger seems to have every prospect of making its way in the Colonies as well as on the prairies of Western America. This implement, of which little is yet known, was invented by Mr. Roye Stone of New York, the engineer who adapted to submarine purposes the hydraulic jet of the Californian Miner, and used it with complete success in cutting the clay-bar of the New York Harbour.

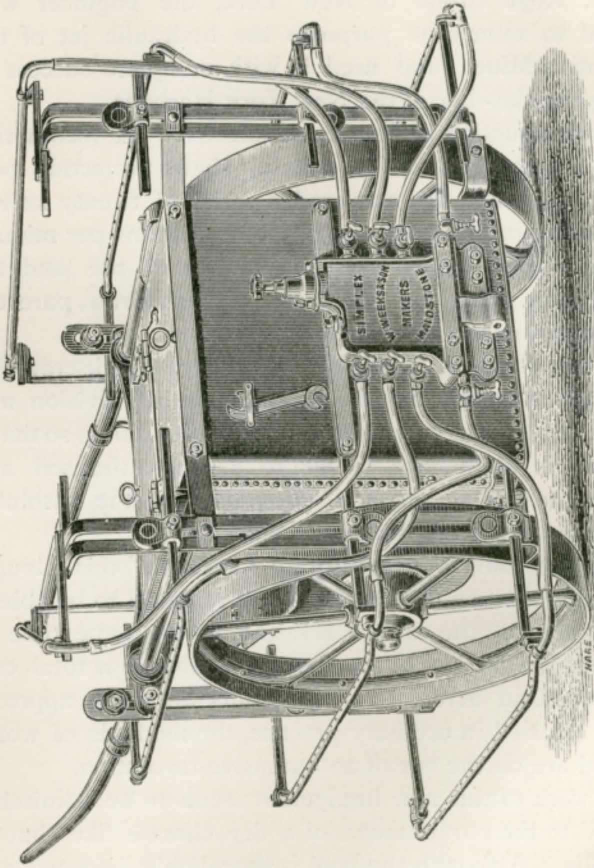
The construction is simple and effective. A locomotive engine has five horizontal revolving shafts projecting posteriorly, on which are arranged a series of twenty knives, which swing round at the rate of 300 revolutions per minute. As the engine passes over the surface of the land, the knives, each going the full depth of the furrow, pare the earth from the soil not yet turned over.

As the earth is removed in this semi-corkscrew-like fashion, it is broken up into a fine state of division and thrown out behind in a loose and tilthy condition, so that it contains an abundance of air to sweeten the soil and to promote the action of disintegration of the insoluble substances in the preparation of plant food.

Only one man is necessary to "operate" this plough, which cuts a seven-feet furrow. It is reported to be able to dig or pulverise the surface soil and at the same time to carry out the process of seeding and rolling at a total cost of $1 or 4*s*. an acre. If these results are even approximately realised in ordinary practice, the methods of working land are on the eve of an extensive revolution.

The work of this new implement seems to be admirably adapted to the requirements of a dry climate like that of Australia. Although the land is thoroughly loosened and air admitted while the work is going on, a tilthy unbroken surface, which prevents the escape of moisture by evaporation, is secured. No fissures are left or are likely soon to form by which moisture can escape from soil which has been in the manner described so effectually subdivided.

The cracking and opening of clay land in dry weather will be prevented and the necessity for shallow and flat ploughing will in a great measure be dispensed with.



"Simplex" Horse-Power Hop-Washing Engine.

The Hop-Washing Engines, either for hand-power or horse-power, by Weeks and Son, Maidstone (one of which is illustrated in the accompanying figure), leave nothing more to be desired. As a horse draws the engine between two rows of hop-poles, powerful gun-metal pumps force the liquid through the perforations on the upper sides of the two pipes which encircle each travelling-wheel, with such force that it rises in jets to the top of the hop-poles and plays with sufficient force upon the hop-bine to wet the entire surface of the leaves with the liquid fungus-destroyer or insecticide.

The cost of the "Simplex" horse-power washing engines varies, with the size and capacity, from thirty-four guineas for one capable of holding sixty-five gallons, to forty-six guineas for one large enough to contain 110 gallons.

One of the latter, in the possession of Mr. Fergusson of Brighton, Victoria, has already done good work, and has proved an effectual check to the red spider; but **the cost** was raised to £90 by import duty and carriage, which is a prohibitive price so far as the small grower is concerned. Surely Colonial engineering skill does not require such a measure of protection, and certainly some moderation might be exercised in adjusting the duties upon machinery which is to be of special value in protecting a struggling Colonial industry!

The hop crop is one which is well worthy of the attention of the Colonial cultivator. The low range of prices in the English market during recent years has not been encouraging to the Colonial grower, but with hops selling at £15 per cwt., the price realised for much of the English crop of 1890, this excuse can no longer be urged. Apart altogether from an export trade there must be a large, and, with the increase of population, a growing Colonial home-market.

Many **hop substitutes** have been tried from time to time when, after a poor yield the price has risen to an exorbitant rate; but none of the spurious articles can come up to the hop itself for brewing beer. There is as little prospect now as at any time of a chemical substitute being found to take the place of the real article. The prospects of hops continuing to be an important agricultural product and a considerable trade commodity are now as good as ever.

The hop crop has in the past been a risky and often a ruinous one for the grower, but the quality was frequently the result of the grower's want of knowledge, want of action, or want of proper appliances for treatment. Now there is no excuse for ignorance with the published results of **Miss Ormerod's researches** into the causes of insect injuries within the reach of every one, and no lack of serviceable mechanical inventions for the effectual application of dressings in the form of either powder or liquid, known to effectually overcome fungoid and parasitic attacks, to which the crop in Australia is especially liable.

The Strawsonizer (invented by Mr. G. F. Strawson, of Newbury, Berks, and made by Messrs. Hornsby and Sons, Grantham, England), is probably the most valuable mechanical invention of recent years for the farmer, the fruit-grower, or the wine-producer.

In **construction** the machine is extremely simple. It is repeatedly asked why such a simple principle has not been applied before to the purposes for which it is now found to be so suitable.

The accompanying plates make detailed description unnecessary. Suffice it to say that the power is communicated from the two wheels, which bear the working parts of the machine, to a fan which is made to revolve at high speed within a horizontal tube which opens posteriorly. A strong blast or current of air is thus created. **The material to be distributed** is dropped, from the hopper in which it is placed, into the line of the air-blast as it rushes through the tube. It is discharged with such force that liquid is blown off in the form of the finest spray; and dry powder in a cloud of finely divided dust. By this

The Strawsonizer for High Work.

means the applications used for destroying surface caterpillars or fungoid parasites on crops, fruit-trees, or vines, can be reduced to the finest possible state of mechanical division, and spread over the entire surface of the plants—the under as well as the upper side of the leaf. So perfect is the work that one gallon of paraffin—similar to that used in oil-lamps—can be sprayed over an acre of ground, and left as a gentle dew. Paris-green, and solutions of soap (so much used to destroy injurious insects on fruit trees) are equally easy of manipulation.

For amounts and proportions, as well as for a complete and detailed list of the materials used as dressings for the various forms of attack, the reader is referred to Miss E. A. Ormerod's excellent '**Manual of Injurious Insects and Methods of Prevention**,'—Simpkin, Marshall, Hamilton, Kent and Co., Limited, price 5*s.*—a book which ought to be in the possession of every fruit-grower and farmer in the Colonies.

The Strawsonizer can also be utilized as a **broad-cast grain sower**, or a dry-manure or liquid-manure distributor. Grain can be sown to the breadth of 18 feet at a time, and 30 to 40 acres can be accomplished in one day.

In a word, for spreading any finely divided material on the surface of the ground, or on crop plants at moderate elevations, there is no mechanical contrivance which can compete with Mr. Strawson's machine.

Had it been possible to treat the fungus of **wheat rust** (*Puccinia graminis*, Uredo stage) in this fashion, the greatest and most serious agricultural difficulty in the Colonies would have been solved ; but this does not come within the range of possibility.

The only hope * in this matter which the Colonial wheat-

* The theory of Mr. Smith Ellis, like many another theory of a similar kind based upon a mistaken idea of the nature and life history of the organism causing the injury, is of no practical value, and will soon be lost sight of and forgotten.

The Strawsonizer for Low Work.

grower has, exists in the selection of certain varieties of wheat which resist the disease under Colonial circumstances, and by discovering and thereafter destroying the wild or native plants which act as intermediate hosts, and which perpetuate the existence of and even increase the fungus now threatening to put an end to wheat-growing over a vast area of the Australian continent.

CHAPTER XX.

ROTATION OF CROPS.

The Fertile Character of Virgin Soil—Weeds of Arable Land—New Zealand Systems of Rotation—Influences at Work in their Formation—The Beneficial Influences of Leguminous Crops—Hellriegel and Wilfarth's Experiments—Details of Rotations, Good and Bad—Rotations in New South Wales and Queensland—Uncertainty of Grain Crops near Toowoomba in Queensland.

As is usual in new countries where the virgin soil is rich in organic remains, containing combined nitrogen and other ingredients of plant-food (salts of potash and phosphates) usually applied as manures to arable land, the necessity for a good system of rotation is not brought home to the pioneer cultivators, and the application of manure is of course quite out of the question. It is only after the soil begins to show the exhaustion produced by repeated grain cropping, that it is seen to be advantageous, and even necessary, to give it a rest either by laying it out in grass, sowing crops of different habits of growth, or, in a few instances, by fallowing, *i.e.* by leaving the land without a crop for a season and clearing it of weeds meanwhile.

In Britain, the weeds which most demand the fallowing of land, are the couches (*Triticum repens*, *Poa pratensis*, and *Agrostis alba*).

Poa pratensis is one of the most troublesome weeds in many districts of New Zealand. The worst forms in those parts of Australia where bare fallowing is practised are, in addition to poa, sorrel (*rumex*), and iron-weed (*Lithospermum arvense*, Linn.).

New Zealand, which, with the exception of the mountain regions, is, as a whole, more suitable than Australia for cultivation, has taken the lead in the matter of rotations. No doubt the closer system of cropping in this Colony is one good reason why the benefits of rotations have been more felt and taken advantage of, but in addition to this, the development of the frozen beef and mutton trade with Europe has necessitated the providing of a greater amount of succulent or green forage, more particularly during the winter season when the supply of food from natural growth is reduced to a minimum. A good supply of meat must be kept up all the year round to maintain a satisfactory footing in the British market. The growing of turnips as winter food makes this possible. The land, meanwhile, is permitted to rest from the growth of cereal crops, and is manured by the droppings of the sheep or cattle turned on to consume the root crop. An additional advantage is gained by the consumption, along with the turnips, of straw which would otherwise have been in a great measure wasted —either burnt or trodden down in a heap.

Besides turnips there is another class of plants, viz., that of the **leguminous order**, which induces fertility in the soil in quite a different way. All the clovers and also lucerne, which grow so well in some parts of Australia, belong to it. Hellriegel and Wilfarth have proved by experiment that leguminous plants have the power through special means, not at the disposal of other crop plants, of making use of nitrogen derived from the free nitrogen of the air by the action of microbes found in the wartlike processes or tubercles adhering to their roots, and of leaving it as root residue in the soil, for the use of succeeding generations of crops belonging to any order. Quite recently the nitrifying organism has been isolated by Winogradsky of Zurich, who has named it Nitromanas. *

* The results of these experiments are published in *Annales de l'Institut Pasteur*, 1890.

There are various reasons why leguminous forage crops should find a much more important place among the crops cultivated both in Australia and New Zealand, viz., (1) on account of their being a complete change in a rotation from grain crops, (2) the power of their root tubercles to fix nitrogen in a useful form, (3) their suitability for irrigated lands, and also for being made into silage.

In New Zealand a common rotation is a turnip crop between two grain crops, preceded and followed by some years of grass: for example, oats, turnips, wheat, seeds. Sometimes oats are followed by wheat before turnips. In either case the land may be laid out in grass at the end of the cultivation without a grain crop. Another method of breaking in is practised near Oamaru on the property of the New Zealand and Australian Land Co. The land is let for one crop of wheat for a rent of about £2 10*s*. per acre to a class of contractors called "croppers." These men plough up the lea about Christmas (summer-time in the antipodes), and sow turnip-seed for the owners, who consume the root crop on the land. It is afterwards ploughed and sown with wheat during the last week of May or in June.

Some of the badly arranged rotations afford good evidence of the excellent quality of the soil in certain parts of the country.

The road from Windsor Park to Oamaru station (in the South Island of New Zealand) passes through a number of small farms of about two hundred acres in extent, and worth, in capital value, about £25 per acre, but badly farmed, and with the houses very poor, owing to many of the occupants being in debt. The soil is a friable, black, volcanic loam, well-suited to potato cultivation. Wheat and potatoes are grown alternately, with rarely a rest of eighteen months while down in grass; yet the soil is so rich that it produces excellent crops.

The Maories have cropped regularly for thirty-three years some of the rich alluvial land in the neighbourhood of Hawke Bay, and nevertheless harvested fifty bushels of oats per acre in 1889.

On the fertile banks of the river passing Richmond, New South Wales, (called the Hawkesbury in its lower reaches and the Napean further up), crops have been grown regularly for over seventy years. Two crops are generally got in one season—first, oats or wheat made into hay, and second, maize; pumpkins may be at times substituted for the latter. **Lucerne** would not grow satisfactorily on the land before the flood of 1867, but now it thrives well, and as it holds its own for many years, it can, with advantage, be sown when the soil requires rest.

At Toowoomba in Queensland the land is usually broken in with a crop of maize, and this is followed for a few years by wheat cut for hay. Oats are also grown for hay, and sometimes for seed, but neither of the grain crops can be relied upon to ripen, on account of the prevalence of rust. **Maize**, though it does not give such a good return as a successful oat crop, is nevertheless much more certain in its growth.

CHAPTER XXI.

FORAGE CROPS AND SILAGE.

Lucerne in Australia as a Forage Crop and for Hay—The Hay Season—Wheat cut for Hay—Straw from Ripe Grain—Prices of Hay—Silage and the System of Ensilage—Importance of for the Colonies—Sweet Stack Silage—Advantages over Hay—Origin of Fires.

Lucerne (*Medicago sativa*), (sometimes called Egyptian clover, and by the Americans "Alfalfa"), is the great forage plant of Australia and New Zealand, in the parts where there is sufficient moisture for its requirements. In much of the wheat-growing area of South Australia, the climate is too dry for lucerne to produce a satisfactory yield, and a grain crop is substituted, usually to be cut green and made into hay. Though lucerne grows in great luxuriance in some parts, as in the Hunter River valley where five or six cuttings can be taken in one season, yet it is liable to disappear from a pasture after a time. Some soils retain it better than others. At Mudgee it will persist for thirty years, and on the Hawkesbury for fifteen to twenty years, while in many places it does not stand more than six, eight, or ten years. Much depends also upon the method of **treatment in pasturing** or cutting. Before stock are allowed to graze on the young lucerne, it should have a period of from twelve to eighteen months after sowing, to develop roots and to thoroughly establish itself; and even after that time it is best to have the paddocks subdivided, so that one part can be eaten down closely and at once, and then, on the removal of the stock to the next division, left to rest and grow. By this means the young shoots of each new growth are preserved until they have matured, and the weakening which results from bleeding the plant by injuring its young and tender shoots, is obviated. Lucerne grows best when sown for the second time, after an interval of a few years, during which other crops have occupied the soil.

In some parts of Queensland, as in the neighbourhood of Toowoomba, it is believed that lucerne does not now grow so well as it did thirty years ago. It is thought that there is now less rainfall, and that this is sufficient explanation; but it is possible that lucerne had grown naturally more freely on the virgin soil than it does now on that which has been previously cropped by it. Lucerne is a plant which responds well to **irrigation**; nevertheless, the deep habit of growth of its roots, provided the subsoil holds sufficient moisture to supply its requirements, enables it to live without artificial watering where many other plants would perish. It grows well on light soils overlying a heavy and moist or "fresh" subsoil. It is least suited to heavy clay, which on drying in summer contracts and cracks and strangles it by pressing the root fibres and tearing away the minute root hairs which act as mouths to the plant, and project from the surface of the easily visible roots. A rich open alluvial loam, with sufficient moisture underneath, suits the plant best. Of all crops grown in the Colonies lucerne is perhaps the most valuable to the small occupiers or "cockatoos" in the neighbourhood of towns. It holds a similar position in the irrigation states, in Western America.

It is said that but for lucerne (alfalfa) Salt Lake City, the centre and head of the great Mormon church, could never have been developed in so surprising a manner. Lucerne is made into hay of excellent quality, and used as food for horses and milch cows, which always exist in large numbers in populous centres. The hay possesses many of the qualities of good clover hay, and as it is made in a climate perfectly suited for the purpose, the keeping quality as well as the general quality is excellent.* Lucerne suffers from the attacks of dodder (*Cuscuta hassiaca*, and *C. densiflora*, Hook.).

The great hay harvest time of South Australia is in December, when green wheat is cut just as it approaches to its heaviest growth, and dried into the most beautiful fodder, on which horses in country districts thrive remarkably well without any additional or concentrated food. Straw which is allowed to mature is not so good in a hot climate as in one of a more moderate temperature, and in a country where the cost of labour and carriage is high it does not pay to trifle with an inferior article ; we, consequently, find that the straw which has borne the mature grain is left in the field after "stripping," and fodder is provided by a certain area of the wheat crop being cut while completing its most vigorous growth.

Hay is not made from green grain crops in **Britain** for two reasons :—(1) It has been shown by the experiments of Sir John Bennett Lawes, and Dr. Gilbert, that the full return from an oat crop in feeding value can only be secured when the crop is allowed to mature, and it must be remembered that in this country the straw of the crop makes good fodder. (2) The climate is too uncertain, and the sun not strong enough to thoroughly dry the crop when, as would often be the case, it might be wetted during the process—thus entailing heavy loss. Green straw is extremely difficult to dry sufficiently at the joints to prevent its heating immoderately and injuriously in the stack. However dry it may seem to appearance and to touch, in our climate sufficient moisture to ruin the whole mass, when it is closely packed, is long retained in the joints. The price of hay varies considerably with the season in Australia. Those small holders who grow hay for the Melbourne market

* The author examined a stack belonging to Mr. Towne, of beautiful, green, well-scented lucerne hay which had been seven years in stack.

get as much as six or seven pounds per ton for it after a period of drought. It goes down in price, at times when there is a period of great abundance, to twenty-five shillings, though it cannot be grown at a profit for less than fifty shillings. On an average of years the price ranges between £3 and £4. The average return from good land in the Ballarat district (the property of Sir William Clarke) was two and a half tons per acre, though in some seasons it reaches as high as four tons.

The system of ensilage,* which has been so successfully adopted within recent years in Europe and America, is one which, when fully developed, cannot fail to prove a great boon to the Australian Colonies, suffering as they do from long periods of drought. All the conditions likely to ensure its success are present, and so also are all the conditions required to make its adoption necessary. There are times of great abundance, when the natural supply of food is far beyond the capacity of the stock to consume it; and again there are periods when the death-rate is high from insufficiency of ordinary nourishment.

Silage has been tried in many places with complete success; but the area where the system will no doubt ultimately prove to be of greatest value is in the droughty regions of Queensland and similar parts of the other Colonies. Water is now being provided at great expense, but it will be found that although sheep can live very much longer when they have plenty of water than with a short supply or with none at all, yet something more than water will have in time to be stored up against the evil day, as

* The definitions laid down in the paper of the late H. M. Jenkins in the Journal of the Royal Agricultural Society of England are adopted; viz., *Silo*, the pit or house in which the material is stored; *Silage*, the material itself; the *System of Ensilage*, the process. "Siloh" is the name given to a dome-shaped pit or underground structure now used in Palestine for preserving grain.

the necessity for looking to other products than wool increases. In some of the driest parts of the country it will be necessary to grow lucerne or some other forage crop to secure the silage material, but once secured it can be preserved in good condition for years, until a time of scarcity arrives.

The silage-stack system of storing, on the plea of economy, simplicity, and convenience, will no doubt be the method followed. The cost of putting green food into a silage stack is little, if any, more than that of making and securing hay when the stack is located at a convenient point in the centre of the field from which the fodder is to be carried. It may be said that the cost of the system would be too great; but this argument does not cover such a case as that of a man (and he is only one of many) who went up to Queensland with a capital of £60,000, and returned at the end of three years, disappointed and penniless. No ordinary expense, provided it had obviated the death of the entire flock, ought to have been spared under the circumstances. What is wanted is a cheap and ready method of storing the green fodder, before it gets too dry or ripe, in such a way as to prevent the temperature rising so high as to char and blacken the substance. The larger the stack, there will be the less waste and greater keeping power combined with good quality, provided it is built slowly enough to allow the temperature to rise to 120° F., and thereby secure that the product shall be sweet silage. There is not much risk of a large stack being built too quickly, as it must be allowed time to settle, to obviate the danger of falling over if run up too high.

If a stack is made twenty-one feet in diameter at the base, and properly supported on each side—as by means of a couple of strong upright posts twenty feet high, sunk well into the ground—no expensive process of pressing is necessary. The grass could be carried up by an elevator worked by a single-horse gearing; and a few heavy logs of wood, earth, or stones are all that is required in the way of pressure. A large mass of green food put together is not only silage, but it also supplies the necessary weight required to make it all good except the upper layer and a few inches round the sides. The author has seen excellent silage made in Ireland, without any weights being used, by simply packing grass tightly within upright posts, carried up so that the stack could be raised to a height of twenty feet. No doubt the surface layer at least would have been the better for some little pressure which could have been inexpensively applied.

The great advantages of silage over hay in a time of scarcity are (1), that it is a moist and natural food which sheep take to without difficulty and (2), that it cannot be set on fire either by accident or by intent—two almost equally prevalent sources of casualties. Grass gets so dry in the hot weather that it will burn on the slightest opportunity. Sometimes it is ignited by lightning, frequently through the carelessness of people camping out, or it may be through the resentment of an unfriendly neighbour or discharged servant.

CHAPTER XXII.

GRASSES AND PASTURE PLANTS—NATIVE AND EUROPEAN.

A few of the best Pasture Grasses—Native Grasses Destroyed—Kangaroo Grass—Native Grasses when Cultivated like British—Tussock Grass—Black Grass—Shelter for Lambs—Tussock Grass in New Zealand—Influence of Dry Weather and of Rains on Grass in Summer—"Ring-Barking" Trees for the Improvement of Pasture—Couch Grass or Dúb—Yorkshire Fog—Prairie Grass—Meadow Poa—Common Agrostis—Fiorin—Buffalo Grass—Australian Yellow or Bur Clover—English Yellow Clover or Trefoil—White Clover—Red Clover or Cow Grass—Quality of British Grasses in the Colonies—Rye Grass and its Habit of Growth in the Colonies—Cocksfoot—The Fescues—Ergot—Its Varieties and Poisonous Effects on Animals—Parramatta Grass—"Seeds" Mixtures—Methods and Times of Sowing—Thistles.

ALTHOUGH the season of the year in which the author visited Australia was unpropitious for the study of the natural grasses of the Colonies, the drawback was considerably minimised by the goodness of Baron von Mueller, who presented him with a beautiful collection of dried specimens, numbering 120 species of grasses.

The following were marked as being specially valuable for pasture :

Agrostis Billardieri, R. Br.—All the Colonies, including New Zealand and Tasmania.

Agrostis nivalis, F. v. Muell.—Victoria. For Alpine country.

Andropogon halepensis, Sibth.—Queensland, New South Wales, and West Australia.

Anthistiria ciliata, Linn.—Common kangaroo grass. All the Colonies.

Anthistiria membranacea, Lindl.—Barcoo grass of Queensland; also called Landsborough grass. West and South Australia, New South Wales and Queensland.

Cynodon dactylon, Pers.—Indian dúb grass, couch grass. All the Colonies except Tasmania.

Cynodon convergens, F. v. Muell.—The northern couch grass. Gulf country of Queensland and New South Wales.

Danthonia nervosa, Hook.—All the Colonies, except Queensland.

Danthonia pencillata, F. v. Muell.—Wallaby grass. Throughout Australia.

Diplachne fusca, Beauv.—All the Colonies, except Tasmania.

Ehrharta stipoides, Labill.—Weeping grass, meadow rice grass of New Zealand. All the Colonies.

Eleusine indica, Gaertn.—Yard grass, crowfoot, crab grass, wire grass. Queensland and New South Wales.

Eleusine verticillata, Roxb.—North Australia and Queensland.

Eragrostis Brownii, Nees.—Love grass. Throughout Australia.

Eragrostis falcata, Gaudich.—New South Wales, Queensland, and South Australia.

Eragrostis megalosperma, F. v. Muell.—Queensland.

Eriachne ovata, Nees.—West Australia and Central Australia.

Eriathus fulvus, Kunth.—Sugar grass or brown top.

Festuca dives, F. v. Muell.—Victoria.

Neurachne alopecuroides, R. Br.—Victoria, South Australia, and West Australia.

Neurachne Mitchelliana, Nees.—Mulga grass. South Australia, Victoria, New South Wales, and Queensland.

Panicum decompositum, R. Br.—Barley grass, native millet, umbrella grass. Throughout Colonies, except Tasmania.

Pappophorum commune, F. v. Muell.—All parts of Australia.

Poa cæspitosa, G. Forst.—Weeping polly grass, wiry grass, tussac poa. All the Colonies, including New Zealand.

Setaria macrostachya, H.B. and K.—All the Colonies, except Tasmania.

Spinifex paradoxus, Benth.—New South Wales and Central Australia. For sandy deserts only.

A number of the best native grasses of Australia have been eaten down by sheep (and more recently by rabbits), and prevented from seeding, so that they have practically disappeared from fenced-in pasture-land, on which they were at one time abundant. Specimens of them may be found on road-sides and railway banks, or on such places as are not regularly pastured.

Kangaroo grass (*Anthistiria ciliata*, Linn.) is a strong coarse-looking grass which tends to grow in tufts, but which is highly appreciated by stock, and forms very excellent and nutritious pasture if it is not too closely eaten down. The flower-head is not unlike that of common oats with the flowers well apart. This is one of the most valuable of the grasses that have disappeared in ordinary pastures with the increase of the sheep stock. In some places, notably in the southern parts of South Australia, brake-ferns have taken its place and entail considerable cost in their removal when the land is broken up for cropping. In some parts of the back-country of New South Wales and Queensland, since the land has been stocked with sheep and fires have become less frequent, pine-tree scrub is coming up in a manner which threatens to render the land useless for grazing purposes.

Though native grasses naturally tend to form into bunches or tufts, it has been shown by some **experiments** in the growth of native grasses carried out at Toowoomba, that when sown and cultivated a number of the best of them grow more like British grasses.

Tussock-grass,* observed in sheep pastures in that part of South Australia lying to the north of Adelaide, is so named because it stands up prominently in tufts or tussocks when everything else is eaten closely down. Its leaves are flattened rigid spines terminated by sharp points. The large whitish-yellow waxy-looking flowers springing from the solid mass of leaves, old and new, are much appreciated by sheep and are of special value when seasons of deficient rainfall follow one another. The flower even then appears at its proper time—during the

* Or Tussac grass.

lambing season—however surrounding plants may suffer from want of moisture. The air, as in the neighbourhood of may-flower in full bloom, is sweetly scented with the perfume of the flower.

The South Australian **black-grass** also grows in tufts in country similar to that occupied by tussock grass, and at a distance resembles it. It is a strong flat-stemmed plant with a dark, wood-rush-like flowerhead—found to possess, when pulled up by the root, a considerable amount of resin at the base of its stems and leaves. Sheep eat the flower-heads in dry seasons and also graze on the young shoots, if the old tufts have been burnt over at a season when the fire does not destroy the plants entirely.

It must not be forgotten that a **bush-fire** or a **grass-fire** at a wrong season is one of the greatest causes of loss, and therefore one of the greatest sources of anxiety, to the stock-owner in Australia. Not only may he be suddenly deprived by fire, during hot weather when everything is parched, of the temporary food of his flocks or herds, but, as in the case of the black-grass country, the whole nature of the vegetation may be suddenly changed for the worse by the destruction of some of the most valuable of its component parts.

Black-grass and tussock-grass are not only available as food in times of scarcity, but they are in ordinary years of immense value as **shelter**—especially during frosty nights in the lambing-season. With a bush or a tuft for shelter, a ewe can usually preserve the life of her offspring even in the coldest nights which occur in Australia at that season, but where the surface is plain and unbroken, the want of shelter is forcibly brought home to the observer by the numerous white specks that may be noticed in passing—representing lambs so chilled during the first few minutes after birth that they have been frozen to the ground without even being able to gain their feet.

The blue tussock (*Triticum scabrum* R. Br.), a grass of superior quality, has been mostly eaten out of the South Island of New Zealand, where it was at one time plentiful. Along with it a **barley grass** and wild **parsley,** both of superior feeding value, have also practically disappeared from the natural pastures, leaving a coarse **inferior tussac** which now stands up white, wiry, and worthless in the dead season. Where the land can be ploughed, the inferior tussock-growing soil is vastly improved by being broken up and sown out with British grasses, after a course of grain-crop and turnips has been taken.

The dry season of the year is a decided advantage to Australian flocks, provided it is not too long continued. After the growth for the season—which follows the advent of the rains—all grass left on the ground in November is dried up by the heat of the sun, and though not stored is preserved in good condition, as hay, where it stands,* and is what the sheep live and do well upon till the rains come again next season. By this time the growth of the former year is pretty well cleared away and the surface left smooth on land fully stocked with sheep.

In our own islands, grass left over at the end of the growing-season has the soluble portion or strength washed out of it by the succeeding winter rains soon after it withers.

When summer rains fall out of season in Australia, they wash away the strength of the grass, and sheep fall off quickly in condition. Any young growth which comes is quickly burnt up in the hot sun. It does not possess the nourishing properties of grass grown in the usual grass-growing season.

In the heavily-timbered districts of Australia the method adopted for the improvement of pasture is **"ring-**

* This is similar to what happens with the grass left on the prairie-land of the Canadian North-West, where Indian ponies are turned out in autumn in poor condition, and come in the following spring quite fat, in spite of the frost and snow of winter.

ing" the bark of trees, so that the flow of sap is cut off and the trees die. The trunks remain in their places with their gaunt and withered arms projecting for a number of years, until their root-supports rot and give way, and the wind levels what remains of them with the ground. An abundant growth—in many places of bur-clover(*Medicago denticulata*, Willd.)—usually springs during the first season after ring-barking. In some instances seeds are sown, though the usual practice in Australia is to leave nature to her own resources. In New Zealand grass-seeds are almost invariably sown.

At one time the densely-timbered country was thought to be inferior to that with timber and grass combined, if not altogether worthless, but the heavy-timbered land having the richer and deeper soil as a rule, is now found to give the larger yield of pasture, although stock are not so fond of it as they are of the short sweet grasses of the open country. **Grass** grown under trees is inferior in quality from want of sunlight and heat. In the proximity of most living Australian trees (excepting the red-gum) it is what is termed soured, and stock reject it.

Couch-grass or Doorva-grass (*Cynodon dactylon*, Pers.) is the famous **dúb** grass of India, where it is so widely distributed and so invaluable as a source of horse-fodder in times of scarcity. It is of slender growth, and extends by underground stems which throw out roots at the nodes. It is thus able to resist severe drought and to maintain itself on light land when most other grasses would perish. It is not then surprising to find that dúb is spreading throughout Queensland, where it is already abundant in places and specially valued for dairy cows. It is there, and in the extreme north of New Zealand, more highly appreciated than in the other Colonies.

This grass was seen growing well in the Botanical Gardens at Adelaide alongside its much stronger and coarser lawn companion, buffalo-grass (*Stenotaphrum*

Americanum, Schranck). Dúb had not, however, extended to the parts visited in that colony, although it would be admirably suited to much of the lighter and drier descriptions of soils there under pasture, or more correctly under a natural cover of weeds. It is infinitely superior to the obnoxious weed **Yorkshire fog** (*Holcus lanatus*), which it has been suggested might be planted on light, poor land.

If holcus were sown on inferior soil, it would without fail extend to the best land (owing to the lightness of its well-matured seeds), and there it would for ever remain as an obnoxious weed. No argument is good enough, however plausible, to excuse a man for sowing Yorkshire-fog in any pasture-land in the Colonies. In fact it is in reality so worthless and injurious, that in a land where Government interferes with such matters as thistles and other weeds, it would be well to prohibit the sowing of it among other grass seeds, whatever excuses might be urged in its favour.

Couch-grass is unfortunately difficult to establish owing to the imperfect manner in which the seeds mature, and the consequent difficulty experienced in securing them and then in getting them to germinate and grow. Once this grass has obtained a hold, it spreads slowly but surely by its roots. The tenacity with which it maintains its existence in arable land has secured for it the name of "couch" in the Colonies. It does not appear in our fields in England, although it is indigenous to places on the South Coast.

Couch-grass, like buffalo-grass, is an excellent summer grass, but it withers with the first appearance of frost. It is nevertheless valuable in a pasture as one of a number of grasses having different times in which they develop and come to maturity. It is by a judicious combination of good grasses of various habits of growth that a pasture is made serviceable at all seasons of the year. When, with the natural alternation of the seasons, one grass declines, another is ready to occupy its place and perform its duties, while the roots remain more or less inactive till the proper time comes round.

Prairie-grass (*Bromus unioloides*, Humboldt) does remarkably well to grow on the same ground with couch, as its period of greatest usefulness is in winter. It frequently springs up without being sown in districts where it has been previously grown, but oftener on the heights than in the hollows or flats, to which it is not so well adapted. The seeds are dropped by horses in their dung, and having sustained no injury by their passage through the digestive systems of the animals, germinate.

Couch may die out or become thin upon certain heavy lands. Even in India, its natural habitat, it tends to break up into patches, and ceases to form a uniform covering, unless the soil is grubbed to a moderate depth. Anything which will stir the immediate surface and break a few underground stems increases the number of plants and encourages their growth. Disc-harrowing at the proper season would no doubt be a useful means of encouraging the development of Australian couch-grass.

Smooth-stalked meadow-grass (*Poa pratensis*) is also called "couch" in some places, but it is not so widely distributed as dúb, the true "couch" of Australia. It grows readily on light and dry land, but once introduced it is almost impossible to eradicate it.

The common bent-grass (*Agrostis vulgaris*), another obnoxious weed, was being introduced into some parts of the North Island of New Zealand under the name of "Fiorin" (*Agrostis alba stolonifera*).

Our colonial kinsmen would do well to be very careful of new experiments in the way of introducing such plants as are unknown to them, after the losses they have sustained from thistles and other weeds.

Buffalo-grass (*Stenotaphrum Americanum*, Schranck), although possessing some habits in common with couch-grass (dúb), notably that of extending by trailing stems and growing most luxuriantly during summer, is yet very different in size and appearance. Both are used for ornamental grass on lawns, and each forms in its own peculiar way a close and uniform cover or matting when kept closely cut. Buffalo-grass is strong and coarse in texture, and will, in time, where allowed to grow to its full size, choke out all other grasses. In this particular it is inferior to couch for mixed pasture.

Bur-clover (*Medicago denticulata*, Willd.) is, though an imported species, the yellow clover of the Australian Colonies of the present time. It strongly resembles the common so-called yellow clover or "trefoil" (*Medicago lupulina*) of England, but its flowers are single, not in clusters like those of trefoil. It also possesses a larger, more pointed, and more hairy-edged stipule, and the characteristic coiled-up seed-pod. One variety has also a little black spot on the leaf. It is a plant which occupies a peculiar position in the Australian Colonies, as it is so valuable as food for stock and at the same time so detrimental to the quality of the wool. The **burs** or spirally coiled seed-pods adhere to the fleeces of sheep and cannot be removed by any ordinary preparatory treatment of the wool, and only with great difficulty and at much expense during the process of manufacture.

Unlike the **New Zealand bur** (*Atwai* or *Pidi-pidi*), it cannot be easily broken up in working and removed in small pieces.

The presence of the bur-clover reduces the value of the wool by 2*d.* per lb., which would amount to an immense annual loss if it became general. It is, however, one of the best of the pasture-plants of the temperate parts of Australia. It gives a large and valuable return of green food in the growing season. It comes so quickly sometimes after a season of scarcity or drought that cattle not accustomed to an abundant supply of green food are liable to suffer from "hoven" or "blowing" after eating it. Its seed-pods and dried and broken leaves remain on the surface of the ground, and are greedily licked up by stock during times of scarcity.

With plenty of water, sheep and cattle do well on land which grows bur-clover for a long time after every vestige of green substance has disappeared. With a deficient supply of water, hard **dust-balls** are liable to form in the stomachs of animals thus supported, and are frequently the immediate cause of death in times of drought. Bur-clover grows freely in New South Wales, Victoria, and the southern parts of South Australia and Queensland. It springs spontaneously on land on which the trees have been destroyed by ring-barking, and will for a time occupy the surface alone. This it does all the more completely where, on account of the superior quality of the soil, the tree growth has been strong enough to smother undergrowth or surface vegetation. It forms an excellent preparation for the reception of pasture grasses in the course of time.

Though the plant has been imported into New Zealand, and may be seen among the roadside herbage in certain parts, it has not there established itself in pasture as it has done in Australia. The place of bur-clover would readily be taken in New Zealand by the common so-called yellow clover or trefoil (*Medicago lupulina*), but it grows at a time when there is abundance of green food and disappears in the winter season, when, although not in full growth, a first-rate pasture plant should contribute something to the support of the stock of the country.

White clover (*Trifolium repens*) was found growing in abundance in certain places visited in New Zealand, South Australia, Victoria, and New South Wales. Near Kiama, in the south-coast region of the latter colony, white clover came up in great luxuriance about the beginning of the fifties. Now it is greatly reduced in quantity, but it has served its purpose as a valuable preparation for superior pasture grasses, to which naturally it has partially given way. At times the young plant of white clover is to a considerable extent destroyed by the brown-headed, white grubs of the cockchafer already described.

Red-clover (*Trifolium pratense*), or the late-flowering variety—usually termed "cow-grass" by seedsmen, though not the true cow-grass of the botanist—grows on the deep, rich, black vegetable loams of the North Island of New Zealand quite as permanently as it has done on the Rothamsted red-clover garden-plot. Several places were visited where red-clover was growing in increasing luxuriance as it had done for five years, during which time it was eaten closely down by sheep and not allowed to produce seed. In other districts where the soil is not so rich, red-clover has been known to do remarkably well for two years, but when pastured with sheep it got eaten out within a year or two. Hellriegel and Wilfarth's experiments, mentioned at page 284, have thrown quite a new light upon the importance of clover in permanent pasture as well as in rotations of cultivated crops.

British grasses growing in Australia and New Zealand—the latter more especially—seem, like rabbits and some other animals, to be subjected to conditions which increase their vitality, and they consequently thrive and grow more luxuriantly. Their seeds are more perfectly developed than in Europe; the result is, that New Zealand grass seeds possess a superior appearance and bear a good name in our home markets.

The history of the **growth of common rye-grass** (*Lolium perenne*) in the Colonies adds nothing to what is already known in this country regarding its nature, value, and habits, although it confirms the views expressed by those who have taken a medium course in the discussion as to whether rye-grass should or should not be largely, or at all represented in a "seeds"-mixture, in laying land out to permanent pasture.

In certain soils of poor or medium quality it requires to be renewed from time to time, as it disappears within a few years after being sown, while on deep rich land it approaches in permanence to a true perennial. On a part of the Totara Estate, for example, it grew for sixteen years without being allowed to seed, and then it was in abundance in the turf when it was broken up. Until the advent of the three or four dry years that preceded 1889, it was regarded as absolutely permanent on such land in New Zealand, but being a shallow-rooted plant it died out to an alarming extent during that time.

If the first crop is cut, the roots get burnt out in Australia even in an ordinary year, unless rain falls immediately, but if not cut till the second year, a "sole," or mat of root-leaves, forms to protect the roots, and they acquire a greater power to resist the influence of the dry season.

On the beautiful, rich, black, volcanic loam in the Mount Gambier District of South Australia, rye-grass seemed to grow as well as in any part visited. It was specially valued on account of the amount of food it yields during winter and before the native grasses come in spring; but owing to its roots being surface-feeders, it does not give, even where it grows most permanently, a large bulk of summer herbage.

The different varieties are not all equally permanent. **Poverty Bay rye-grass** has a reputation, for standing power as well as for excellence of quality, superior to all the others. It has a small seed and is not in itself one of the largest-growthed varieties. On land which is rich in quality and sufficiently moist to sustain rye-grass, it perpetuates its existence when eaten down and not allowed to seed, by lateral root-budding, or, as it is sometimes termed, "division."

In some instances where it ripens seed, it is maintained in the pasture by the germination of the seeds which grow where they are shed. This is a more uncertain means of reproduction on land not under cultivation, than that of root-division, and, consequently, rye-grass is found to remain most permanently in those rich pastures that are kept closely eaten down at all seasons. The whole energies of the plant are directed to the formation of leaves, and do not then lead up to a culminating-point where they collapse, as is the case with the vital energies of annuals when they have brought their seed to maturity. The function of an annual or biennial plant is then performed, and in the ordinary course of nature it dies; but when frustrated in its effort to mature seed, it does not immediately give up the attempt, if a liberal supply of nourishment is within its reach.

It is a matter of no uncertainty that our common straw crops die after ripening the grain, but they can be kept alive for years if they are regularly cut back, so that seed-stems do not develop.

Cocksfoot (*Dactylis glomerata*) is universally admitted to be the most generally used of all the European grasses in Australia and New Zealand. It is rapid in growth, deep-rooted, and thus well able to withstand the effects of drought. New Zealand has now become one of the chief sources from which cocksfoot is imported into this country, owing to the fine appearance and the quality of the seed grown in certain districts of both the North and South Island—for example, Banks's Peninsula, near Christchurch.

Notwithstanding all its excellent individual qualities, cocksfoot does not form a satisfactory pasture when sown by itself or when it preponderates in a seeds-mixture; it then becomes too coarse, and stock do not eat it down properly. It does admirably when the seed is sown in moderate quantity, as an ingredient in a mixture either for hill or plain. It is especially good on steep places subject to landslips. On hill-land it is not so liable to run to tufts as on the flat. After a summer shower it springs immediately, and it is for this reason of greater value than rye-grass in those parts where summer rains are looked for.

The Fescues (*pratensis* and *elatior*) grow remarkably well in New Zealand, but when they are allowed to run to seed they are injuriously affected with **ergot**—which appears as black or dark brown cockspur-like masses of fungus in place of certain of the seeds on the seed stem.

When eaten by stock, ergot acts as a poison which exhibits its results under different circumstances in distinctly different ways. It induces **abortion** in the case of pregnant animals. In other instances it is the cause of **paralysis**, and when taken in large quantities the injury assumes the form of **gangrene** of the extremities among cattle, just as in the human species it produces gangrene of the intestines. Rye, among the bread-corns, and certain grasses—notably the fescues, rye-grass, cocksfoot and fiorin—are peculiarly liable to be attacked by this parasitic fungus.

The sizes of the spurs on different grasses are in the order of the sizes of the different seeds, although they do not always maintain the same relative proportions. Least injury results from small spurs, as these are more easily dropped through the mat of root leaves and out of the reach of grazing animals on breaking off from the seed stem. The ergot on cocksfoot has not been reported to have done much injury, because (1) the spurs are small and (2) neither cattle nor sheep eat the mature seed-stems. The ergot of meadow fescue being much smaller than that of tall fescue is less liable to cause injury.

The tall, or more correctly the **giant**, **fescue of New Zealand** is quite a different variety from the tall fescue usually found in the British Isles. It is a much larger, coarser, harder and more worthless plant than the old-country fescue. Animals eat it only during the early stages of its growth. The New Zealand tall fescue is quite unsuitable for the requirements of farmers in this country. If New Zealand seed-growers wish to preserve this branch of their trade, they should, without delay, procure samples from this country of the true British tall fescue as stock seed.

Ergot poisoning. The author had the good fortune to see and examine two animals suffering from the affection and one that had died, on the property of Mr. J. D. Ormond, near Woodville. In the plain language of the country people, the feet of the animals suffering from the effects of the ergot-poison are said to "rot off." The description, though rather brusque, is pretty nearly correct. The hoofs of the hind feet do ultimately slough, but the first indication of the presence of the malady, in addition to lameness, is swelling of the hoof-heads or coronets, followed by blotches on the skin of the pasterns and the falling out of the hair. When an animal dies the skin of the hind pasterns more specially is found to be hard and detached from the flesh.

If removed, on the first appearance of lameness, to a pasture free from tall fescue the animals usually recover. It is worthy of special remark that ergot does not seem to be equally poisonous at all times. This is inferred from the serious consequences of its presence appearing with greater effect in certain years when there is no apparent increase in its amount over that of average seasons. The exact facts have yet to be determined by experiment.

Ergot is not confined in its attacks to British grasses—it appears on the native species as well—though all are not alike susceptible to its influence. **Parramatta grass** (*Sporobolus indicus*, R. Br.) is specially liable to it. This is a very strong coarse grass which is noted in the dairying district of New South Wales for pulling out the teeth of old cows that attempt to eat it; so tough is it.

The most common "seeds"-mixture used in New Zealand is rye-grass, cocksfoot, and white clover—from 30 to 40 lbs. of seed per acre. But in some parts where seeding down with English grasses is most extensively practised, other well-known grasses and clover are represented: the

X 2

mixture adopted on the **Edendale Estate** of the New Zealand and Australian Land Company being—rye-grass 25 lbs., cocksfoot 6 lbs., white clover 3 lbs., and 2 lbs. of each of the following: timothy, cow-grass, and alsike. Timothy would be quite unsuited to the drier parts of the country. On **Te-Ore-Ore**, the property of Messrs. Thompson and Company, the mixture used is made up of rye-grass, cocksfoot, meadow-fescue, dog's-tail, cowgrass, alsike and white clover.

When seeds are sown without a grain crop, at times a quarter of a pound of turnip-seed (purple top) is added to the grass-seeds to secure a heavy yield the first season. The turnips come up sufficiently to shelter the young "seeds," but not to smother them, and are the means of securing an extra top-dressing of manure by supporting a much greater number of sheep than the grass alone could do.

While a portion of the grass-seeds is sown along with turnips, another portion frequently of the same field may be laid out at the same time with an oat crop in the usual fashion. The two systems are made to work together in the following way. Of a given field of lea, which has to be broken up for a course of cropping (which will include two consecutive crops of turnips) and then be laid down in "English" grasses, one half is ploughed and sown with oats the **first year.** The straw is left in the field, to be consumed by the cattle or sheep eating off the turnip-crop which succeeds the oat-crop on that half of the field first broken up.

The second half would carry oats the **second year.** In the **third year** all the field would be under turnips. In the **fourth year** the first broken part would be sown out with grass-seeds along with a wheat or oat-crop, and the other part would be laid down with grass-seeds and a thinly seeded turnip-crop. By this means a field is all brought back to grass at the same time, and throughout the whole rotation, straw and turnips have been produced together, which increases the value of both products for feeding purposes.

Though it has been shown that **British grasses** are fairly permanent upon the best qualities of land, nevertheless, in actual practice on the greater proportion of the ordinary and even good soils used for cultivation in New Zealand, it is better that these grasses should be renewed every five or six years. The cost of cultivation is more than covered by the additional amount of resulting produce. At times, and in some parts, the "seeds" are found to do best when sown alone, in spring, or in autumn on the removal of the grain crop, after the land has been disc-harrowed, but before the end of May, else it is too late in most places. The young plants if not well developed are liable, as in this country, to be thrown out and destroyed by the succeeding winter's frosts. To sow "seeds" with rape is frequently disappointing, as rape is said to be not now so certain of growth as formerly, and when it does grow it comes forward too quickly for the "seeds."

Thistles of various species have spread at a marvellous rate, and continue to grow with great vigour in many districts of both Australia and New Zealand. In many parts the thistle plague is only second to the rabbit plague. In New Zealand under certain exceptional circumstances thistles are looked upon with favour. It has been demonstrated that if they fully occupy the land for a time they are certain to disappear within a few years, leaving the soil in a much better state of fertility than before. Their deep and fleshy roots go down into a heavy clay soil and open it up for the admission of air and water. Mineral plant food is also brought up and accumulated near the surface, along with the vegetable matter or humus formed from the decay of the stems and leaves ; and above and beyond all this the soil is improved by being densely covered with foliage and obscured from the sun. Although the fact is perhaps not widely known in Britain, the surface shading by a bulky root-crop is one of the important features in the preparation of land for a good grain crop in the following season. After a good crop of thistles has grown and has disappeared either grain or grass will thrive admirably. So much was this the case in some parts of New Zealand that thistle seed has been bought at high prices and sown as a means of breaking in land for cultivation; but thistle seed is now so abundant that the practice is unnecessary, and one man should not be permitted to sow for his own advantage the seeds of such an obnoxious weed.

Where thistles grow among cultivated crops, or where they do not fully occupy the surface, they must at all times be considered as weeds demanding the best endeavours of the cultivator for their destruction; but in pasture they are not always weeds. The leaves of the "spear" thistle and of the more luxuriant "variegated-leaved" thistle (*Carduus marianus*, Linn.) are eaten by sheep during times of scarcity in autumn and in summer, when other plants wither for want of moisture. Sheep also eat the flower-heads before the seeds begin to blow away.

The larger species of thistles tend to die out if the land is left down in pasture. The time that thistles make way among grass, is when they spring with the "seeds" during the first season, but if they come pretty strongly, though they do not fully occupy the ground during the first year, they decline in strength during the following years.

The species commonly called the "Scotch" thistle is the spear thistle (*Carduus lanceolatus*, Linn.); but people in Australia are rather given to naming certain weedy plants and many of the common trees by common English names, simply because in some particular the tree or plant named has a remote resemblance to something which has been familiar to them or their ancestors in this country.

One of the most recent importations, which is likely to be attended with more injurious results than in the case of the above species, is that of the "Canadian" or "Californian" thistle. It is said to have been introduced about 1886 in Californian barley. It has already spread over a very extensive area in Australia, and also in the South Island of New Zealand, on which the natural herbage has lately been so much destroyed by rabbits, by sheep, and by fire. It is identical with the common British "corn"-thistle or "green"-thistle (*Carduus arvensis*, Curt.), the most widely distributed species of thistle. It is tall and slender and very prickly. Its roots are creeping and sink deeply into the soil. In South Australia, where the so-called "Canadian" thistle had been even more recently introduced than in New Zealand, the Bureau of Agriculture had taken steps to eradicate it. From its appearance in so many other parts of the colonies this seemed to be a hopeless task.

An attempt to eradicate thistles over such a vast area can only prove to be a vain effort. It might be possible to kill the existing thistles on a given piece of land by ploughing, but in a country where thistle-down flies about in abundance the more ploughing that is done the greater number of young thistles will there be in the future.

A useful **check** to an excessive growth of thistles on restricted areas is to cut them while in a green condition before they flower. Young green thistles make excellent silage, and they can be cut and put together in silo on a large scale at a cost of about six shillings per ton. This has been successfully practised on some of the Australian property of the New Zealand and Australian Land Company.

It would seem that thistles are likely to remain one of the chief drawbacks of the Colonies, as they have already become too widely distributed to permit of eradication by any ordinary or possible means.

Mr. McAlpine, the accomplished botanical expert who was recently added to the Agriculture Department of Victoria, is making a special study of thistles in the Colonies for the benefit of the colonial cultivator.

CHAPTER XXIII.

RABBITS.

Benefits of Change of Locality on Plants and Animals—Abnormal Increase of Animals in Certain Seasons, as Voles and Rats—Influence of Droughts in Increasing and Decreasing the Numbers of Rabbits—Destruction of Rabbits by Rain and by Overcrowding—Rabbits in Flocks—Starvation from Overcrowding—Climbing Trees—Wire Netting as a Means of Destruction—Poisoning with Phosphorised Oats—Netting and Trapping—Cost of Killing—Suffocating—Stoats—Weasels—Ferrets—Cats—Injury Done, South Island, New Zealand—Other Causes of Injury to Pasture—Rabbit Preserving Works.

Some plants and some animals acquire an extraordinary power of reproducing their species, and of increasing in numbers when imported into a new country. The change of climate and conditions, in place of checking, seems to add to their vigour, and for a time at least, it would appear as if no bounds could be fixed to the rapidity of their extension. **The worthless scrubby plant** called *Lantana mixta*, with its clusters of small pink or red flowers, is one of the most persistent and successful in its usurpation of the place of the indigenous herbage wherever it can secure a footing. It has not only taken possession of vast areas of waste land in Ceylon and on the hilly regions of Southern India, but it is extending rapidly in Australia and also in the islands of the Pacific. At Honolulu it forms a conspicuous part of the wayside vegetation.

The vast increase in the growth of the various species of **thistle** in Australia and New Zealand is another example of the rapid extension of imported plants.

The rabbit plague has, however, been the most costly development of this kind. The power of excessive development is not one which has lately been acquired by the rabbit, as we read of swarms of rabbits taking possession of the island of Porto Santo on the north-west coast of Africa as far back as the fifteenth century.*

There are times and seasons when animals, from some unknown cause, increase in extraordinary and in exceptional numbers even in their own natural and original habitats and are subsequently reduced to their normal numbers in quite as mysterious a manner.

The late Sir Walter Elliot described, in the Journal of the Berwickshire Naturalists' Field Club for 1879, a plague of **Voles** or short-nosed field-mice, which spread over large areas of the south of Scotland for a couple of years, and then suddenly and mysteriously disappeared.

During the year 1890 many parts of both England and Scotland were over-run by extraordinary numbers of the **common rat**. It has been frequently asserted that the collection of weasels sent out to New Zealand to help in the destruction of rabbits has reduced the number of the natural enemies of the rat, and thus permitted them to increase. There is, however, no foundation in fact for this quite unpractical though plausible assumption.†

* Winwood Reade, writing of the discovery of Porto Santo and Madeira by the Portuguese, says, "A shipload of emigrants was despatched to the former island, and among the passengers was a female rabbit in an interesting situation. She was turned down with her young ones on the island, and there being no checks to rabbit population, they increased with such rapidity that they devoured every green thing, and drove the colonists across into Madeira."

† Weasels are no doubt the natural enemies of rats, but corresponding members of the two species are so equal in strength that encounters between them come more by accident than by choice on the part of the weasel. Weasels have been for many years practically extinct in certain districts which have been subjected to rigid game preservation, so that had the reduction of the number of weasels been the cause, an increase of rats would have taken place long ago.

There is little doubt that one of the **inciting causes** to the marvellously rapid increase in the number of rabbits in Australia and New Zealand was that same **want of rain** which ultimately brought about the disastrous droughts from which the various Colonies suffered for a number of years previous to 1889. While this was the case, the droughts on the other hand were the cause of the death of immense numbers of them where they had become too numerous on the ground. The copious rains of 1889 were also the means of destroying them in many low-lying parts of the country. **According to a common sequence** of events in nature, rabbits ought to decline in numbers after the first wave of excessive increase has passed over the country, and indications of this are given in several places where rabbits are said to suffer from diseases which cut them off in such numbers that they are diminishing rather than increasing. Overcrowding is capable of pressing forward the development of some more or less harmless forms of disease into a virulent type. If this possibility has been realised in the case of the rabbits in Australia, it will probably take the well-known process of natural selection some considerable time before it is able to build up a rabbit-constitution capable of securing immunity from the worst consequences of these diseases.

The owner of land infested by rabbits cannot afford to wait till the full cycle of events has been reached, because, before rabbits die from overcrowding, sheep and cattle will have been exterminated or driven away. It is thus necessary to wage war upon them before they have accomplished the maximum amount of damage, and while yet they are in the heyday of their increase.

Professor A. P. W. Thomas of University College, Auckland, whose name is so well known in Britain in connection with the discovery of the life history of the **Liver Fluke** in sheep, has made some valuable investigations into the diseases affecting rabbits, and the results are stated in an interesting report, dated 1889, of investigations in the Wairarapa district. He found that the most valuable means of destruction was winter poisoning followed by trapping, and by turning out cats and ferrets.

Professor Thomas says that only two of the various parasitic diseases are worthy of special notice as being capable of destroying rabbits; viz., those due to bladder-worm and liver-coccidia, but neither disease can be depended upon to do more than destroy a moderate percentage of rabbits, and consequently it does not seem profitable to be at the expense of inducing disease in healthy rabbits.

There are two other causes of death among rabbits which may be named, *i.e.*, the louse-mite (*Sarcoptes cuniculi*), producing rabbit scab, and the rabbit-louse (*Hæmatopinus ventricosus*).

The most important bladder-worm (*Cœnurus serialis*) which is found in the muscles of the rabbit is a young tape-worm of a different species to that best known to us as the cause of "gid" or "sturdy" in sheep, the *Cœnurus cerebralis*. Both species develop into tape-worm in the dog, which is supposed to be the means by which the parasites are enabled to become so numerous and wide-spread.

It is difficult to realise, by comparison with anything which one has experienced in this country, to what extent the land in some parts of the Colonies has been overrun.

Rabbits have been described as being so numerous that during the heat of summer they covered the ground in droves like sheep, and listlessly hopped before one passing through a paddock, hardly caring to do more than move out of the immediate course of the person approaching them; and this in the daytime, when, as a rule, rabbits are close in cover.

In some parts, where overcrowding was excessive, they were driven to great straits for want of food. After devouring every green thing, they gnawed the bark from the stems of trees and shrubs up to the height which they could reach from the ground while standing on their hind legs. Sheep were driven to support themselves in a similar manner, and the bark seemed to agree better with the constitution of the sheep than with that of the rabbits.

By the kindness of the Hon. George H. Cox, the author was enabled to see the results of an instance where one or more rabbits in the desperation of hunger had apparently climbed up a height of six or seven feet and gnawed from the roots upwards the bark of trees, the stems of which were about the thickness of a man's wrist. The trees grew perpendicularly and apart, so that in no way could the rabbits ascend except by climbing. In the case of large trees, the bark was only eaten up to the height which a rabbit could reach from the ground.

At one time it was thought impossible to stop the increase in numbers and, consequently, the injury to property; but means are at hand, and it is now only a question of **money.** **Wire netting** is used on an extensive scale for the purpose of stopping their advance into country which has not been infested, or which is to be cleared; and it is also employed to close in breeding centres and burrows where rabbits hide themselves by day and come out at night to feed. By shutting them up in this manner in a restricted area, they soon die of starvation. Wire netting costs on an average about £30 per mile. The Victoria Government voted no less than £150,000 in 1889 to be spent upon rabbit netting. The net must be of sufficiently small mesh (1½″) to keep small rabbits from passing through, and it need not be more than three feet high, but the lower side should be sunk about six inches into the ground. Rabbits do not attempt to jump it, because they can see through it, and they have no direct inducement to make them climb over it, which they could certainly do if they tried, after what we have seen of their performances in connection with young trees.

Poisoning is perhaps the second most important means of destruction, if one may be allowed to single out the various methods adopted in different parts of the country and at different seasons. Though this may be approved of in our short description of the war being waged against rabbits, in practice it is better to use other available means first. The difficulties are great, and the reward is worth striving for. If rabbits are not kept under, the property is rendered valueless, and the owner is now liable to be fined if he neglects his duty, which is considered by Government not only in the light of his own interests, but also in that of his neighbours.

The difficulty in poisoning wild animals is to get a deadly material which can be incorporated with their food without their suspicions being aroused by the presence of some uncommon taste or smell, of which they are usually most wary. **Phosphorus,** which has so long been successfully employed in poisoning rats, has proved to be useful for the destruction of wild rabbits.

Oats or wheat is saturated with a solution of phosphorus dissolved in bi-sulphide of carbon, in the proportion of 2 oz. of stick phosphorus to a bushel of corn. A bushel of oats is put into a barrel or revolving churn-like mixer along with the phosphorus and half a gallon of flour paste, and there thoroughly mixed.*

The phosphorised oats are sown by a distributing machine, or are laid out, a few grains together, by means of a spoon, during the winter season, on bare places where the beaten appearance of the surface gives ample evidence that rabbits frequent them. In some places little sods of three inches square and one and a half inches deep are dug out and inverted at convenient distances, and the grains of

* Particulars of Lascelle's Phosphorizer may be had of Messrs. James McEwan & Co., Limited, Melbourne.

oats deposited on the fresh earth, so that they may be more readily found by the rabbits.

Rabbits die in great pain soon after partaking of one or two of the dressed grains. Many find their way back to their burrows and are never found, but those left on the surface are skinned. **The flesh** is eaten by large brown hawks. It is in no way injured by the poison, as the direct action of the phosphorus is confined to the stomach of the rabbit.

Rabbits can also be destroyed in vast numbers in Australia during periods of drought by **poisoned water.** Strychnine and also arsenious oxide (As_2O_3), or white arsenic, have been used with great effect, but both materials are objected to as being more or less unsuitable. Strychnine is bitter, and it is also expensive (not less than about two shillings per ounce), and, moreover, being an organic substance it is liable to decompose. White arsenic requires to be boiled with soda to dissolve it in water. The most suitable form of arsenic poison for the purpose seems to be arseniate of soda (Na_2HAsO_4, $12H_2O$) produced as a by-product in the manufacture of coal-tar colours. It can be bought as the crude salt in a fine state of division at *6d.* to *8d.* per lb., and can be readily dissolved in cold water, to which it will not impart more flavour than is possessed by many so-called "sweet" waters in the Colonies. The method of poisoning adopted is to shut up the tanks or water-holes at night by rabbit-proof netting during very dry weather, and to place poisoned water in troughs or in holes in the ground, which are also fenced so that only rabbits can approach the water. By this means thousands of rabbits have been killed round a single water-hole in one night. It is strange that rabbits should be able to live for weeks without water even when everything seems parched up, but they can take shelter in the comparatively cool atmosphere of deep burrows during the heat of the day, and thus save themselves from the exhaustion which would naturally follow exposure to the influences of the sun's heat upon the scorching surface of the ground.

Another system adopted to reduce the number of rabbits is to offer so much per scalp to men who kill them by the ordinary method of netting, trapping, &c., especially during summer, when poisoning is not possible. Mr. Morton, agent to Sir Wm. Clarke, paid a halfpenny per scalp when rabbits were numerous, and had killed, on 4,000 acres of property near Ballarat, 46,000 rabbits during 1888.

In the year 1889, from the month of January till August 7,000 more were destroyed, but the rate per scalp had to be raised to twopence and twopence-halfpenny as the numbers declined. In addition, nineteen miles of wire netting had to be erected to secure the advantage which had been gained.

The cost of killing rabbits, on the properties of the New Zealand and Australian Land Company, yet amounts to from £8,000 to £10,000 a year, although it is admitted on all hands that the worst of the rabbit plague has been encountered. On one run of 100,000 acres near Queenstown, Otago, the annual expenses for the destruction of rabbits amount to nearly £1,000.

Rabbits may, under certain circumstances, be **suffocated** in their holes by burning brushwood over them and then drawing the burning ashes into the mouths of the burrows and covering them so that the wood or charcoal continues to smoulder. If this is properly executed, the air from the hole is sucked up by the fire to keep alive the combustion, and the carbonic acid gas formed, being heavier than air, falls back into the hole to take its place.

Predatory animals, as stoats, weasels, ferrets, and even cats, have been turned out in considerable numbers to help in the work of destruction. These are of very great service in completing the work after the rabbits have been well thinned in numbers by other means.

Stoats and weasels are collected in Lincolnshire and some other districts of England, and sent out to New Zealand at a cost of from £2 to £4 15*s.* each. Ferrets are bred in the country at a cost of about 7*s.* 6*d.* each. On one place of 100,000 acres in the Kaikoura District of New Zealand, 200 ferrets are turned out yearly. The ferrets produced in the wild state become more active and useful than those that have been turned out.

Cats grow to a large size and become wild and fierce, like the descendants of cats cut off from civilization and found in a state of nature upon some of our Highland hills.

In New Zealand, rabbits at first began their depredations in the extreme south of the South Island. From this point the wave of destruction extended northwards. Although rabbits are not now nearly so numerous nor yet so healthy as they were three or four years ago, owing to their becoming "too thick on the ground," yet great care has to be taken that they are not again permitted to increase. On the property of Edendale, extending to about 52,000 acres, ten men have to be kept "rabbiting" all the year round.

There is no denying the fact that the pastures of the southern part of the South Island of New Zealand have been **seriously and permanently injured** by rabbits ; but there have been other influences at work simultaneously with the rabbits, which are entitled to bear their full share of blame in this matter.

The hilly regions of the extreme south seem, during the winter season, almost destitute of vegetation (if we except the stalks of myriads of dried-up thistles), and the surface is rugged, and of an earthy, red-brown colour. A little further north, grass, tri-tri and fern begin to show among the stones and rocks. **Many of the valuable grass and other herbage plants** native to these parts have been killed by the withered remains left on the surface having been too frequently burnt during winter, in some instances by the owners, who did not suspect the injury they were unwittingly working, and in others by gold-miners, who swarm in these parts. Fires, occurring year after year, followed by too heavy stocking with sheep, and finally by the still heavier stocking with rabbits, have very seriously and permanently reduced the stock-carrying power of immense tracts of country in Southland, New Zealand. **Some large runs** are reported to have their sheep reduced by two-thirds of the original number ; others by one-third. The extent to which damage has been done may be still further realised when it is known that one rugged little holding of 3,000 acres, carrying about five hundred sheep, is let by Government for the merely nominal yearly rent of £10.

Rabbits tend to spread to new fields, and also to linger in certain parts where the surroundings are specially congenial to them, as, for example, in the south-east of South Australia, not far from the sea, where the soil is naturally dry. In a low-lying and more humid country like Glencoe, near to Mount Gambier, rabbits establish themselves with difficulty at any time.

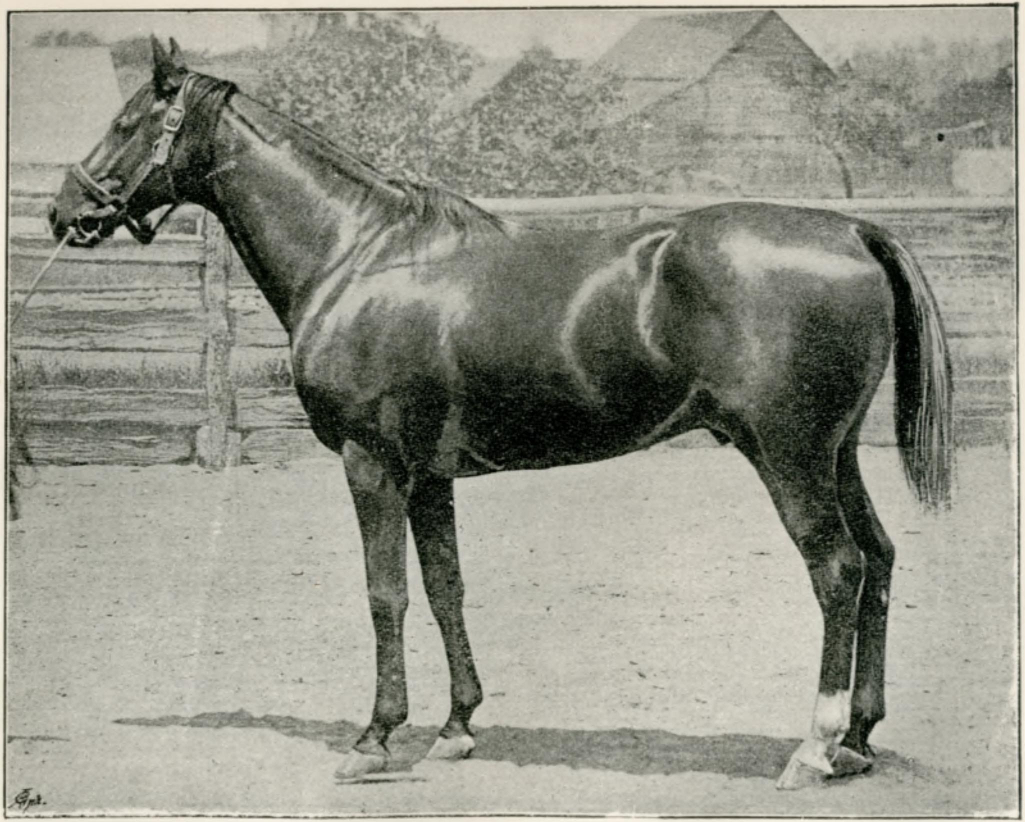
Three rabbit tinning and preserving works exist at Winton, Makerewa, and Woodlands, and it is proposed to start one at Gore. Now that the scare as to the possible ruin of the pastoral interests of the country has been reduced to a matter of *£ s. d.*, it will be possible to get people to see that some return at least is to be had by preserving the flesh.

CHAPTER XXIV.

BREEDS OF HORSES, MANAGEMENT, AND DISEASE.

The Thorough-bred—Interest taken in Racing—The late Mr. Towne's Breeding-Stud—Prices Realised—Mr. Gardiner's Stud—Food and Exercise for young Race-Horses—Superstitions—Departure of the Hon. Mr. White's Thorough-breds for England—Results Confidently Expected—The Actual Results—Sale of the Horses at Tattersall's—Pedigree and Prices—Sale of the Stud in New South Wales—Clydesdale Horses—Studs belonging to Mr. Angas and Mr. Towne—Mr. Reid and Mr. McCulloch—Tendency to Loss of "Feather"—American Trotting-Horses—Their Origin—Formation of Shoulder—Action—Weighting the Feet in Training——Influence of Training—Injury from Training and Racing while Young—Influence of Public Opinion—Racing Boots—Racing and Trotting in America—The Suffolk Punch—The Cleveland Bay—Crosses Suitable for Carriage-Horses—Difficulties about Selecting a Stallion—Cross-bred Cleveland—Yorkshire Hackney—Diseases Peculiar to the Colonies—Injury from Tick Bites—Stringhalt—Gouty Feet—Queensland Horse Mange—Its Cause and Treatment.

Thorough-bred horses in Australia are of the first water, although their performances in Europe have fallen far short of sanguine colonial expectation. The best blood has been imported and breeding carried on in the most systematic and perfect manner since the early days of the Colonies. Doubtless too the breed has profited by the change of habitat, as in more than one event the record has been beaten on Australian courses. The credit, however, must be shared with the salubrious climate and the condition of the race-courses.



LVIII.—Thoroughbred Horse—"Grand Flameur,"
Which belonged to the late Mr. Andrew Towne, and started in nine principal races in Australia, and never was beaten.

There is no sport in which a wider or more **profound interest** is taken in the Colonies than in racing. Every little town has its race-course and large cities can count their courses by the dozen: Melbourne, for example, possesses twenty within a radius of a few miles, and it is no exaggeration to say that a Saturday without a race meeting at one or more of these places would be an anomaly. **If an opinion** might be ventured, it seems as if racing were too widely and too well appreciated by classes who can afford to spend neither the time nor the money which its indulgence naturally absorbs.

The two largest breeding-studs in Australia were visited; viz. that of the late Mr. Andrew Towne of Richmond, to the north-west of Sydney, and that of Mr. Samuel Gardiner of Windora Park, near Melbourne.

Mr. Towne had a stud of about 200 thorough-breds.* He used to dispose of about 100 yearlings in January at the annual sale. In 1889 these realized 120 guineas each. In this stud among many animals equally famous for performances and appearance was seen **Grand Flameur,** a bay horse, which ran in nine classic races in Australia, and never was beaten.

Mr. Gardiner's stud numbered in all over 220. It contained 120 brood-mares and 8 stallions, besides youngsters. With the object of increasing the breeding stock, none had been sold since 1887. As in the former instance, the greatest possible care is taken in the mating and also in the treatment and management of these animals.†

* Besides thorough-breds, the stud contained about forty half-bred mares, fifty American trotters, and over one hundred and fifty pure-bred Clydesdales. The last sale realised over £12,000, and affords the best evidence that can be adduced as to the superior quality of the stock, when it is remembered how much the prices of all but the very finest of the pure-bred animals have fallen in the market.

† In the treatment of his horses, Mr. Gardiner expressed great faith in two extremely simple remedies for ailments not unknown to the ordinary stable attendant, viz. (1) 1 oz. of ether in a pint of water given as a stimulant to

Young thorough-breds cannot be fed too highly with a mixture of dry and green food, provided they get plenty of exercise, not only to aid digestion, but also to develop muscle and to give experience in going. In a litter of well-bred greyhounds it is usually the pup that develops a special fondness for running by way of amusement, though it may be after no particular object, that turns out best. Young thorough-breds are in this somewhat like greyhounds. Those that show a fondness for exercise, other things being equal, naturally turn out most satisfactory.

A stable is not without its **folk-lore** and superstitions. An alternate white foot, fore and hind, is said to be lucky: a horse that is to be shipped to India should have the curl in the star of the forehead above the level of an imaginary line drawn between the eyes, else it is considered unlucky by the natives of India.

One of the great excitements of the sporting world during the period of the author's visit to Australia was the **departure** for England of seven **thorough-bred horses**—Kirkham, Narellan, Wentworth, Nepean, Mons Meg, a bay yearling colt, and Plutarch—from the famous racing stud of the Hon. James White of Sydney.

It was made no secret among Australian racing men that **Mr. White would win the Derby,** and many, if not all of the best races in England! The only fear expressed was that the horses would be disqualified for some races in the event of the death of Mr. White, who was suffering from heart disease.

Mr. White's death led to the **sale and dispersal**, not only of the horses sent to England, but of the stud in Australia. It was amusing to a stranger to observe the confidence of the Australian sons of the turf as to what success would

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mares heavy in foal, that are unable, through weakness, to regain their feet after lying down, and (2) the prolonged use of warm enemas at a temperature of from 96° to 100° Fahr., in cases of colic.

fall on Mr. White's horses in England. In such a risky game as horse-racing the doctrine of chances could, under no circumstances, place a limited number of selected animals on a higher platform than that shared equally by a number of the best stables in this country. It is said that the European record has been beaten on more than one occasion in Australia, but as an offset to this, is to be placed the fact that the new world has a clearer and purer atmosphere, and the condition of the course, which is there absolutely under control, can be adjusted to suit the climate and requirements.

The results of the plucky and popular action on the part of Mr. White, in sending his horses to this country, are not to be wondered at, although they have not been so successful as the over-confident expression of public opinion anticipated. Up till the sale at Tattersall's, on the occasion of the Second October Meeting at Newmarket, only one of the animals in question, viz., Kirkham, had ever started, although more than a year had elapsed since their arrival. It is to be inferred as a reason for withholding them so long, that they were not in fit condition. It is also stated on the authority of one of our most experienced and successful trainers, Mr. William Day of Salisbury, that the **performances** of Kirkham on the three public occasions on which he had appeared were not nearer than perhaps 21 lbs. to two stones of many of our own home-bred horses. The full effects of the voyage and the change of climate and country had not been fully discounted by those who expected so much, so soon. It is quite possible that after a time we may hear more of the Australian strangers. Some of the prices realised at the sale show that they are yet expected to come to the front. This expectation is fully warranted by the build and appearance of the horses as well as by the stock from which they have come, as may be gathered from the following details, which were made public at the time of the sale October 8th, 1890 :—

Kirkham, a chestnut colt, 3 years old, by Chester (son of Yattendon)* out of La Princesse, by Cathedral, out of Princess of Wales (dam of Albert Victor, George Frederick, Louise Victoria, Edward the Confessor, etc.), by Stockwell, sold to Captain Machell at 610 guineas.

Narellan, a chestnut colt, 3 years old, by Chester, out of Princess Maud, by Adventurer, out of Princess of Wales, by Stockwell, sold to Mr. Swann at 250 guineas.

Wentworth, a bay or brown coarse-looking colt, 2 years old, by Chester, out of Trafalgar, by Blair Athol, out of Mosquito (sister to Musket), by Toxophilite, sold to Mr. D. Cooper at 1,700 guineas.

Nepean, a bay colt, 2 years old, by Chester, out of Iolanthe, by Maribyrnong, out of Rosedale, by Tynedale out of Thrift (Tristan's dam), sold to Mr. D. Cooper at 350 guineas.

Mons Meg, a bay filly, described as "almost a perfect type of a strong, well ribbed-up, powerful 2 years old," by Martini Henry, out of Malacca, by King of the Forest, out of Katinka, by Paul Jones, out of Ding Dong, by Kettledrum, out of Stella, by West Australian, sold to Mr. D. Cooper at 2,600 guineas.

A bay yearling colt ("quite a prodigy as to size, and on grand limbs"), by Martini Henry, out of La Princesse (dam of Kirkham), by Cathedral, out of Princess of Wales, sold to Mr. D. Baird at 550 guineas.

Plutarch, the seventh horse, was given away before the sale.

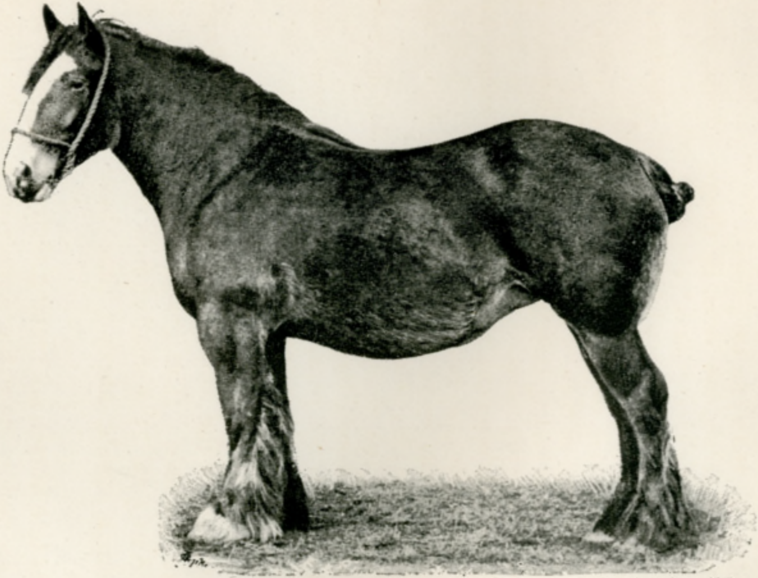
About the same time eighteen horses in the Australian stud of the late Mr. White were catalogued for sale at the Newmarket stables, Randwich, but five of these were retained owing to the flooded state of the country at the Kirkham stud-farm. The results of this sale were as follows :—

* Yattendon (sire of Chester) is by Sir Hercules, by Cap-à-pie (son of the Colonel) out of Paraguay, by Sir Hercules (by Whalebone), out of Paradigm (dam of Lord Lyon and Achievement), his dam, Cassandra, by Tros (son of Priam), out of Alice Grey, by Emigrant, out of Gulnare.

Lady Chester (dam of Chester), is by Stockwell, out of Austrey, by Harkaway, out of Zelia, by Emilius.

Maribyrnong is by Fisherman (son of Heron), out of Rose de Florence, by the Flying Dutchman, out of Boarding School Miss, by Plenipotentiary.

Martini Henry is by Musket, out of Sylvia, by Fisherman, out of Juliet, by Touchstone.



C. Reid, Wishaw, N.B.

LIX.—CHAMPION CLYDESDALE MARE—"MOSS ROSE" (6,203).
The Property of Mr. JOHN GILMOUR, Montrave, Leven.

Sinecure, chestnut gelding, three years, by Martini Henry—The Solent, sold to Mr W. T. Jones for 700 guineas.

Dreadnought, chestnut colt, three years, by Chester—Trafalgar, sold to Lord Kesteven for 2,100 guineas.

Singapore, bay colt, three years, by Martini Henry—Malacca, sold to Mr. O'Shanassy for 2,000 guineas.

Rudolph, brown gelding, three years, by Martini Henry—Rusk, sold to Mr. W. R. Wilson for 820 guineas.

Tribune, bay gelding, three years, by Martini Henry—Wheel of Fortune, sold to Mr. Oakley for 100 guineas.

Titan, chestnut gelding, two years, by Chester—Tempe, sold to Mr. E. G. Brodripp for 4,600 guineas.*

Marco, chestnut colt, two years, by Martini Henry—Mellanie, sold to Mr. A. L. Johnson for 625 guineas.

Carlist, brown gelding, two years, by Chester—Copra, sold to Mr. H. C. Dangar for 550 guineas.

Denman, chestnut gelding, three years, by Chester—Bullfinch, sold to Mr. J. Wood for 250 guineas.

Prelude, bay filly, two years, by Martini Henry—Phillina, sold to Mr. V. J. Dowling for 2,750 guineas.

Ulimate, brown filly, two years, by Martini Henry—Ultima, sold to Mr. T. Saunders for 220 guineas.

Utter, bay filly, two years, by Martini Henry—Uralla, sold to Mr. H. Oxenham for 400 guineas.

Litigant, bay filly, two years, by Martini Henry—Leonie, sold to Mr. W. T. Jones for 1,550 guineas.

Total, 16,665 guineas. Average, 1,281·12 guineas each.

The average of the sale of the horses sent to England was 1010 guineas. The grand total of the two sales amounted to £23,725, a small sum as compared with what such animals would at one time have brought at the hammer.

Clydesdale horses are making their way in the Colonies, but not so rapidly since the serious drop in the prices of

* This is said to be the largest price ever paid for a thorough-bred in Australia, and is probably the highest figure ever reached for a gelding even in the United States of America, where racing has in recent years developed in an unprecedented manner. Raceland, a gelding foaled in 1885, was bought in America in the autumn of his two-year-old form for $18,000, or, roughly, £3,600; and $17,000 was paid for Drake Carter.

all well-bred farm-stock during the recent years of drought and depression. Among pure-bred draught-horses the Clydesdale is by far the most largely represented. No expense has been spared by a number of wealthy men to secure animals of the best quality to form or to develop their studs.

Among the most important studs visited were those of (1) **the Hon. J. H. Angas*** at Collingrove, where there are about 200 pedigreed Clydesdales of superior quality, including twenty stallions; and (2) the Hobartville stud **of Mr. Andrew Towne** at Richmond, numbering 120. Here among a selection of animals of special merit was found an "own sister" to the famous horse "Macgregor."

(3) **Mr. Reid** of Elderslie, in the South Island of New Zealand, had a small but choice stud of 35 mares and three imported sires; and (4) **the Hon. Wm. McCulloch** in Victoria, the nucleus of a valuable little stud in five imported mares with their produce.

The long silky hair or "feather," on the legs of Clydesdale and of Shire horses is liable to fall out, to a greater or less extent, in the warm climate of Australia, and this is all the more likely to occur if any considerable proportion of maize † is given in the food.

American trotting-horses are becoming increasingly attractive to the young and sporting Australian. Trained from youth to appreciate a good galloping competition, his

* Mr. Angas has also a stud of about a hundred well-bred ponies. At the last sale, prices ranging from twelve to sixty-five guineas per pair were realised for thirty disposed of.

† The more experience one gains of maize as a food for man or animals, the more is impressed upon one the necessity of the use of it merely as one of a number of ingredients in a food mixture. As a substance to be largely or solely used it has signally failed: 1st, as human food among the poorer classes of the Italian peasantry, where its use gives rise to the awful disease *Pellagra*; 2nd, as the staple food of London cab-horses, where its heating propensities rendered them after a time unfit for work; and 3rd, as a food for fowls, which are liable to succumb to a form of liver disease, for which an excess of Indian corn seems to be responsible.

LX.—CHAMPION SHIRE STALLION—"STAUNTON HERO."
The property of Mr. WALTER GILBEY, Elsenham Hall, Essex.

taste is decidedly developing in the special direction of trotting performances. Though it is not to be expected that a trotting contest will ever develop the same amount of interest and excitement among a crowd of spectators as a good gallop, yet there is something marvellously attractive about the movements and style of a well-trained trotting-horse—a something which an ordinary unskilled and non-sporting observer has time to see and ability to appreciate.

The American Trotter, from which the representatives of the class in Australia are directly descended, had an origin similar to that of the Race-horse or "Blood" horse of England; but the two breeds are now quite distinct from each other in appearance, the form having differentiated with the development of the various parts which are brought specially into play by the different methods of movement involved in trotting as compared with galloping.

The most striking difference between the two is to be seen in the powerful and massive shoulder of the trotting horse, which might be described as decidedly heavy at the shoulder point, or where the *scapula* and *humerus* articulate.

The scapula in the trotter may either be steep or well laid back. The latter is probably the better of the two constructions and certainly is more pleasing to the eye; but it is of greater importance to have **the humerus** placed sufficiently perpendicular to admit of free action and to give strength to carry the weight of the body without curtailing the animal's command over his fore limbs, as is the case when a horse of any kind is weak in front. **The action** should be free—not high—and the stride long.

While an animal is undergoing training, **a weight** amounting at times to 4 oz., in the form of a little brass ball, is fastened to the toe of each forefoot shoe. The prolonged toe of the shoe, doubled back on the upper crust of the hoof, forms a guide-rod on which, by means of a slot, the brass ball is fixed. The weights encourage the animal to throw its feet forward, while they tend to keep the knees from rising too high. **This breed** has been beautifully **trained** in America for many generations, and there is little doubt that the naturally tractable nature of the young animals born in Australia is due to heredity, a fact which would be a serious blow to Weismann's anti-heredity theory if it could be practically demonstrated. This is, however, one of those things well known to men of experience in such matters, but which is difficult or impossible to prove, in concrete form, to one who is without experience.

Training both in America and Australia is begun at a very early age and has to be regularly kept up to the extent which the strength of the animal will stand without breaking down. **Trotters, like thorough-breds, are run as year-olds**, and many are in consequence sacrificed through over-training in the effort to please a depraved public appetite for grand youthful performances. The baby-trotter is asked to do what is beyond its power at the time but what would become quite natural and easy to it in a little while.

The result is that even the winners that are able to pass through both training and competition with most success, get bent and shaky in the forelegs and prematurely old. But, from the breeder and trainer's point of view, the public taste and demands must be considered before the animals themselves. Compliance with public demands means money, when it is remembered that the yearly sales of Mr. Towne's trotting stud, produced from cross-bred as well as pure-bred mares, averaged in 1889, 123 guineas for youngsters of but one year off, or a shade over the average reached by the galloping thorough-breds. People will not buy trotting horses, however good-looking, at high prices, unless they see that they can go.

During training, young trotters have **boots** put on to protect such places as the shins, shanks, knees, and pasterns, or any parts of the limbs liable to be injured. A full set costs as much as 8 guineas. Weak or untrained horses are liable when young, if put to their paces, to over-reach or otherwise strike their feet against their legs, especially when they are tired. Some horses, again, are naturally formed so that when they go at high speed they are liable to receive injury.

Tarragon, winner of the champion race at Melbourne and many other good races, laid her feet down so that when at full gallop, she cut her fetlocks, and boots had to be put on to protect the parts.*

While a taste for trotting competitions is developing in Australia, it is interesting to note that in **America** the public attention has quite recently been turned as much to **racing** as to **trotting,**† if a judgment may be formed from the fact that, during the year 1890, there were sold at auction in America 39 thorough-breds at or above the sum of $5,000, while there were only 35 trotters disposed of at or above that figure.

The highest prices ever paid for trotting-horses in America are the following :—Axtell, (stallion), 2 : 12, three years old, $105,000 ; Sunol (mare), 2 : 10½, three years old, $41,000 ; Rarus, (gelding), 2 : 13¼, $36,000.

The Suffolk punch is a favourite breed of horses in the Colonies where they are known, and in the opinion of breeders of the best strains of them, such as

* This peculiarity, which may be looked upon as an example of atavism, or reversion to some ancient ancestor, suggests the question, Are not these warty, indiarubber-like growths on the posterior points of the fetlock, and embedded in the lock of hair, the remains of protective pads which were necessary in the early history of the species ? It is rather a corroborative fact that the thorough-bred, which is admittedly the most refined type of horse, is more free from these growths than cart-horses or light-legged mongrels.

† In New York, which has become a most important racing centre, trotting is practically nowhere.

Mr. A. A. Dangar of Baroona, New South Wales, no other horse approaches it for draught purposes in the Colonies. It is even preferred by some to the **Cleveland Bay** in the breeding of cross-bred carriage-horses. This no doubt is due to the animals representing each breed being of different quality and consequently not equally representative.

One of the best stud-horses seen by the author for turning out with a mob of country mares to secure useful foals of good size and substance, was a cross * by a Cleveland horse out of a thorough-bred mare. It is a great difficulty to know what **kind of stallion** to put to ordinary country mares to secure the most valuable progeny. **The mares**, as a rule, lack substance and are too light in bone ; consequently, a **thorough-bred** horse is not calculated to repair the defect, although his stock can generally be depended upon for uniformity and for quality in other respects. **The Cleveland** stallion is said to be too sluggish and soft, and the same remark equally applies to any of the draught breeds as sires of animals required for active road-work.

Size and substance can be secured by crossing country mares with a draught-horse and then using thorough-bred stallions on the female produce ; but the difficulty exists to get at what is wanted by other means than this round-about fashion which is, in many instances, not practicable. **A cross-bred sire** must always be looked upon with some degree of uncertainty, but it is distinctly within the range of possibility that on further trial the crosses between (*a*) the Yorkshire coaching-horse, and (*b*) the Cleveland horse, and thorough-bred mare may grow in the estimation

* "Yorkminster," seen at Archerfield on the Hunter River, New South Wales. This is a good-looking horse, the winner of many prizes. He has plenty of bone, and is an excellent foal-getter, not only as regards numbers, but also quality, a point which cannot as a rule be relied upon in horses bred in the same way.

of colonial breeders, more especially among those whose common breeding mares are nearly full "blood."

A number of English hackney stallions, descended from Yorkshire trotting-horses, could no doubt be selected with sufficient bone and size to be satisfactory in improving the substance of the lighter varieties of colonial horses.

Diseases. Colonial horses are remarkably free from disease. The most serious affection is the common influenza, which is not deadly if remedial treatment is adopted at the proper time. But apart from the ordinary well-known diseases or injurious influences at work among horses, there are a few of a special character which require special notice.

Horses, like other vertebrated animals not indigenous to the country, are liable to suffer from the bite of a **tick**.

The author examined a Shetland pony, the property of Mr. Towne, which had been down and unable to walk for three weeks with paralysis induced by the biting of nine ticks that had fastened upon it while grazing in a tea-tree scrub. **The restorative treatment** necessary in such a case is the complete removal of the ticks; the administration of stimulants and nutritious food, along with repeated doses of strychnine; and the application of strong spirits or a stimulating embrocation over the spinal chord. **Yearlings**, which have less vitality of constitution than a matured pony, more readily succumb to the injuries resulting from tick-bites, one scrub-tick being sufficient to induce paralysis.

The following account of the **scrub tick**, by Thomas L. Bancroft, M.B., Edin., was extracted from *The Queenslander* of January 3rd, 1891:

When in Brisbane a year ago Professor Wallace, of Edinburgh was anxious to gather whatever information he could concerning the Australian poisonous tick. I placed at his disposal a written account of what I knew of the subject then, and have since completed a further investigation on the lines laid down by him. Mr. J. R. Gair kindly assisted me with a few dogs to enable me to carry out the investigation, and further encouraged me to write the present short account for the benefit of those who frequently lose valuable dogs and other animals by tick poisoning.

The scrub tick is a small animal with eight legs when mature, flat, brown in colour, about an eighth of an inch in length and the same in breadth. It is found in scrub country, particularly where the scrub merges into forest. There are many kinds of ticks, but it is easy enough to learn which is the scrub tick. Several kinds attach themselves to man and dog; but it is from the scrub tick alone that harm arises.

Ticks are peculiar in their choice of a host. Some prefer iguanas and snakes—one species attaches itself only to the wallaby. The scrub tick when empty is, as I remarked before, small, flat, and of a brown colour; but as it distends itself with blood it becomes rounded in form and blue in colour. When thoroughly distended it is as large as a pea, and has received the name "bottle tick." This has been thought by many to be a different animal. The female tick only, like the mosquito, appears to bite. Ticks attach themselves by their mouth organs and never become buried under the skin, as some persons have imagined.

A QUEENSLAND SCRUB TICK.
(*a*) Magnified representation; (*b*) natural size.

The scrub tick hides itself in winter, but in summer, and especially in dry weather, it is active, and may be found under or on the edges of leaves, ready to drop upon any moving object. I have succeeded in obtaining ticks in several ways, namely:—1. By shaking bushes and ferns, growing on the edge of a scrub, on to a white sheet of calico. 2. By taking dogs into a scrub where ticks abound, and at intervals examining them for any ticks that may have crawled upon them. Sometimes you may find a tick crawling upon yourself. Many specimens of what I take to be the male tick are found in this way. 3. By shooting mammals, such as the native bear, opossum, or kangaroo, in or near a scrub, and at once examining them for ticks. Should one be found it is removed by snipping off a small bit of the skin with it, and placed in a bottle. In course of a few hours it will generally have detached itself from the piece of skin and be found crawling on the glass. The native bear is the best animal to shoot for this purpose. If a tick be forcibly pulled out of the skin, its mouth organs are injured—often broken off—and it is afterwards unable to bite.

The poison appears to be absent, or at any rate present only in minute quantity, in the tick when it first attaches itself. A solution made of eight ticks and a few drops of water was injected under the skin of a dog. No effect followed, and the same dog afterwards succumbed to the bite of two ticks. The tick sucks blood from the animal to which it has attached itself, and it is presumed that some poison, probably of the nature of a ferment, passes from the tick into the animal. Most mammals are susceptible to the attacks of the scrub tick. Even horses have been killed by them. It is possible that human beings would succumb were the ticks suffered to remain long enough in the skin, but by reason of the irritation caused they are discovered a few hours after attaching themselves and invariably removed. The guinea-pig appears to be insusceptible to tick poison. I have never seen a kangaroo-dog die from ticks. Dogs that have recovered from tick bite become tick-proof—that is to say, they are not again susceptible to tick poison. The native Australian animals are of course tick-proof by heredity. Many dogs, especially those in the country, are insusceptible to the bite of the tick. These dogs are assumed to have had ticks upon them previously, which they have been able to dislodge, either by biting or scratching. No doubt a number of cases can be so explained; but I think I am right in saying that some dogs are naturally insusceptible. A young fox-terrier, which had never been out of town, was not affected by six ticks, whilst a strong full-grown black and tan succumbed to one tick. There is an analogous case in man. Some persons only are annoyed by the scrub itch, which is an animal closely allied to the tick.

The native animals, although tick-proof, suffer considerable irritation, judging from the swollen condition of the parts surrounding a bite. Ticks when attached to an animal usually distend themselves with blood in five days, but I have seen them remain upon a guinea-pig a fortnight, and eight days upon a dog, whilst others have fallen off dogs fully distended in four days. Dogs influenced by tick poison generally shows signs of paralysis on the sixth and die about the seventh or eighth day. Ticks having distended themselves fall off, and notwithstanding their enormous size crawl away and hide themselves in damp places under bark or rotten leaves on the ground, where they remain until their meal of blood is digested. I presume that at this time the tick lays its eggs. I kept alive some distended ticks in a box made of perforated zinc, in which grew some moss; they hid themselves in the damp moss, and in a fortnight several were hungry enough to bite again, although their bodies were not quite down to their normal size.

No symptoms arise provided a tick be removed before the fourth day after attaching itself to a dog. It is easy enough, if one cares to go to the trouble, to make a dog tick-proof. It can be done in the following manner :—Obtain some ticks, make a slight cut, not sufficient to bring blood, behind the ear of the dog, take hold of a tick and gently press its snout into the wound ; it can in this way generally be induced to bite, but if it refuses it is well to place it in a bottle again for a few hours. The part behind the ear is selected because the dog is unable to scratch the tick off when attached in this position. A pair of surgeon's dressing forceps are handy for laying hold of the tick, yet it can be done with the finger and thumb. Two ticks should be placed on the dog, and after they have been in two days remove them. They can either be immediately pulled out or first smeared with grease, turpentine, or kerosine to kill them. The blacks do not pull a tick out, but make a hole into its abdomen with a splinter of wood ; the tick is said then to detach itself. Allow a week to elapse after removing the ticks, and then place two others upon the dog and remove them after being in three days, then allow another week to elapse, place two more ticks upon the dog, and remove them before the fifth day. After this ordeal the dog will be tick-proof. Another way to accomplish the same end is to periodically take your dog into a scrub to gather the ticks for himself.

There is no special treatment for a dog sick from tick poison. Medicines such as quinine, strychnine, or strophanthus may be tried. Symptoms should be treated as they arise ; especially should paralysis of the bladder be looked for and attended to. The best advice to those who own valuable dogs, and who live in a locality where ticks abound, is for them to take the trouble every two or three days to examine their dogs for the presence of ticks ; the parts about the head should be especially searched.

Australian stringhalt, more prevalent in certain seasons than in others, has been traced * to the irritation set up by intestinal worm-parasites, prominent among which is a small **red worm,** which bores through the inner lining of the bowels, more particularly of foals and young horses in poor condition.

* For details see Report of Australian Stringhalt in Horses, by Mr. E. Stanley, F.R.C.V.S., London, Government Veterinarian, New South Wales ; dated July, 1886.

Mr. Towne pointed out one paddock liable to flooding by the river in which stringhalt was produced by the **sand** picked up by horses put to graze in it. It is quite a natural consequence that the **irritation** of the bowels produced by sand should have a similar effect to that resulting from the boring of parasites. There is as intimate connection between bowel affection and spinal chord affection in a horse, as there is close correlation between the condition of a man's stomach and his brain, whether sober or intoxicated. It is not uncommon to find a horse suffering from an attack of **colic** also seized with paralysis of the limbs.

A mild form of fever in the feet or something of a gouty nature is sometimes induced in animals in high condition by the too liberal use of lucerne.

Queensland horse-mange—an itching skin disease in consequence termed Prurigo *—has been known for some years in Northern Queensland. In 1887 it spread over the colony, and it has now also found its way into New South Wales. It is most prevalent in the humid coast regions and during periods of heavy rains. It disappears to ordinary observation in the cold weather, though no doubt it sometimes lurks in an obscure form, as it occasionally reappears on the same animal next season, although, in other cases, it may not again be seen.

Cattle, and even sheep, are not entirely free from it, although it is milder upon them than on the horse. The disease is pronounced by experts to be produced by a parasitic fungus, which makes it nearly allied to ring-worm, so common during the winter season on poor cattle in this country, although the appearance of the animal more resembles one affected by mange, which is produced by minute mites (*Psoroptes*). The skin becomes rough, scaly, and scabbed, and the hair falls off. It begins

* See the Report of the Chief Inspector of Stock for New South Wales, dated June 1st, 1889.

along the line of the back, and extends to other parts of the surface, including the extremities.

The remedies which have been used are the various forms of carbolic wash, dipping material, or sulphur dressings, but since a fungus is the cause of injury, the liquid formed by dissolving sulphate of copper in liquor ammonia will probably prove to be the most effectual remedy if the injured surface is well wetted two or three times, with intervals of a few days between. There is no danger of injury to the skin by this treatment. The disease is **most prevalent** on animals in low condition. It is distinctly **contagious,** and it is also said to be infectious, because the minute spores of the fungus float in the air and fall upon the backs of horses, and thus spread the disease. It will not of itself produce death, though the irritation induced lowers the condition of the animal. When it assumes a chronic form the skin becomes thickened and corrugated.

CHAPTER XXV.

COLONIAL HORSES.

Quality of Colonial Horses—Their Ancestry—Neglect of the Principles of Breeding—Type of a Station Horse—Carriage-Horses—Horses for India—"Walers"—Numbers of Horses in the Different Colonies—Horses in New South Wales, Numbers and Classes—Draught, Light Harness, and Saddle Horses—Treatment of Breeding-Mares on a Station—The Stud Stallion—A Tax on Entire Horses—Influence of Locality, including Soil and Climate, upon Horses—Value of Early Training on Uneven Ground or among Fallen Timber—Cantering Movement—Fodder and other Food—Prices of Common Horses for Road and Farm Work—Sheeting Work-Horses.

No class of stock in the Colonies shows a greater range of quality than that of Horses. On the one hand much of the finest blood of our most favoured breeds has been imported regardless of price and of expense of transit by the various Colonies, and, as already indicated, large studs of Clydesdales, some Suffolk Punches, Shire horses, and American trotters, and a good many Thoroughbreds, are to be found, which it would be difficult to surpass by similar studs in Britain or America.

On the other hand quite a large number of all of the three varieties—draught, light-harness, and saddle—must appear in any table of classification under the heading "very inferior.' **A large majority, of the common saddle-horses** especially, are what are usually described as "light-legged," being out of weedy mares by English Thoroughbreds, or by Arabs imported from India in the early days.

Though in the class of horses under consideration the majority are distinctly mixed and inferior, some of them show even in extreme cases of degeneracy their noble ancestry.

There was a period, of some fifteen or twenty years after the discovery of gold, when the **breeding of saddle-horses was grossly neglected** by the large owners who possessed large breeding studs, and weedy animals both male and female were permitted to breed. **Prices** were so low that owners took little interest in this class of stock, but occupied their energies in developing and improving the quality of their cattle and sheep, which paid them best; and many sold off their horses at 40*s*. or 50*s*. each.

In this way much of the early imported excellent blood got mixed up with draught blood and with inferior or degenerate strains, and the truly famous equine performances which were not uncommon during the early years of Colonial settlement, and which showed not only high speed, but wonderful endurance and staying power, in animals supported on common fare, became to a large degree matters of ancient history.

It is quite in accordance with the common laws of breeding to find that highly bred animals degenerate rapidly when not sufficiently cared for, and this is more especially so when they are allowed to cross with inferior breeds. In this instance many wild entire horses ranged over the Colonies, but more especially in New South Wales, and bred much inferior stock.

When the impetus given to change by crossing is not guided in any particular direction, **Nature steps in** and selects those which are most suited to perpetuate their species under given local circumstances, and no regard is had to those qualities which make the animals serviceable for work.

The type of horse, too, required to mount station hands, is not that which would command a high price in the

European market. It is altogether too small and too light in the bone, too much of the substance and type of its ancestors the Race-horse and Arab, to bring a high price in this country.

Large well-bred carriage-horses command very high prices in great centres of population, such as Sydney and Melbourne ; but the demand is not wide enough to encourage the systematic breeding of this class of horse on any considerable scale. Though the wealthy inhabitants do possess carriages, it appears to a stranger that they do not use them so freely as do owners of carriages at home. Possibly a profuse display of carriage grandeur does not bear with it so much *éclat* in the Colonies as in the old country, and there is no reason to doubt that the excellent service of cable tramways has much to do with the general or every-day paucity of carriages in the streets of Melbourne.

The demand from India for artillery and remount horses is neither steady enough nor extensive enough to command special attention in any one colonial breeding centre. The risks of transport are considerable, and the standard of quality exacted by the Government of India is high.

New South Wales possesses the largest number of horses of any of the Australian Colonies. Owing to the acknowledged superior quality of much of its common stock of horses, **the Indian supplies** have been mainly drawn from New South Wales under the name of "**walers**," although the exports in this trade have not been confined to this colony nor yet to Australia.*

The report for 1889 of the Chief Inspector of Stock shows, that although it was estimated that 15,504 horses in New South Wales were suitable for the India and China markets, only 605 horses were sent from five districts to be

* Horses of size and quality suitable for Indian purposes were, during the time of this visit, being collected in New Zealand.

shipped from Sydney, and 800, from six districts, to go from Melbourne for foreign countries.

TABLE SHOWING THE NUMBERS OF HORSES IN THE DIFFERENT COLONIES.

—	1871.	1881.	1888.	1889.
New South Wales .	304,100	398,577	411,368	430,777
Victoria	181,643	278,195	320,181	329,335
Queensland . . .	91,910	194,217	324,326	352,364
South Australia . .	78,125	159,678	170,000	170,515*
Western Australia .	22,698	31,755	41,390	42,806
Tasmania . . .	23,054	27,805	29,238	29,778
New Zealand . .	81,028	161,736	204,700†	187,382
Totals . . .	782,558	1,251,963	1,501,203	1,542,957

The increase in New South Wales has been over 130,000 since 1870, fully 20,000 of that increase being made during the year 1887–88 ; or it may be accounted for by a more complete return being secured.

While the total continues to grow, as it has done since 1861, when the numbers were estimated at 251,497, a decrease of 739 in the numbers of wild horses occurred in 1888, leaving 5,481 as the estimated total of this class in the returns of 1889. In New South Wales the number of horses in 1889 was 430,777, subdivided into:—

——	Thoroughbred.	Ordinary.	Total.
Draught	19,850	119,528	139,378
Light harness	14,226	95,433	109,659
Saddle	25,057	156,683	181,740
Grand Totals . .	59,133	371,644	430,777

* Exclusive of Northern Territory. † Estimated.

The draught-horse.* The draught or waggon-horse of New South Wales, at the time when gold was discovered, could not, as a rule, be correctly termed heavy draught. On the farming districts of the Hawkesbury and Lower Hunter, some horses of the true heavy-draught type were, no doubt, then to be found; but taking the dray and farm-horses generally throughout the colony, they belonged to a type of the large-sized, ragged-hipped, bare-fleshed carriage-horse, with high withers and light bone. They were very active and hardy, for they lived almost all the year round upon grass, and they were treated and driven like bullocks, six, eight, and even ten in a team.

With the "outbreak" of the **gold diggings**, however, anything in the shape of a draught-horse went up to an extreme price; and as a result draught-entires were put to the larger saddle and light harness mares, the outcome of which was that, in a few years, there were large numbers of nondescript animals which were but apologies for draught horses; and at the same time the supply of females from which the old style of well-bred light harness and upstanding saddle-horses were bred was reduced, to the injury of the whole breed. The females of these nondescripts, got by the draught-horse out of well-bred mares, were as unfit to breed light harness and saddle-horses as they were to produce draught-horses.

In course of time considerable numbers of **Clydesdale entires** were imported from Scotland, and a change for the better began to take place, especially in Victoria and New Zealand; and ten or twelve years after the discovery of gold, the teams seen on the roads in the former colony were excellent—the four or five powerful, shapely, well-fed horses, with the driver seated on the waggon and driving with reins, taking quite as heavy a load as the

* Indebtedness is acknowledged to Mr. Bruce, Chief Inspector of Stock, Sydney, for much of the information contained in the following description of the three classes of Colonial horses.

eight or ten badly-formed, ill-fed, light-framed animals (so common at one time in the Colonies) driven and treated like bullocks with the driver trudging alongside.

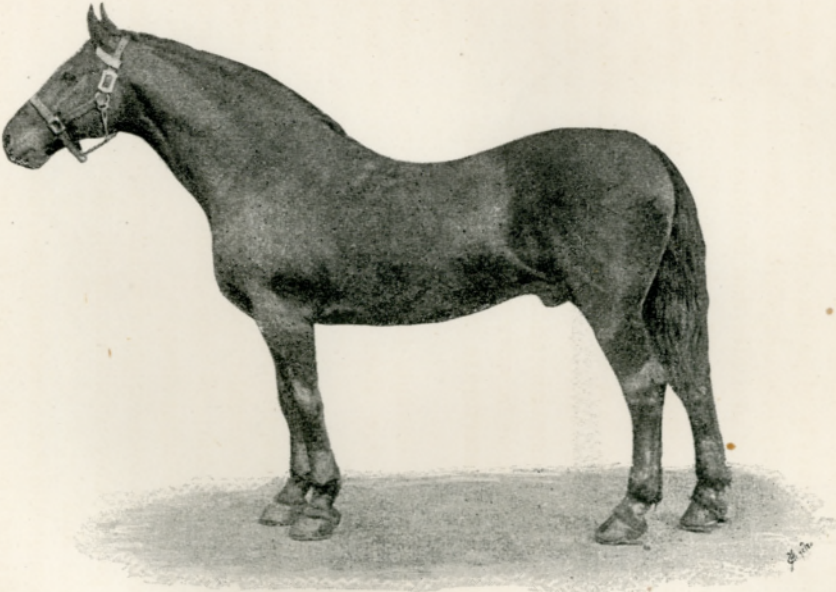
This improvement in the draught-horse spread to the other Colonies; and it can now be said that in all the Colonies, except perhaps in the northern parts of Queensland and South Australia, and in Western Australia, the Australian draught-horses are a very fair sample of what a useful draught-horse ought to be. There are a good many small, light-boned horses in use as waggon and plough horses, but there are now large numbers of Clydesdale and Shire entires standing at service in all the Colonies, and the draught stocks are, in consequence, rapidly improving.

There are few representatives now to be met with of the original type of New South Wales dray-horse.

The light harness horse. In the early days only a very few representatives of the true carriage, or light harness-horse were to be seen in the Colonies, but within the last fifteen or twenty years a good many Cleveland entires, some Yorkshire coaching-horses, American trotting-horses, and a few German carriage-horses have been introduced, and a decided increase in the number of this class of horses, as well as a considerable improvement in quality, has taken place.

This has arisen not only to meet the extensive demand there is for coaching and carriage-horses, and more particularly for buggy-horses, but also with the view of increasing the size and strength of Colonial saddle-horses, which are deteriorating in these respects through the increasing lightness in the body and bone of the thoroughbred sires which have been in use of late years.

The ordinary light harness-horse in the Colonies is usually got out of a light well-bred mare, either by (*a*) a Cleveland; (*b*) a coaching horse; (*c*) a small-sized Clydesdale; or (*d*) a Suffolk Punch.



LXI.—CLEVELAND BAY HORSE—"FIDIUS DIUS."

The property of Mr. H. V. WEBSTER, Northallerton.

The last named gets a serviceable coach- or buggy-horse even out of a weedy mare if she has descended from well-bred stock; and he would be more highly appreciated if he were more frequently bay or brown in colour.

The Australian saddle-horse. Going back twenty-five or thirty years, when there was in all the Colonies an almost unlimited supply of pasture, with a climate in which horses, in the majority of cases, were able on the grass to keep in good condition in winter, and become fat in summer, the Australian saddle-horse not only maintained the credit of his English ancestors, but outstripped them in size, stoutness, and endurance. At that time it was safe to say that he was the best saddle-horse in the world, and he may, perhaps, very fairly, in many cases, still lay claim to that distinction, notwithstanding the fact that he is not now so good a horse as he once was.

He began to **deteriorate** soon after gold was discovered:—

(1) Through the servants leaving for the diggings, and the studs which were then on the open runs being neglected;

(2) Through the introduction of draught entires into the studs of saddle-horses, thereby rendering the young mares, the progeny of the draught-horse and light mare, very unfit to breed even light harness horses, and quite unfit to breed saddle-horses of the right stamp;

(3) Through an over-supply of inferior saddle-horses and the low prices they realised during the period above referred to; and

(4) Through the deterioration of the race-horse in bone and substance, brought about by the prevalence of handicaps and two-year-old races.

Except in the case of stud-stock, and a few instances where the stallion is considered to be of more than usual value, **breeding mares** are turned out to grass, and the stallions allowed to run with them. In this way a larger number of mares are got to breed than is possible in either India or in Britain, where breeding animals of both sexes are kept in a condition of partial or complete captivity.

A stallion placed with a number of mares (say 80 to 100 as a suitable season's allowance for him) assumes control of the whole stud, rounds it up in grand style in the evening, and drives any reluctant loiterers forward to the general muster. He selects his mates for the night, and then allows the mob to disperse.

A majority of horse-breeders are in favour of a **special tax on entire horses,** to prevent careless managers keeping inferior males to reproduce their species.

The nature of the country has much to do with the character for usefulness of the horses bred in it, more especially as regards saddle and light harness stock. For example, the district in New South Wales called the Western Slopes, and similar land in the adjoining Colonies, with a moderate climate, plenty of shelter, sweet pasture, good soil, and a rolling surface, produce horses for physical development, hardiness, and sure-footedness, which leave nothing to be desired.

To work either in saddle or harness such horses are much more safe from accident than horses which have been reared on a level country where the development of muscle and lung due to the necessary exercise of their functions is not so great. **The habit of varied use** is not so fully acquired in the "plains" country. The difference is similar in the case of horses or ponies in this country reared on the flats, as compared with those accustomed from youth to a hilly district.

Horses bred in the interior, within the area of scanty rain-fall, have better feet and more endurance than horses from the southern parts of Australia. In some places where ironstone comes to the surface, horses have to be shod before they are turned out, and even these protections get very hot.

In no instance is the **value of early training** more fully seen than in the case of horses that require to make their way and carry a rider at a good round pace through the tangled débris of a heavy bush of fallen trees, after fire has cleared away the remains of undergrowth.

When begun young enough, an animal not only becomes most adroit at clearing the trunks or picking his way among the trees and large branches, but at saving his legs from injury among the projecting limbs of the fallen timber. A Colonial horseman will with ease head a number of cattle through a dense tangle of fallen trees, where an old-country rider would be perfectly helpless, even on a good English hunter.

Horses prefer to canter rather than to trot: they seem to enjoy it and take more interest in their surroundings than horses do while at work in this country.

The food of a horse on a station, except in seasons of drought, and during winter in cold upland country, is the natural herbage. The great horse fodder of Australia for hard or fast work is the **hay made from oats or wheat cut green** or immediately after it comes out in flower, when it approaches its maximum growth. About 20 lbs. per day is given to a horse at full work, along with pollards or bran, or in New South Wales and Queensland maize. Lucerne hay is substituted in certain parts, more especially when wheat suffers from the attacks of rust. Lucerne hay is best for slow work, and it is well to feed it along with a proportion of oaten or wheaten hay.

Oats are not generally given, unless to carriage-horses or those at work in large towns, but considerable quantities have been imported from New Zealand, and they are coming more into use.

About sixteen miles daily is a good complement of work for the ordinary coach-horses. They vary in value, according to the locality. From £8 to £12 each is given for ordinary, medium-sized, plain, but useful animals.

Prices of horses rise and fall considerably with the abundance or scarcity of food, or in the case of farm animals with the demand for agricultural products; a good four-year-old gelding of this description was worth £25 in the South Island of New Zealand in 1889. So recently as the year before, the same class of horse was not worth more than £15 to £18. The increased value was owing to the demand for agricultural horses on the increased area of crop-land due to the rise of 1*s*. per bushel, viz., from 1*s*. 4*d*. to 2*s*. 4*d*., in the price of oats put on rail.

The draught-horses belonging to the tenants of Sir Wm. Clarke on his property near to Ballarat were as a class perhaps the largest and best ordinary working animals seen: the estimated value of good specimens was about £30 each.

When horses are kept at work during cold or changeable weather and not given the shelter of a house, protection is provided against the chills which all animals heated at work and then exposed to wind or rain are liable to, by a **canvas sheet** lined with the coarse woollen cloth used for the lining of saddles and collars of cart-horses. The threads of the canvas on being wetted by rain contract so as to make the covering practically waterproof, and the lining fortified by the animal heat within excludes all moisture which might tend to soak through.

The sheet is secured by a breast strap, a crupper, and two belly straps—one forward at the girth and one at the flank; and when properly fastened it is maintained in position without difficulty. This means of shelter is particularly useful in the South Island of New Zealand, where the cold approaches that of our own climate. Horses can be sent to a distant part of a large holding to work in winter weather without house accommodation of any kind; the men being provided for by small portable box-houses on wheels.

CHAPTER XXVI.

MERINO SHEEP.

The Merino Breed—The Mutton—Influence of an Acquired Taste for Meat—Relations between the Prices of Beef and Mutton—Change from the Merino to Long Wool Breeds—Merinos bred solely for Wool—Method of Examination by Judges—Characteristics Common to the Various Strains of Merino—Points—The Wool—Metis-Merinos—Saxon Merinos—Tasmanian Merinos—Negretti or German Merinos—Spanish Merinos—Rambouillet or French Merinos—Vermont Merinos—Characteristics of Merinos continued—The Lambing Season—Times when Sheep will Breed—Merino Crosses—Comebacks and Quarterbacks—Sheep in New South Wales—Table showing Breeds, Classes, and Numbers—Riverina Merinos—Average Clip of Wool—Land required for Sheep—The Western Slopes—Profitable Sizes of Flocks—Prices of Estates and Interest returned on Capital—Price of Wool and Return per Sheep—Men Required on a Holding—Ages of Sheep when Sold—Prices and Objects—Weight of Carcasses—Early Lamb—Hampshire and Southdown Crosses—Number of Ewes put to a Ram.

The Merino breed* is by far the most largely represented in Australia on account of the wonderful adaptability of its numerous varieties to different surroundings. The Merino occupies among sheep, in the matter of wide distribution, the position held by the Short-horn among cattle. The Merino makes an excellent pioneer, not only on account of its adaptability and hardiness, but also in virtue of its large yield of excellent wool—a product which, where distances are great and means of transit difficult, can be much more easily brought to market than mutton.

* Imported into Australia by John MacArthur in the end of last century.

The mutton of a prime Merino wether at five years old is of the very best quality, resembling the mutton of our mountain breeds, although Merino mutton shipped to this country is at a discount in the market. Its appearance is much against it; and the joint is small and therefore unthrifty. There is a general want of that fat with which the eye of the consumer has become familiar in British sheep; and more especially is there a want of the film of fat which almost completely envelops the dressed carcass of a home-fed sheep. The flesh on this account becomes too dark in colour, and loses the attractive bloom which, if retained, would much increase its value.

It has been argued that if Merino mutton is so good, it will, in spite of appearance, soon assert its position against the coarser and more rankly-flavoured mutton of the heavy long-wool breeds. If it were not for the stolid nature of British prejudice, and also the **effects of early training**, no doubt this would be so, but in this particular instance we have not to deal with impartial judgment—a badly educated palate is an expensive associate.

It is difficult to realise to what an extent the whole equilibrium of a man's mind, and indirectly even his physical constitution, may be upset by early associations in the matter of food. It is a fact that certain townspeople prefer the strawy taste of a stale egg to the sweet and natural flavour of a fresh country egg, and declare the latter to be insipid and tasteless. It is also well known to travellers that, of people whom they chance to meet by the way, those who generally complain most of the quality of the food set before them are people accustomed to very ordinary living at home.

How much the uneducated palate is responsible for, and how much is to be set down to a general want of experience, is doubtful. The question of early training in the consumption of flesh meat is a most important one, especially in connection with the frequent extraordinary divergence in the prices of beef and mutton from their true relative values as food-stuffs. The exceptionally high price of mutton as compared with beef in England in 1889 is an illustration of the tenacity with which the consumers of mutton, who have learned to prefer it to beef, will hold on to their old practice, although the beef might be in reality much better food-value at the comparative prices. Prices will, however, slowly tend to adjust themselves in this way. Considerations of economy induce the mothers who cater for large families to make the best selections, independently to a great extent of the taste of the majority of the consumers. In this way mutton-eaters are gradually converted into beef-eaters.

Change is the order of the day in most things which retain a full share of vigour, and which seek in change an opportunity for improvement. Although the Merino still occupies the higher hill-country, there is a distinct general tendency, where conditions in the Colonies are suitable, to **displace the Merino** by long-wools. **New Zealand** has been most favourably situated for a successful issue in this direction. The development of the frozen mutton trade has stimulated the movement in the Australian Colonies ; and while the favour for long-wool mutton remains, the displacement of Merinos by long-wools will go on increasing within the limits which the climatic conditions of the country prescribe.

Small flock owners will most probably take the lead in this movement. Some ten or twelve years ago selectors and small holders had a large proportion of cross-bred sheep in their flocks ; but the prevailing bush fence of that time was not good enough to shut in the restless cross-breds, and these were replaced by Merinos. Now that the bush fence has given place to substantial wire fences, and barbed wire has been introduced, it is most probable that the men with small holdings in good country will again take to cross-breds, which find a more ready market than the Merino.

Merinos in Australia have been chiefly bred for their wool, but now that there is an inducement to produce an additional amount of fat along with the lean, for the purpose of giving a suitable market appearance, there is every reason to expect that judicious selection will in time accomplish this object without any serious sacrifice of the powers of wool production; and systematic crossing with European long-wool sheep will no doubt be greatly extended. So much has the one object, **wool**, been looked to, that judges at shows have hitherto paid comparatively little regard to the form of the frame or quality of the flesh—they merely grasp the wool to determine how it fills the hand, or part it to see its colour and quality.

Before going into the details of the various kinds of Merino, it is well to state a few **characteristics** which are common to nearly all.

The breed is white in hair, hoof, horn, and wool; the bare portion of the muzzle is of an orange fleshy colour (white being objectionable); the eyes are light grey; the horns in the **male** well-developed (not unlike the horns of a cross between the black-faced Highland and Cheviot breeds), spirally coiled inwards, and not placed too wide nor yet close enough to touch the cheek. In the case of **ewes** the great majority are absolutely without horns: when horns do appear they are comparatively insignificant.

To the touch, the back is thin-fleshed, and as in the Cheviot breed, slightly elevated at the withers; the backbone is rather sharp. The skin of some breeds, notably the German and the Vermont, is more or less full and wrinkled, more particularly about the neck, but the great majority of the Australian Merinos are plain-skinned, with the exception, perhaps, of a few wrinkles at the neck. The looseness of skin and the folds were objected to by the shearers, who were greatly retarded in their work owing to the care it was necessary to exercise to prevent cutting the skin;

but in these days of shearing by machinery, wrinkles do not offer such an impediment or source of danger.

Irrespective of the difficulty of shearing, **wrinkles** are not liked except as an indication of purity of breed. If it were not the case that the progeny of Vermont and other wrinkled sheep lose the wrinkles, the infusion of fresh blood of this kind would be in less favour. There is a tendency to the production of coarse wool fibre, especially on the crowns of the wrinkles when these are large and numerous. **Wool** should be abundant on the belly and extend down the legs to the feet and well on to the head and face, so that at shearing-time little but the nose and hoofs are to be seen projecting from a flouncing ball of white wool. The part of the face not clad with wool should be covered with soft silky hair.

In well-bred sheep the wool is close, dense, and fine; though it varies in these characters as well as in length and profusion in the different varieties of the breed, and even within these varieties, according to the locality in which they are reared and kept, or in other words, to the nature of the country, food, and climate.

Sheep generally produce finer wool after they are once shorn. Uniformity in the quality of the wool on the different parts of the body is striven for—the wool of the hind quarter or thigh should not be hairy or strong in staple, but should resemble the wool of the side and fore quarter as much as possible. On being parted for inspection, down the side, thigh, shoulder, or back, it should divide freely without any sign of adhesion or matting, as this would stamp it as inferior for the purposes of combing wool. A fine, wavy, bright staple should be presented down the sides of the opening (a condition usually more pronounced near the fore-quarter than on the thigh), and at the bottom of it a bright flesh-coloured streak of skin.

A real Merino fleece as it grows on the sheep should be firm as a board and packed like a cauliflower—the tips of the wool being even, neither fuzzy nor straight, nor standing up in places. With great length of staple, which is not a natural characteristic of the breed, the density which is of so much importance is lost.

The following **scale of points** applicable to a system of "single-judging" has been proposed by Mr. Bruce, the Chief Inspector of Stock for New South Wales.

MEDIUM COMBING MERINO RAM.

	Singly.	In Groups.	In Divisions.
	Aggregates		
I. BREEDING AND QUALITY.	250	100	100
1. *Pedigree:* Purity of Breeding as shown by certificates and owner's declarations	20	16	28
2. *Offspring:* Success of offspring to be proved as above	20		
3. *Style and character:* Bold vigorous style, and proper complexion of covering	10	4	
III.—HEAD.			
4. *Countenance:* The forehead should be broad, and the countenance healthful	5	8	
5. The *Eyes* should be bright and placid	3		
6. The *Muzzle*, &c.: The muzzle should be clean, the nostril expanded, and the nose white, wrinkly, and covered with short, furry, soft, velvety hair ..	5		
7. The *Ears* should be white, soft, thick, wide apart, and partly covered with wool	3		
8. The *Horns* should not be too close to the head and neck, nor standing out too widely, and free from black or dark streaks	4		
Carried forward	70	28	28

Medium Combing Merino Ram (*continued*).

	Singly.	In Groups.	In Divisions.
	Aggregates.		
	250	100	100
II. FORM AND CONSTITUTION.			
Brought forward	70	28	28
IV.—FOREQUARTER.			
9. The *Neck* should be short on the top, deep when viewed from the side, and long below, strongly set to the head and shoulders, towards which it should be becoming deeper	5		
10. The *Shoulders* should be broad and massive as to depth and breadth, very little, if any, above the level of the back, and well placed	4	6	
11. The *Chest* should be wide and deep	4		
12. The *Skin* should be thick, soft, and pink	2		
V.—MIDDLE.			
13. The *Barrel* should be round and lengthy	6		
14. The *Back* should be short, level, strong, and straight	5	6	
15. The *Loin* should be broad and strong	4		20
VI.—HINDQUARTER.			
16. The *Flank* should be deep and straight	4		
17. The *Quarters* should be long and well filled up ..	4	4	
18. The *Thighs* should be long and broad.	2		
VII.—LEGS, FEET, ETC.			
19. The *Legs:* The fore legs should be short, straight, and well apart, and the hind legs should be set so as to give the hind parts a perpendicular appearance; while the bone should be heavy, but of fine texture	5	4	
20. The *Muscle* should be fine and firm	2		
21. The *Hoofs* should be clear in colour and well shaped	3		
VIII.—SIZE.			
22. *Size*	5	2	2
Carried forward	125	50	50

MEDIUM COMBING MERINO RAM (*continued.*)

	Singly.	Groups	Divisions.
	Aggregates.		
III. THE WOOL.	250	100	100
Brought forward	125	50	50
IX.—QUANTITY.			
23. *Length of Staple:* according to division	5	22	22
24. *Density:* Closeness and thickness all over, but especially on the top of the shoulder and back ..	30		
25. *Evenness* in length and density of fleece over the whole body, legs, belly, back, and head	20		
X. QUALITY.			
26. *Brightness*, including Lustre, denotes facility for taking delicate dyes	5	8	26
27. *Softness*	8		
28. *Crimp:* The regularity of the waves, and regularity, evenness, trueness of fibre	7		
29. *Freedom from Gare*, i.e., Kemp	5	18	
30. *Fineness:* According to Division	17		
31. *Freeness:* Denoting few noils in combing	6		
32. *Evenness* in the quality of the fleece over the whole body, legs, belly, back, and head	17		
XI. CONDITION.			
33. *Quality of Yolk*	3	2	2
34. *Fluidity of Yolk*	2		
Aggregates	250	100	100

N.B.—See pages 358 and 359 for Award Paper.

Metis-merinos from France produce wool of the long and loose character indicated. They were originally formed by crossing the Merino with the Cotswold breed, to increase the amount of mutton, and are in consequence not so hardy as pure Merinos for the drier parts of the country.

Saxon Merinos have very fine bright, close, soft wool, forming an ample covering, fully extended to all parts which grow wool.

LXII.—Merino Ram.

The property of Mr. John Riddoch, of Yallum.

LXIII.—Merino Ewe.

The property of Mr. John Riddoch, of Yallum.

The Tasmanian Merinos, which now, as a rule, bring the largest prices at ram sales, belong to this latter breed. **The highest price** ever given for a sheep in Australia was 1,150 guineas. It was paid by the Hon. J. H. Angas for a Merino ram bred in Tasmania. The author had the privilege of seeing another ram in the possession of Mr. John Riddoch at Yallum, for which £1,100 had been paid about ten years before, and even after the lapse of so many years he had maintained the quality of his wool to a wonderful degree.

The Tasmanian flock-owners have but small flocks, and they bring their animals out to show better than their opponents in the other Colonies, but in addition to "tittivations," to housing, feeding, and protection from wet weather, there is no doubt that the soil and climate of Tasmania is peculiarly well suited to the development of the best qualities of the breed.

The north and middle of the island produce better sheep than the south. The lambs are much wrinkled in the skin, particularly when they are well fed and fat, but this condition is lost, except on the neck, as they grow up to maturity.

The Negretti or German variety was at one time introduced in considerable numbers into New South Wales and Queensland. The skin of the imported sheep is much wrinkled all over, and the staples are not free. The wool does not part readily in shedding, which causes loss in combing, and necessitates the transfer of the wool from the "combing" to the "clothing" class, for which there is not so much demand. The climate and soil of Australia have in a few years altered the defective condition and lengthened the staple.

The Spanish Merino is a sheep of large size, producing a superior quality of strong combing wool. It is not now represented in the Colonies in a pure form. The flock (established 1845) of the Hon. J. D. Macansh, in the

AWARD PAPER FOR "MEDIUM"

Num- of Ex- hibit.	Age of Sheep. Months.	Days.	How Fed.	Growth of Wool. Actual number of days.	Under 365	Over 365.	Addition for under.	Deduct for over.	Breeding and Quality. I. Pedigree.	Offspring.	II. Style and Character.	III. Countenance.	Eyes.	Muzzle.	Ears.	Horns.	Form and IV. Neck.	Shoulder.	Chest.	Skin.	V. Barrel.	Back.	Loin.
	I. Single Points } Aggregate 250.						Points per day.	Points per day.	20	20	10	5	3	5	3	4	5	4	4	2	6	5	4
	II. In Groups. . . Aggregate 100.								16		4	8					6				6		
	III. In Divisions . Aggregate 100.								28								20						

The same Award Paper will answer for Ewes, with the following alterations: Reduce "Muzzle"

neighbourhood of Warwick, near the Queensland border of New South Wales, is one of those that have been formed by introducing Spanish as well as Rambouillet blood. It numbers from thirty to forty thousand, and has been for many years almost exclusively confined for rams to its own members.

The Rambouillet or French Merino, descended from the Imperial Flock, are larger than the German or Spanish Merino and produce fine wool, though not quite so fine as that of the Saxon Merino. Several of the best flocks in New South Wales belong to this variety; the **Colleroy flock**, for example, which took the first prize for the heaviest and most valuable fleece at the International Exhibition at Melbourne in January 1889.

COMBING MERINO RAM.

Constitution.						Size.	Quantity of Wool.			Quality and Condition of Wool.									Total.	Award.
VI.			VII.			VIII.	IX.			X.							XI.			
Flank.	Quarter.	Thigh.	Legs, &c.	Muscle.	Hoof.	Size.	Length.	Density.	Evenness of Covering.	Brightness.	Softness.	Wave.	Freedom from Kemp.	Fineness.	Freeness.	Evenness.	Quality of Yolk.	Fluidity.		
4	4	2	5	2	3	5	5	30	20	5	8	7	5	17	6	17	3	2	250	
	4			4		2		22			8			18				2	100	
						2		22						26				2	100	

to 4, omit "Horns," and add 5 marks to "Evenness" of covering.

The Vermont Merino, from the State of Vermont,* is one of the most perfect as regards good covering and density of fleece. It is one of the most highly bred varieties of Merino, having been kept pure since 1803. Although it is refined in appearance and grows a very heavy fleece of wool, it is not a universal favourite with breeders. It is thought by some to be soft in constitution, the result of close breeding; and the wool, which is lacking in softness, brightness, and fineness, contains an exceptionally large proportion of yellow yolk which washes away when the fleece is scoured.

Merinos are more liable, in wet districts, to foot-rot than

* One of the five New England States of North America located on the eastern border of the State of New York.

long-wools or even long-wool Merino crosses, but even these breeds require to have their feet stimulated by a walk through a trough containing a solution of arsenic, crude carbolic, or pitch-oil, an operation which is described at page 375, under diseases of sheep.

Merino ewes and rams will breed at any time all the year round. The report of the Chief Inspector of Stock for New South Wales divides the time of lambing into six periods, which embrace the whole year.

The English breed which most nearly approaches to the Merino in this respect is the **Dorset**—a close-coated, white-faced horned breed, which produces two crops of lambs within the year.

Long-wool rams in Australia will not attend to the ewes except at the **ordinary breeding season,** which in southern parts of Australia in a great measure corresponds to the breeding season in this country—our winter and the Australian summer coming at the same time. Summer is the Australian period of scarcity due to excessive heat, while the supply of food in this country is least plentiful during winter on account of cold.

Lambs in both countries are usually timed to arrive so that they may be ready to take full advantage of the period of the greatest food supply.

The Hampshire Down * breed of sheep can be made to breed at an earlier period than Long-wools, and may thus help to supply a demand for early lamb which will grow with the increase of population.

Merinos breed freely with Long-wool or Down sheep. The carcasses of **first crosses** of the Merino are well suited for freezing. The sheep are large and vigorous, and have all the advantages of a first cross. When a pure Merino ram is put to a cross ewe the produce is termed a "**come-back**" or "**quarter-back.**" When there is much

* Some good specimens of this breed (ewes and rams) were imported into Victoria by the Hon. William McCulloch in 1889.

Morris, Dunedin.

LXIV.—Vermont Merino Rams.

The property of Mr. John Reid, Elderslie.

Morris, Dunedin.

LXV.—Vermont Merino Ewes.

The property of Mr. John Reid, of Elderslie.

Merino blood present these "come-backs," or sheep which have recently been breeding towards the Merino side, are objected to, because, although the mutton is excellent, it has not the uniformity of quality which is natural to the flesh of the Long-wools supplying by far the greater proportion of the trade with Europe.

Distribution of sheep in New South Wales—(1) **The Coast division** of this country is not suited for Merino sheep, but in certain parts some English Long-wools thrive.

(2) **On the Mountainous division** British Long-wools and large coarse Merinos do well in the drier and less lofty districts. Where there is much rain, especially on granite soils, there is danger from foot-rot and from internal parasitic worms.

(3) **The Western Slopes** comprise the area where the finest (either combing or clothing) Merino wool of the Colony is grown. Mudgee, noted in the history of wool production, is in this division.

(4) **In the intermediate divisions** sheep are remarkably healthy; but with the rich food supply of grasses and salt-bush mingled, they have a tendency to grow larger, and to produce stronger wool than is the case on the Western Slopes; and, moreover, the climate is too warm for the growth of the finest samples.

(5) **The Salt-bush- or Back-country** division is the least suitable for the production of wool, although it is most healthy for the animals themselves, were it not for periods of drought involving scarcity of water and deficiency of food.

The wool is made coarse by the heat, and it is further injured by dust and by being checked in growth and broken in fibre by the starved condition of the sheep in times of want. Much of this part of the Colony has been improved by stocking with sheep, and this improvement will no doubt continue to go on.

The following table extracted from the report for 1889, (published 1890), of Mr. Bruce, the Chief Inspector of Stock for the great sheep Colony—New South Wales—will be a sufficient indication of the relative importance of the various breeds in the Australian Colonies.

Name of Breed.	Pure and Stud.	Ordinary.	Total.
Combing wool Merinos—			
(*a*) Superfine . . .	1,177,492	5,213,011	6,390,503
(*b*) Medium	2,849,767	13,220,710	16,070,477
(*c*) Strong	2,821,827	9,362,825	12,184,652
(*d*) All classes . . .	6,849,086	27,796,546	34,645,632
Clothing wool Merinos—			
(*a*) Superfine . . .	634,938	1,711,899	2,346,837
(*b*) Medium	842,726	6,929,391	7,772,117
(*c*) Strong	1,047,346	3,147,409	4,194,755
(*d*) All classes . . .	2,525,010	11,788,699	14,313,709
Combing and clothing Merinos, all kinds .	9,374,096	39,585,245	48,959,341
Lincoln (Long-wool) . .	89,047	159,246	248,293
Leicester (Long-wool) . .	59,960	116,723	176,683
Romney or Kent (Long-wool)	554	896	1,450
Down (Short-wool) . .	9,686	16,462	26,148
Long-woolled sheep, all kinds	273,527	293,327	452,574
Crosses of Long-wools and Downs with Merinos principally	..	..	694,853
All breeds (Grand Total)	..	..	50,106,768

In the Riverina district of New South Wales watered by the Murrumbidgee and Murray Rivers, and famous for the richness and depth of its soil, Merinos of a large and superior quality are kept. The nature of the soil tends to make them light in the fore-quarters, and causes the wool to grow long and loose, and the woolly covering of the head and legs to recede. To counteract this, close-woolled and amply covered Tasmanian rams are run with the home-bred ewes.

A good average "**clip**" **of wool** in this district for a well-bred flock is about 6 or 7 lbs. per sheep. Special rams yield about 18 or 19 lbs. and special ewes about 12 lbs. from one year's growth.

In good parts of the Riverina about 1½ acres are required to support a sheep all the year round: in drier parts from two to three acres.

In the most favoured areas of the Colony, as in the best of the **Western Slopes** between the Main Coast Range and the plains, with an annual rainfall of about 25 inches, a sheep to the acre can be kept, where the trees have been ring-barked (or killed) and sufficient water conserved.

Each lot of breeding **ewes** should not exceed more than from 2,000 to 3,000, nor "eild" or **dry flocks** more than 5,000. The smaller the paddocks and the smaller the flocks, within reasonable limits, the more will the country carry and support—it is stated upon good authority that this may amount to fifty per cent. of an increase.

Estates in Riverina, 1½-acres-to-the-sheep land, have recently been sold for about 50*s.* per acre (including stock and improvements) and are capable of returning about eight to ten per cent. interest on capital invested. This is calculated on the basis of an average clip of five to six lbs. per sheep with "fleece" quality of wool selling at 11*d.* per lb. Deductions which have to be made for the lower value of pieces on the lighter portions of the neck and on the breeches, and also for "locks" from the belly, and the inferior soiled pieces, or "clarts" reduce the total average return for the whole yield per sheep to 8*d.* or 9*d.* per lb.

With an original total outlay of £2 10*s* to £3 per acre on one-acre-to-the-sheep land, the percentage return for capital is not materially different.

In the case of a good property, the annual **cost of**

management should be more than covered by the proceeds of sales of surplus sheep, so that the **whole return from wool** is set free to meet interest on capital, or as the income of the owner.

Station hands. As a rule a large station should not employ more than one man to 5,000 sheep, or ten men on a run carrying 50,000, except at shearing-time; but should the land be mountainous or a travelling-stock road pass through it, the numbers require to be increased. On the other hand, only one man is required for 10,000 sheep where a good station lies compactly and is properly subdivided.

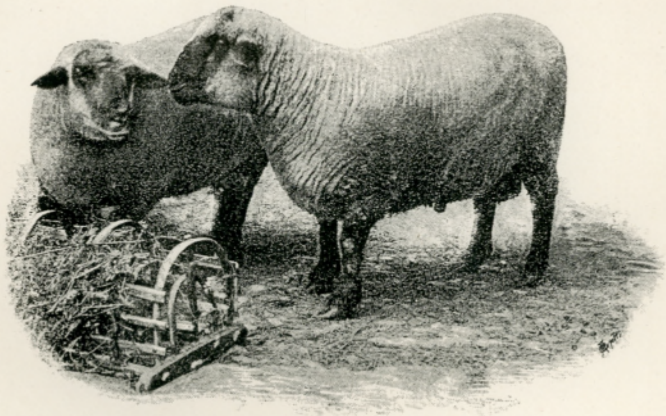
The ages at which sheep are disposed of vary considerably according to circumstances. Where a back-country is being stocked for the first time, draughting of ewes is practically done away with, and all that are likely to breed retained to increase the numbers as quickly as possible. The natural sequence of events is, that as the flock fills up, sheep are drawn by the "mouth" or according to the presence or firmness of the incisor teeth. Then they ultimately come to be drawn according to the age-mark of the district—five years being considered the termination of the period of greatest profit. Where there is a demand for ewes for breeding purposes in another part of the country, some ewes are draughted there for sale at four years old. This has been the case in the Riverina country, whence breeding sheep have been sent in large numbers to Queensland.

Prices have ranged from about 10*s*. down to 7*s*. 6*d*. In parts less favourably situated as regards markets, ewes at five years old may sell at 5*s*. and upwards. When fat, carcasses of such ewes average about 45 lbs. and some run up to 50 lbs.

On distant runs **Merino wethers** are kept till they are four or five years old, and even beyond this age; but from such places as the Murray River Country on the northern

LXVI.—LINCOLN RAM.

The property of the Hon. JOHN HOWARD ANGAS.



LXVII.—Hampshire Down Rams.

Bred at Downton Agricultural College.

border of Victoria within easy distance of a market like Melbourne, cross or "comeback" wethers are sold at three years of age (after shearing, which in their case is done a little before the ewes), and fetch about 11*s.* The weight of the dressed carcasses averages about 60 lbs. Merino wethers, though older, are nearly 10 lbs. less in weight. A few months later prices fall to some extent, as greater numbers are then sent to the fat market.

From the same district the **early lambs** from cross-bred ewes, by Lincoln rams, go to Melbourne about the 1st of August, and sell for about 10*s.* to 12*s.* each. One ram is provided for every 50 ewes, and he remains with the flock from six to eight weeks.

Hampshire-down sheep have recently (1889) been imported by the Hon. William McCulloch, with the object of breeding Down rams to use in place of Leicesters and Lincolns for the early lamb trade, which will naturally grow with the increase of urban population. **South-down crosses** have also been tried by Mr. McCulloch in the Colac district. These are sold early in November at about 12*s.* 6*d.*, to go to Melbourne during the Cup-meeting of the Racing Club, when people from all parts of the Colonies congregate there to hold high festival.

CHAPTER XXVII.

LONG-WOOL BREEDS AND DOWN SHEEP.

Long-wool Sheep in New Zealand—Advantages over the Merino—Lincolns—Romney Marsh or Kent Breed—Likeness to the Cheviot Breed—Border Leicesters—Cross Ewe Flocks—Shropshire, Hampshire, and South Downs—The Frozen Lamb Trade.

Long-wool sheep, descended from English flocks, are largely represented in New Zealand and are increasing in proportion to the total number of sheep in the Colony, while Merinos are decreasing. For this there exist a number of good reasons :—

(1) Long-wool sheep do not suffer from foot-rot to the same extent as Merinos do on rich, deep land, such as is to be met with in many parts of New Zealand, when associated with an amount of rainfall such as is experienced in that country.

(2) Their mutton is more like home-grown mutton, and finds a readier market in London than Merino mutton.

(3) Fashion has been changing in favour of woollen goods manufactured from Long-wools.

The three most common breeds (named in order of importance) in New Zealand are Lincoln, Romney, and Leicester.* Cotswolds are also bred, but are not so common.

The Lincoln is appreciated on account of the excellent

* The following prices realised for the ram hoggets of 1888 at auction on the same day, by good representative specimens of each breed, will give a fair indication of their relative values : Lincoln, five guineas ; Romney, three and a half guineas ; Leicester, three guineas.

LXVIII.—First Prize Lincoln Ewes.

The property of Mr. Robert Wright, Nocton Heath, Lincoln.

LXIX.—Romney Marsh or Kent Sheep, Recently Shorn.

The property of Mr. Henry Rigden, Lyminge, Hythe, Kent.

LXX.—Romney Marsh or Kent Sheep, in their Wool,
showing the characteristically strong bone and broad forehead.
The property of Mr. F. Neame, Jun., Macknade, Kent.

quality and abundance of its fleece, and also because of the weight and homelike appearance of the mutton, more especially of that of its crosses which, both as wool and mutton producers, are much more numerous than the pure-bred specimens. A good Lincoln flock of ewes will average eight pounds of wool all over; hoggets by themselves eleven pounds each. The breadth of staple which is of such special importance in England is not in New Zealand looked upon as of much consequence.

The Romney Marsh or **Kent sheep** is, although larger than the Merino, a smaller, but hardier and better-milking and more active sheep than the Lincoln. It is thus admirably suited to the steep hill sides which are so numerous in New Zealand pastures. The breed is specially distinguished for compactness of form, strength of bone, and breadth of forehead. It crosses well with the other breeds of sheep, and its mutton and wool are of the kinds now appreciated in the British market.

The backs of Romneys and their crosses, like those of the Merino, are harder to handle and are not so heavily fleshed as the backs of the other Long-wools. The backbone is more prominent, and they tend to rise at the withers like the **Cheviot** sheep. This peculiarity is not to be wondered at, seeing that a relationship is generally admitted to have existed at one time between the two breeds. The so-called improved Cheviot does not now resemble the Romney Marsh breed so much in appearance as the old-fashioned form.

A number of **Cheviot sheep** have also been imported into the Colony within recent years, but they could not properly be classed among the Long-woolled breeds. The probability is great that more difficulty will be experienced with the feet of Cheviots on rich or damp soil than with those of Romneys; although in other respects the Cheviot sheep of the present day has a constitution which would suit the North Island of New Zealand much better than its own native hills. There seems to be little doubt but that Romney sheep in New Zealand develop into larger and better animals (at least as wool-producers) than their home-reared relatives in this country. A good average clip of wool from a Romney flock is about six and a half pounds each. The weight of a good wether should be from sixty to sixty-five pounds—though if kept on and well-fed for a year or so longer it might run up to 140 lbs., but would yield a smaller price per pound.

Leicesters, or more correctly **Border Leicesters**, compete more with Lincolns than with Romneys for a position in the country. The smaller prices paid for rams of this breed have rather favoured their purchase during the bad times when money was not plentiful. Breeders of Leicesters could not afford to change their flocks into Lincolns, and some breeders of cross-breds were induced by low prices to buy Leicesters, who, had the price been similar, would have preferred Lincolns.

But after all that has been said, each breed has more or less its own function to perform : and in maintaining the proper balance of length of wool and fleshy condition in cross-bred ewe-flocks, Lincoln and Leicester rams are often used alternately ; for example, in breeding from Merino ewes, a Border Leicester ram is first used, and to the resulting crosses a Lincoln ram, which is usually continued in later crosses, with the Border Leicester occasionally thrown in when the ewes become too rough.

In the case of a Romney ewe flock to be changed into crosses, the Lincoln ram is generally first selected, then the Border Leicester follows on the Romney-Lincoln ewes. With the Lincoln and Border Leicester **Cross Ewe**, the Border Leicester ram is continued till the wool gets too thin, then the Lincoln ram is used once more.

Excellent results have been got in both mutton and wool where the above system has been adopted ; viz., always breeding from a pure ram, though on variously

LXXI.—First Prize Cheviot Ewe.

The property of Mr. J. A. Johnstone, Archbank, Moffat.

LXXII.—FIRST PRIZE BORDER-LEICESTER EWES.

The property of the Right Hon. A. J. BALFOUR, M.P., Whittingham, Prestonkirk.

LXXIII.—SHROPSHIRE DOWN EWES.

The property of Mr. EDWARD CADDICK, Caradoc, Ross.

crossed ewes. Much disappointment and loss has been entailed where cross-bred rams have been employed for breeding purposes : as that uniformity of quality, which is of immense importance in the marketing of any produce, cannot be secured. The quality may at times be excellent, but no reliance can be placed on the result.

Down rams,—South Downs, Shropshires and more recently Hampshires,—the representatives of the English short-woolled breeds in Australia—have begun to be used in the Colonies for the production of early lambs by crossing with cast ewes of other breeds. The lambs go off early and admit of the ewes being quickly fed off. No doubt the use of Down rams will be increased with the development of the frozen lamb trade with Europe, which is already of considerable magnitude in the New Zealand trade. Any of the various breeds or crosses now in the country will supply suitable mothers for fat lambs, provided they are good milkers ; Romneys should therefore come well to the front in the new development.

It is to the importation into this country of lamb of superior quality that the Colonial producer must look to break down the prejudice of the British consumer against frozen meat.

CHAPTER XXVIII.

DISEASES OF SHEEP.

Anthrax—Parasitic Diseases and their Causes—Lung Worms and Means adopted for their Destruction—Fumigation with Sulphurous and Carbolic Acid Vapours—Intra-tracheal Injection—Salt and Turpentine—Sulphate of Iron a Remedy for Coast Disease—Arsenic—Armstrong's Drenching Tin—Turpentine and Oil—Intestinal Red Worms—Liver Fluke—Hydatids—Eucalyptus Leaves—Healthy Districts—Foot-rot—Its Causes and Treatment—Contagious Lung Disease or Catarrh—Reduced Temperature of Air in Hollows during Night.

Anthrax.—Outbreaks of one form of this deadly disease, —*Splenic Apoplexy*,—known in Australia as "*Cumberland Disease*"—occur in some parts of Australia; and 150,000 sheep running on infected and suspected country in New South Wales, have recently been vaccinated with Pasteur's vaccine of anthrax, by his representative, Mons. Loir, at a cost of about 3½*d.* each. So successfully was the double vaccination carried out, that the losses by the operation did not amount to one in one thousand. The vaccinated sheep have been put back to the infected runs, and the results will be communicated immediately.

Diseases of sheep, other than Anthrax, in the Colonies, when of an unusual or exceptional nature, are mostly parasitic.

Worm-parasites naturally increase when sheep become thick upon the ground. They find most congenial quarters in the systems of the younger members of the flock, or of those of any age that for some reason are poor in condition.

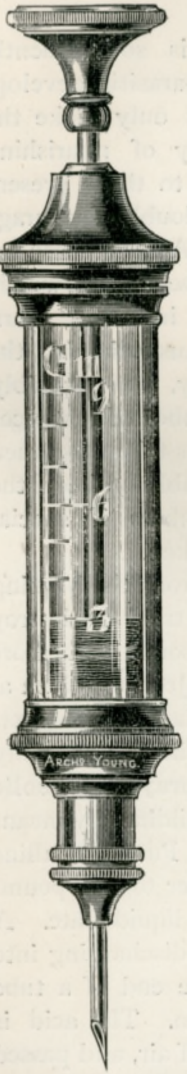
The vital force of a robust, healthy, and mature animal either resists altogether or checks the encroachment of parasites.

The droughts to which Australia is so frequently subjected, are a great encouragement of parasitic development in Colonial flocks. Droughts not only make the sheep poor and weak from insufficiency of nourishing food, but they induce conditions similar to those present when land is overstocked and thereby doubly encourage the increase of certain forms of worms. Among these are to be numbered **the lung-worm** (*Strongylus filaria*), which, increasing and extending as it has done in recent years, particularly in the unsound parts of Australia, *i.e.*, the sour (fluke and foot-rot) upland-country, has possibly been the cause of death in a greater number of instances than in the case of all other parasitic worms taken together. In many parts it would be quite impossible to keep the young sheep from dying in large numbers if special precautions against the worms were not taken.

Fumigation with the vapours derived from the burning of sulphur in a close chamber, has been tried to destroy lung-worms, and is yet continued by some. A more effective method is that practised by Mr. John Riddoch at Yallum in the south-east of South Australia. The hoggets are put each year into air-tight fumigation-houses, specially constructed for the purpose, and a fine **spray of carbolic acid** is thrown into the atmosphere of the buildings by means of an air-pump driven by a steam-engine. Pure crystalline carbolic * is heated and one ounce of water to one pound of carbolic mixed with it to keep it in a liquid state. A jet of compressed air from the air-pump, discharging into the fumigation-house, is made to pass the end of a tube connecting with the carbolic acid solution. The acid is sucked up the tube by the strong current of air, and passed into the house as a fine vapour, to be inhaled by the sheep,

* Gresser's carbolic will do quite as well as Calvert's.

shut up, one thousand at a time, for a period of about half an hour.



Intra-tracheal Injection Syringe (reduced one-fifth).

Mr. Riddoch has treated during spring 16,000 young sheep annually, for a number of years, with excellent results.

Although no external or internal treatment which would not injure the constitution of the sheep can kill the embryo worms located in the lung parenchyma, yet to destroy the adult worms in the trachea and bronchial tubes seems to be sufficient to tide the young sheep over the critical period.

Another effectual remedy which, on account of its immunity from danger to the life of the patient, might prove to be of service in the Colonies in the case of a limited number of valuable animals, is the **intra-tracheal injection,** consisting of—

Olive oil	100 parts.
Oil of turpentine Chloroform Pure carbolic acid	2 parts of each.

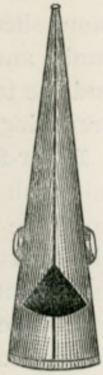
The point of a syringe similar to that shown in the accompanying figure is thrust through the skin and the wall of the trachea (windpipe) in the middle of the neck, and two to four drachms of the mixture injected into it. The operation may require to be performed three times, with an interval of three days between operations.

On all properly managed runs where sheep suffer from parasites, **rock salt** is used as a preventive. To increase the effectiveness of salt as an antidote against worms, it is at times given in the ordinary form of small crystals mixed with **oil of turpentine** ($C_{20}H_{16}$). It is exposed in boxes in the paddock, and strange to say, the craving of the animals for salt overcomes their natural aversion to the powerful, peculiar odour and acrid taste of the essential oil, frequently misnamed *spirits of turpentine*, or vulgarly "*turps*."

Salt mixed with sulphate of iron,* in the proportion of twelve or fifteen to one, is offered in boxes to sheep suffering from the **coast disease** of South Australia, and in all the Colonies also to sheep suffering from worms. When this disease is present, there is a want of iron in the blood and a consequent pining and unthriftiness.

Arsenic is also employed to destroy lung-worms, but its action is inevitably slow on account of the necessity of giving only small and repeated doses. Its use, with so many other alternative means at hand, is not at all advisable, on account of the risk of poisoning; nevertheless, it is by far the most generally used drench, and reports of its effects are all but unanimously favourable.

The best and simplest **drenching-tin** for sheep is the invention of Mr. J. Armstrong, of Rowan and Co., which was described as follows in the *Sydney Mail*:—



"It is a small tin cone, about 8 inches in length, about 1½ inches through at the butt, which is closed. At the mouth or narrow end, which is about ⅜ inch across, and open, the sharp edge is covered by a ring, so that it will not injure the sheep's mouth. Near the base of the cone and about 1¼ inches from the end there is an orifice about 1 inch wide. The use of this drencher is very simple. The sheep are held, and the operator having the drenching material in a bucket, dips the drencher, wide end down, into the mixture. By this motion he instantaneously places in the tin about one

* In England suitable salt costs 30*s*., and sulphate of iron 55*s*. per ton, in addition to carriage, which will amount to fully £1 per ton with the recent rise in the rate of freight.

ounce of the drench, and raising it, is ready to pour the dose down the throat of the sheep. The cone is, in fact, a measure and drench combined. The large opening freely admits the air, the want of which is the great difficulty to contend with when a bottle is used. Six or seven men can easily drench 3000 weaners in a day.

Turpentine and oil (in equal parts, and about ½ oz. of each), administered by means of a stomach-pump to eliminate risk from choking, has proved thoroughly efficacious. The only objection to this method is the amount of time and labour it entails, but against this is to be placed the fact that turpentine pervades the whole system, and is also able to destroy some forms at least of the intestinal worms which are almost invariably associated with lung-worms.

Sheep also suffer from the **red worm** (*Strongylus contortus*) in their fourth stomach. In the southern humid districts of Australia both men and animals suffer from **hydatids**, which represent a stage in the life-history of the tape-worms. These, taken in with drinking-water, fix themselves in one or more of the vital organs and frequently cause death. The perfect tape-worm (*Tænia expansa*) is to be found in the intestines; and, when the pest is at all serious, all the three worms mentioned are generally present in the same sheep, together with common round worms. Many lambs and weaners are carried off by the stomach-worms and the tape-worms if they are not promptly dealt with by drenching.

Liver-fluke (*Distomum hepaticum*) is unknown in the salt-bush plains, and sheep, suffering from rot resulting from the presence of flukes or parasitic flat worms in the bile-ducts of the liver, sometimes recover when removed into that country. On their own ground the best preventive of liver-fluke is a full and constant supply of rock-salt, with an occasional lick of Liverpool salt mixed with sulphate of iron.

Sheep infested with lung-worms are sometimes relieved when turned into pasture where they can get **Eucalyptus**

leaves to feed upon, and a change to fresh pasture is always beneficial. Some districts are much more healthy for sheep than others. The Riverina country in New South Wales possesses immunity from the loss resulting from parasitic affections and even from foot-rot, which is so often associated with sheep to a greater or less degree.

Sheep suffering from foot-rot, as they frequently do in a wet season or at pasture on rich grassy land, should be driven once a fortnight, after careful paring, through a solution of arsenic and pitch-oil—one pound of arsenic and half a gallon of pitch-oil to five gallons of water, dissolved by boiling with soda and soap. Crude carbolic acid—3 or 4 parts to 100 of water—is sometimes used, but there is no remedy so cheap or so thorough as the arsenic foot-bath, if care is taken not to make the solution so strong as to injure the tender parts of the feet, and not to repeat it too frequently so as to unnaturally harden the hoof and induce lameness. The **trough** should be 12 ft. long, 1 ft. deep, 8 inches wide at the bottom, and 14 inches at the top, but the ends only 3 inches deep, and it should be placed on the surface of the ground, between two rows of hurdles or pailing, wide enough for the sheep to pass through. Sheep soon become accustomed to the operation, and walk readily and quickly through without splashing the liquid, which would probably blister the skin of the legs and inner thighs. The solution should stand only about one to one-and-a-half inches deep in the trough—no more than sufficient to cover the horny digits.

Lung-disease of a contagious kind at one time existed in Australia. It was described in a "Prize Essay on the Disease commonly called Catarrh in Australian Sheep," published at the Government Printing Office, Sydney, in 1850. It seems to have disappeared with the change introduced in the management of sheep when wire fences became general in the Colonies.

The author of the prize-essay in a suggestive footnote remarks:—"In deference to general opinion, the writer of this essay treats of the disease under the common name of catarrh, although long ago convinced of its misapplication and satisfied that the head-quarters are much deeper seated, than in the *nostrils* or the head altogether," and also "that the region of the lungs may be considered as the most frequent seat of the *Colonial* malady."

Penning sheep together in hollow ground was specially liable to give them a chill, and thereby aggravate any disease of this kind, more particularly if they had been at all heated by driving.

There is a wonderful difference in the temperature of the atmosphere lying in a hollow at night as compared with that on the rising ground. On descending into a hollow,* one feels it quite chilly, no doubt the result of the layer of air lying immediately on the surface of the earth getting rapidly cooled after sundown, and falling in virtue of its greater density into the hollows. This phenomenon appears in a much more pronounced degree in the Colonies than in Great Britain.

* The author's attention was first drawn to this fact while passing through a hollow in the road which skirts the Botanical Gardens, Sydney, and runs from the site of the recent Exhibition Buildings in the direction of the Curator's residence.

CHAPTER XXIX.

SHEARING AND WOOL.

Shearing—Numbers of Sheep Shorn per Day, and Cost—The Wolseley Sheep-Shearing Machine—Shearers and their Employment—The Wool Shed—Internal Arrangements—Work of Shearing—Classifying of Wool—Baling—Sorting—"Combing" and "Carding" Wools—Table showing Increase of Wool Trade with the United Kingdom—Washing of Wool discontinued—Wool sent in the Grease—Value of Grease—Methods of Washing—Prices of Wool—Value of a Rise of 1*d.* per lb. to the Colonies—Classification of Sheep at Shows—Necessity for an Expert in Sheep and Wool—Instruction which ought to be Supplied—Cross-bred Wool—Lincoln Wool—Dr. Jaeger's System of Clothing.

Shearing begins in the Salt Bush country in the middle of July, in the Riverina about the middle of August, and in the cold upland country about the first of November, and goes on for four or five months. About eighty sheep daily is a goodly number for one man to shear by hand, though at times a man is found who can strip 120 sheep in a day with the shears, and even 200 have been done on a wager. £1 (without food) is the rate paid in this quarter of New South Wales for shearing 100 sheep. In the most northerly districts visited in South Australia shearers used to earn £1 daily; now the rate has been reduced, so that 17*s.* is a good average earning. The men engage to pay their own cook, who is usually one of themselves, the contribution from each to pay the cook's wages being 3*s.* per week.

The Wolseley Sheep-shearing machines are being rapidly introduced, especially on the larger holdings in the

Colonies, where the expense of supplying the necessary power to drive them is, owing to the amount of work to be done, a matter of little consequence. The introduction of these machines has been greatly accelerated by the effort of the Shearers' Unions to push up the rate of wages, while the runholders were suffering from the effects of the recent years of drought and the low prices for wool. The machine is now so simple and works so well that any unskilled labourer who can handle a sheep is able to use it without difficulty and accomplish as much work after two or three weeks' practice as a good man with the shears. Many large squatters have thus been able to a considerable extent to dispense with the services of the expert and professional shearers.

The advantages specially claimed for this machine are to be found in the increased amount of work done; in the possibility of employing unskilled labour; in the uniformity of the work; and in the extra amount of wool taken off the first year.

But perhaps the greatest advantage of all is the preservation of the wool staple intact. When the shears are used, much wool is shortened and thereby reduced in value by the point of the shears being allowed unwittingly to make double cuts—e.g., cut the staple twice while the operation is progressing.

The saving is estimated by a competent authority at 6*d.* per sheep under the following headings: (*a*) increase in quantity and quality of wool; (*b*) increased value of pelt owing to absence of cuts; (*c*) prevention of deaths resulting from cuts; (*d*) saving of labour.

The average tally of one man with ordinary hand-shears is about sixty to seventy sheep per day; with Wolseley's machine-shears, ten to twenty per cent. over that of the shears.

The maximum tally with the machine shears is stated by the Company at 203 sheep in one day.

LXXIV.—Wolseley Shearing Machine at work in a Wool-shed.

The price of each set of machine-shears and fittings for horse-power connections supplied with bracket and driving shaft suitable for any number up to twelve shearers, or for hand-power, is £15. The horse-power and hand-power machines do not yet work steadily, but this is a defect which can no doubt be overcome by a little ingenuity.

The power, which may be derived from any of the common sources—wind, water, steam, gas, or hand-labour—is communicated to the cutter by a flexible shaft making 2,000 revolutions per minute. **The cutter** is nicely adjusted to a comb in the manner of the comb-like cutting teeth of an ordinary hand horse-clipping machine, and moves from side to side 4,000 times per minute over the comb, which rests upon the skin of the sheep, and threads its way among the wool close to the surface of the body. As the points of the cutter are protected by the comb, it is much less likely to cut the skin; yet the machine does cut if care is not exercised and the skin is not pulled level.

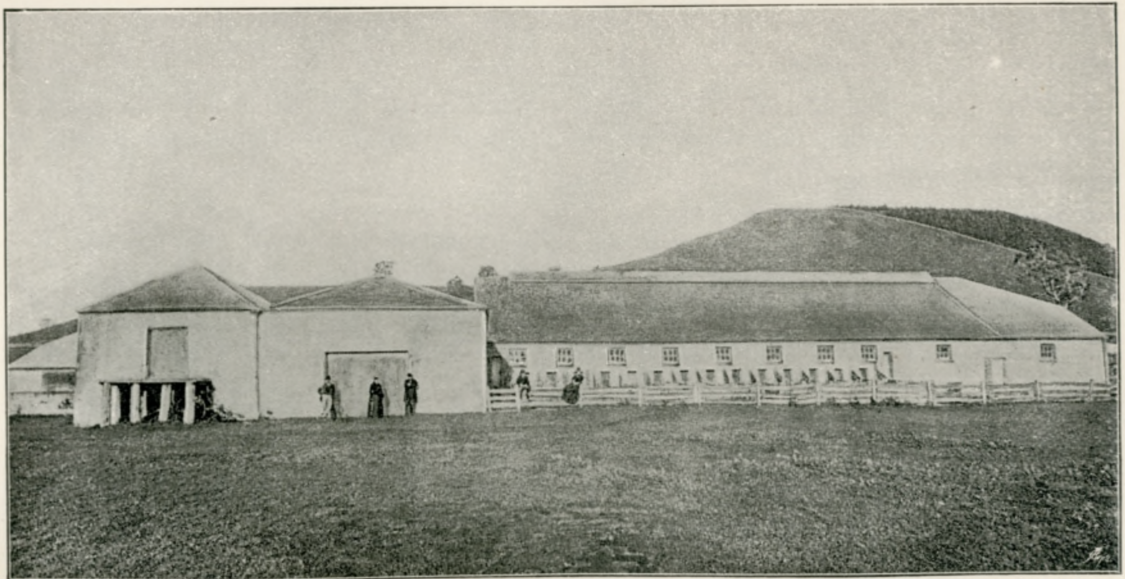
The Silver Sheep-shearing Machine has recently come under the notice of the public. The inventor, Mr. William Silver, is a young man who went out to the Colonies as a child, and is a resident at Tamworth, New South Wales. Though at a little distance the "Silver" machine is like the "Wolseley," yet on a closer inspection it is seen that with the exception of the cutting-knives they are very different. The flexible shaft of the Silver machine is made of a catgut core, jointed together, in parts of about a foot long, by metal hooks and eyes, with a steel ribbon about half an inch broad wound round it. It is claimed that the construction is more simple than that of the "Wolseley," and that it can be worked at a speed of 3,000 revolutions per minute.

Although the first important public trial of it was held so recently as the end of 1889, at Messrs. Younghusband & Co.'s premises in Melbourne, it may nevertheless be already called a success. A little time will be required to manufacture numbers sufficient to give the public an opportunity of pronouncing upon the merits of the machine on the stations and at actual work.

The regular shearer is frequently a small farmer or "cockatoo" from the neighbourhood of a large station, who wisely embraces the opportunity of earning a good wage for a short period of work, which is also a period of sociability and good-fellowship, and which must sparkle with incidents of humour and romance, where so many wanderers are brought together and permitted to detail their experiences of Colonial life. Some men do little else but shear all the year round. They begin in Queensland, where the season is earlier than in the other Colonies. After shearing is over there, they move southwards to New South Wales, then on to Victoria, and finally over to New Zealand, and in this fashion occupy their whole time. Another class begin in New South Wales in August, pass on to Victoria in November, and after shearing-time is past, turn to harvesting in the later parts of the Colonies, and to the digging of potatoes in the rich volcanic soil forming the famous potato-growing districts of the south-western portions of Victoria.

The work of shearing is done within a large building called a **wool-shed**, a prominent feature on all large sheep runs. The external shell is usually of timber, roofed with galvanized corrugated iron, and within it is fitted up with many ingenious contrivances for the expeditious and easy handling of the sheep during shearing-time, the busiest and most important period of the year. Most men take a special pride in having everything in perfect order and brought down to date. No doubt this accounts for the fact that each owner generally boasts, in a manner which is quite excusable, that his own wool-shed is the best in the Colony.

For this reason it was with no little hesitation that one wool-shed was selected to occupy the position held by that



The Author.

LXXV.—WOOL-SHED, MOORACK, MOUNT GAMBIER.

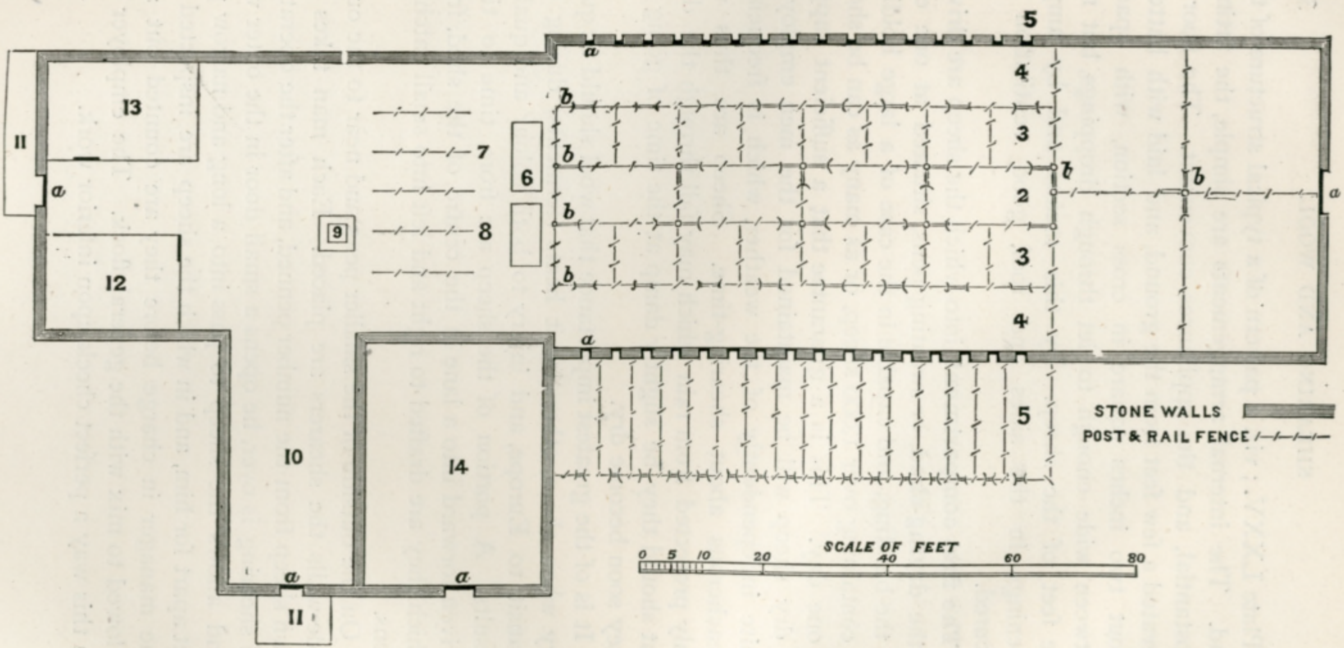
in Plate LXXV.; viz. a pattern of a typical structure of the kind. The internal arrangements are simple, the fittings substantial, and the appliances convenient. The floor is elevated a few feet from the ground, and laid with battens about two inches square in cross section, with spaces between wide enough to let through droppings, but not the feet of the sheep. By this means, and by ample openings in the sides and roof, good ventilation is secured.

The first compartment into which the sheep are driven is the **drying-shed**, or sweating pens, situated at one end of the building, and capable in the case of a large holding of containing over 1,000 sheep, or as many as can be shorn in one day. This is a guarantee that a sufficient supply of dry sheep will be maintained for the men employed, quite independently of the weather, which is frequently treacherous about shearing-time. Sheep are thus not only protected from rain which may fall through the day, but should they be slightly damp at the time of going in, they soon become dry.

It is of the greatest importance that wool should be quite dry when shorn, otherwise it heats (ferments) during the transit to Europe, and injury to both colour and quality results. A portion of the sheep are from time to time driven forward into a lane in the centre of the shed, from which they are drafted to right and left into small catching pens.

On the outside of the smaller pens, and near to the outer side-walls the shearers are placed. Each man takes his own sheep from the number penned, and after the operation of shearing is over, he opens a small door in the outer wall and allows the sheep to pass into a long and narrow pen set apart for him, and in which the sheep are inspected by the manager in charge before they are counted out and allowed to mix with the general flock. The employer has in this way a perfect check upon inferior work.

GROUND PLAN OF AN AUSTRALIAN WOOL-SHED.



See Key on the adjoining page.

There are many ingenious contrivances in the form of gate mountings, including means of tilting or opening and fastening internal division gates, to economise time and space, and make the work easy and light.

Next comes the sorting department, and the wool-pressing or baling apparatus; and at the further end from the drying shed is the wool store.

The wool as it comes from the sheep is at once roughly sorted and classified, and pressed into cubical bales of various sizes, but as a rule weighing from 336 lbs. up to 400 lbs. each. **The bales** are put together by means of a screw press, a lever press, or, in the case of the new adaptations, by hydraulic power. They are bound tightly together by bands of hoop-iron, and they are now sometimes enclosed in a canvas covering.

Even when this is done **the sorting** is by no means complete, as the wool has again to go through the sorting-room of the manufacturer, where the different qualities in each fleece are torn asunder and thrown into the different bins under the **two great main divisions**: (1) Long "combing" wools for worsted making; (2) Comparatively short "carding" wools; in **two subdivisions**: (*a*) Long-wools, and (*b*) Merinos. It is evident that if the whole process of classifying and sorting could be completed in the wool-shed a decided advantage would be gained in marketing. The various buyers would then be able to select wool suited to their different needs, without being forced to take a certain amount of wool of a quality for which they have no suitable purpose, and would in consequence be enabled to pay a higher price for what they actually required.

Key *to the Ground Plan of an Australian Wool-Shed.*

1. Four sweating pens to the right. 2. Race to "yard-up" sheep. 3. Catching pens. 4. Shearing board for 16 shearers. 5. Sixteen pens for shorn sheep. 6. Wool-sorting tables. 7. Bins of fleeces awaiting pressing. 8. Ditto. 9, Wool press. 10. Wool store. 11. Platform for loading wool. 12. Skirtings and pieces. 13. Lumber. 14. Cart and machine shed. *a*. Door. *b*. Gate.

The following table indicates the increase of the Wool Trade with the United Kingdom.

——	1879.	1884.	1889.
	Lbs.	Lbs.	Lbs.
New South Wales .	64,059,824	120,221,143	152,267,520
Queensland . . .	14,048,302	29,924,179	38,050,268
South Australia . .	46,181,518	45,859,187	42,814,220
Victoria	93,655,501	99,354,718	91,367,360
Western Australia .	2,523,913	4,475,718	7,973,479
New Zealand . . .	60,437,190	75,409,444	92,059,544
Tasmania	6,923,363	6,159,280	6,432,000
Totals	287,829,611	381,403,669	430,964,391

The washing of wool, either before or after shearing, is, with the exception of locks and pieces, which are generally scoured, almost entirely given up. It is only when the distance from the port of shipment is great and the cost of transport high that it is now practised in the case of a whole "clip" of wool, as the weight is reduced some 50 to 60 per cent.; but even under those circumstances the washing is not always done.

No less than 97 per cent. of the wool from Australia goes home in the grease, as manufacturers prefer it thus, and a cessation of the old practice of washing and scouring saves much trouble and expense. The grease or yolk is by no means valueless, so that the cost of carriage, which did not amount to much during the period of low freights, was not quite unremunerative. Lanolin ointment is made from the grease or wool-washings, and carbonate of potash is largely manufactured from similar material.

Washing the sheep was done in a creek (brook) or under a spout, after they had been soaked or steamed all night. This was injurious, not only on account of the unnatural treatment to which the sheep—delicate creatures as they are at the best—were subjected, but also from the necessity of keeping them too long from their natural pastures. The wool was also frequently damaged by the use of chemicals.

When the wool was shorn before washing, a method of washing practised in New Zealand involved the use of plant consisting of a wooden box-trows possessing three spouts emptying water into three oval tubs with the sides and half of the bottoms perforated, and so placed that the discharge of water into each tub induced a whirlpool motion or circulation of the wool, while the water and washings had free vent through the perforations.

The prices of Merino wool have from time to time fluctuated considerably, but for about 10 or 12 years before the recent advance the general tendency was downwards. About 1848 wool fell to *6d.* per lb. in the grease, and this nearly ruined a large number of squatters. It approached that point again in 1886. At the second series of the London sales for that year it was sold at 6½*d.* per lb. Between 1871 and 1875 the same class of wool brought 15*d.* per lb. in London.

The years 1880, 1881, and 1882 were good years, when unsorted wool ranged between about 11*d.* and 1*s.* 0½*d.* per lb., and fleece wool rose to close upon 1*s.* 6*d.* per lb. From that it has gradually, with slight variations, declined. Fleece wool never remained for any length of time below 9*d.* per lb. Since 1887, when there was a general improvement in tone, prices have been slightly on the rise. The April sales of 1889 saw a rise of ½*d.* per lb. on the rates of the previous sales, and the June sales a further advance of 1*d.* per lb. This brought fleece wool up to 1*s.*, or about what it averaged for a number of years before the inexplicable rise which occurred at the beginning of the eighties.

2 C

A rise of 1*d.* per lb. in the price of wool means an extra profit of 6*d.* per sheep to the Colonial breeder, or an increased return from the (in round numbers) 110,000,000 of sheep in Australia and New Zealand of £2,750,000. Of this sum £1,380,000 would belong to the colony of New South Wales, with its sheep stock of fully 55,000,000.

At shows, sheep of the same breed and kind, though possessing various qualities of wool, are put all into one class. They ought to be divided into at least four classes, according to the nature of the wool: (1) Superfine, (2) Fine, (3) Medium, and (4) Strong. In the development of the **Agricultural Departments** of the Colonies and in the extension of the means of agricultural instruction, it is to be hoped that the special branch of wool culture, which is of such vast importance to the country, will not be neglected.

Each Colony ought to have an expert, who would devote the whole of his time to the study and practical application of the means of improvement in the quality of wool, and also attend to the breeding of sheep of better quality, for the double purpose of mutton and wool production. Certain districts grow wool of one kind better than wool of another kind, and much money is lost in attempting in ignorance to grow the wrong material. For example: on much salt bush land it would probably be better to grow clothing wools than such combing wools as can be there produced.

Instruction in wool classing and sorting should be made a special branch of the department. A knowledge of the requirements of the various leading **markets** ought likewise to be in the possession of the wool experts, and should be made easily available to those interested. This special branch would grow in importance from year to year as the centres to which wool is shipped become more numerous, as they naturally must do with the steady increase of the North American demand, the immediate development of a trade with Japan,* and the realisation of a prospective business connection in this line with China. Already a considerable amount of wool is sold by auction in the Colonies by such firms as Goldsbrough, Mort and Co., Melbourne, in place of being shipped home by the growers.

Cross-bred wool from Australia is up in price, not only in sympathy with the general rise in wool, but also because Lady Bective and others advocate the superior quality of "homespun" stuffs. Pure Lincoln wool gets beautifully silky, soft, and lustrous after a few generations in the warmer parts of the Colonies, where this stock is kept. This is what ought naturally to be expected, judging from the way in which Merino wool grown in Britain continues to degenerate in its fineness of quality in succeeding generations. It is only excessive tropical heat that tends to develop a hard and hairy, or "kempy" condition of coat.

The success of **Dr. Jaeger's system of clothing**, which practically excludes dyed wool from underclothing, has raised the price of natural black wool in a marvellous way. The Australian Colonies, with a wool crop valued at 19¼ millions sterling, are indebted to Dr. Jaeger for the improvements he has initiated in the matter of clothing and bedding. The work of reform, which in a word means the displacement by woollen materials of all cotton or linen portions of dresses or covering by day or night, is now carried on by Dr. Jaeger's Sanitary Woollen System Co., Ld., 95 Millar Street, London, E.C. The effort, which has met with a large measure of success, should possess a special interest to all Colonial wool-growers.

* A little while before the Author's arrival in Brisbane a Scotchman of the name of Murdoch, at one time a teacher in the Grammar School there, had been sent by the Japanese Government to try to arrange about shipments of Merino wool to Japan. This the Japanese intend to manufacture themselves and by their own labour. They will employ British workmen only to teach them how to do the work.

CHAPTER XXX.

CATTLE IN AUSTRALIA AND NEW ZEALAND.

The Old Durham Breed—Imported Bates Shorthorns—Cattle as Pioneers of Sheep in a New Country—Abnormal Growth of Hoof—Increase of Sheep in New South Wales—Decrease of Cattle—Numbers of Cattle and Sheep in Queensland—Station Cattle and their Treatment—Devon Cattle—Ferine Cattle—Cattle Breeding only Profitable on a Large Scale—Inferiority of the Common Cattle of South Australia—Apathy in the Matter of Improvement—Degeneration of Cattle and Sheep through Crossing with the Inferior Stock of "Selectors"—Queensland the Great Cattle-Breeding Centre—Prices and Transit of Store Bullocks—Prices of Fat Cattle at Flemington Market—Injury to Fat Cattle during Transit—Zebu or Humped Indian Cattle—The Buffalo—General Characteristics—Northern Settlements at First Unhealthy—How Buffaloes were Originally Introduced—Their Present Haunts—Dr. Leichhardt and Other Authorities—The Buffalo the Milch Cow of India—Results of Mr. Howman's Inquiry into the Quality of Buffalo Milk.

By far the greatest proportion of the cattle of Australia and New Zealand belong to what is termed the old **Durham breed** (that from which the pedigree shorthorns of the present day were selected), or crosses of various breeds with the Durham preponderating. **Improved shorthorns** of the best blood, almost wholly belonging to the Bates variety, have been imported from time to time; but although the original station cattle have been improved, and are still being improved in flesh-producing power by the use of well-bred shorthorn bulls, it is generally believed that *tuberculosis* is becoming more prevalent on account of the greater amount of pedigree blood which the common cattle now possess.

It is impossible to make any definite statement with regard to this extremely important matter, because *tuberculosis* is not unfrequently mistaken for *pleuro-pneumonia* by owners or cattlemen, who are not conversant with the specific morphological changes that take place in the affected parts, and are peculiar to each disease.

The Colonies in the matter of stock are essentially sheep and mutton producers, rather than cattle and beef producers, yet **cattle** perform certain special and indispensable duties which will necessitate their continuance and also their increase to some extent, though their multiplication, even making due allowance for the difference in fecundity of sheep and cattle, will most probably be at a much slower rate. Cattle must continue to be reared in numbers sufficient to supply beef to a rapidly increasing population.

The frozen meat trade does not offer as yet bright prospects for the owners of cattle-stations, inasmuch as beef is not, with the present appliances and known methods of working, as suitable for complete freezing as mutton has proved to be ; nevertheless, it is necessary in breaking in new country to **stock with cattle** in the first instance, not only in the fern-growing lands of the North Island of New Zealand, but also in the newly taken-up inland tracts of Australia.

Much of the surface having been in its pristine state but rarely trodden by large animals in any considerable numbers, is in an extremely loose, open, and unconsolidated condition—so much so that it would be quite impossible for sheep to travel over it in search of food and water. **Cattle** therefore are required in the first instance to trample down and consolidate the surface before sheep (which give less trouble and are more remunerative than cattle) can be put on the land.

Even on cattle, taken to this loose soil, enormous **elongations of the hoofs** are developed, so that, if they are driven great distances, the horn cracks or breaks off, and the animals are rendered helplessly lame. Pioneer cattle, nevertheless, get into excellent condition when they are not disturbed.

Not only are cattle and sheep liable to unnatural horny growths, but **horses** also suffer in the same manner. It is recorded that **Sir Thomas Mitchell**, Surveyor-General of New South Wales, found, away on the untrodden inland country, about the end of the thirties, or beginning of the forties, of this century, a horse with its feet immensely overgrown from want of wearing. He and the natives who first noticed the tracks could not make them out, and fancied they were produced by some new species of animal.

Another excellent reason why soil should have cattle placed on it first is, that sheep get enveloped in clouds of fine **dust**, and the wool is thereby much deteriorated.

In what has been said will be found a complete explanation of the **variation** in the relative **numbers** of sheep and cattle in New South Wales during the period of the rapid increase of its stock and the stocking up of the back parts of the grazing or western territory.

NUMBER OF CATTLE IN NEW SOUTH WALES AND QUEENSLAND.

—	1871.	1881.*	1889.†
New South Wales‡ .	2,000,000	2,597,348	1,741,592
Queensland . . .	1,168,235	3,618,513	4,872,416

NUMBER OF SHEEP IN NEW SOUTH WALES AND QUEENSLAND.

New South Wales .	16,200,000	36,591,946	50,106,768
Queensland . . .	7,500,000	8,292,883	14,470,095

* For twelve months ended in March, 1880.

† Year ended 31st December.

‡ For 1890 cattle numbered 1,892,993 and sheep 55,477,404.

The Government returns here quoted show that in 1871 New South Wales had (in round numbers) 2,000,000 of cattle. In 1881 these had increased to over 2,500,000; while in 1889 they had gone down to little more than 1,700,000, or a falling off in eight years of almost 1,000,000. During the same period the **sheep** increased rapidly. Beginning with 16,250,000 in 1871, the numbers rose to 36,500,000 in 1881, and to 50,000,000 in 1889.

During the first decade both classes grew in numbers, as the cattle—on being replaced by sheep—were pushed further back into the unoccupied areas. Within the last eight years sheep have actually driven cattle out of the colony, but the deficiency in New South Wales has been more than made up by the increase of over 1,000,000 in Queensland.

The numbers of **cattle in Queensland** at the three periods were as follows:—1871—1,168,235; 1881—3,618,513; and 1889—4,872,416. During the same period the **increase in sheep** was roughly, from something under 7.500,000 in 1871 to 8,250,000 in 1881, and nearly 14,500,000 in 1889. Here again there is a rapid increase of cattle from 1871 to 1881, and but a moderate increase of sheep, while from 1881 to 1889 the chief increase has been in sheep, that in cattle being small in comparison.

Station-cattle are bred and reared in a semi-wild condition, subject only to the judicious guidance of a man on horseback—any one on foot in a mob of fresh cattle would be in a decidedly perilous position. At one time it was thought to be impossible to manage cattle except through the employment of the most **severe punishment** by the long-lashed and short-handled stock-whip, which, in dexterous and experienced hands, is capable of inflicting painful flesh-wounds.

Such treatment among breeding-stock, when carried to excess, as was too often done in the early days, though it awakened fear, did not inspire in a herd confidence in their guardians. It was such treatment that first gave rise to the idea that the Devon breed of cattle kept under Colonial conditions were wild and dangerous. Under the present milder method of management it is found that Devons are thoroughly amenable to treatment, and owing to certain special characteristics are well-suited for some parts of Australia.

In certain back-country places, as in the west of New South Wales, **cattle have broken completely away** from domestication, and as they relapse to the ferine condition some of the changes that take place are extremely interesting. **In colour** they become much darker than cattle under domestication—black, black and white, and brindles being common varieties of colour. They take **shelter** during the daytime in the native brush-wood or scrub-land, and hence are known by the familiar name of "scrubbers."

During the night the "scrubbers" come out to the open to feed and to procure water, and are hunted down and shot in the moonlight, or are decoyed by tame cattle and driven into traps, or yards with high and strong fences.

Wild cattle become wary of the approach of man and flee at full speed on his appearance. They cannot be turned by a man on horseback like station cattle, but if hard pressed or wounded will charge wildly at anyone who approaches. The sport of hunting them is exciting but dangerous both to man and horse, from more than one point of view. To the dangers from the infuriated quarry are to be added those arising from the imperfect light of the moon, the irregular surface of the ground from the presence of stumps, stones and branches, and the hanging boughs of trees.

Though shy, wild cattle are a great source of annoyance and even of loss on a station. They entice station-cattle to go with them, and by force of example to acquire habits almost as wild as their own. These wild herds are also hotbeds of *Pleuro-pneumonia*, which is from time to time communicated to domestic cattle. So that with wild cattle at large, though not so numerous as they once were, the stamping out of the disease seems impossible.

The fact that so many cattle in the Colonies are reared in large numbers and at the cheapest rate makes it unadvisable for **small holders** to attempt to breed and rear them, unless for a special purpose like dairying. They ought, if possible, to turn their attention in another direction. For example, where a market is to be had for hay, it would never pay a small occupier to feed his cattle on fodder secured at the prevailing high rate of wages. Provided such an occupier can in ordinary years just sell his hay so that he will not lose money, the high prices he can secure during the years of scarcity from recurring periods of drought will return him a fair profit. Instances were frequently encountered where cattle had consumed in a comparatively short time an amount of hay which was worth more than the animals themselves.

The wretched state of the **common cattle** on small holdings in many parts of **South Australia,** and the modicum of interest taken in them by their owners, showed clearly that they returned little in the way of profit. The animals referred to belong to a mixture or cross of a number of old breeds brought to Australia at a very early date; mingled with the old Durham, distinct traces of the Long-horn breed, almost extinct in this country, are to be seen. Devon blood shows its presence in some places, and quite a number of the oldest forms are polled.

To show the **lack of interest** in the improvement of the breed of cattle, in the case of the South Australian "Cockatoo," the following incident may be recorded. The Hon. J. H. Angas of Collingrove, Angaston, anxious to improve the breed in the district, presented to the local Farmers' Association a bull which would probably have brought £300 had it been sold, as it was out of a well-bred cow by an imported bull which cost £2000; yet the farmers would not subscribe to feed him, and he was left to pick up whatever might be got from the roadsides and hedgerows. Three prizes also were offered for the best cows with calves at foot by the bull in question, but there was not one entered for competition, although no fee was required.

If it be asked how it is possible to improve or elevate a class of people so lost to their own interests as these South Australian "Cockatoos" seem to be by this inaction, the natural reply is, **Through education**, because it is evident it must have been ignorance which prevented them from taking advantage of this decidedly handsome offer. It is also possible that had they made strong efforts to secure an improved breed of cattle, it might have involved a serious **change in the management** of their bovine stock for which they were not prepared, or possibly could not afford.

With the low prices prevailing, **cattle** can only **be tolerated** at all on many farms as long as they cost next to nothing for keep. Their office is simply to pick up anything which cannot be otherwise utilised, but they must involve no outlay. Though the cattle are miserable and return little, that little is all profit, as, through many generations of starvation and privation, they have acquired the faculty of living, though it be but poorly, upon the least imaginable amount of food.

The native cattle are thus capable of living and giving a return of some sort where the shorthorn and its "grades" by native cattle would certainly die. Possibly in what has been said may be found the explanation why the well-bred shorthorn was at once put upon his trial to see how little he could live upon!

This ignorance or carelessness on the part of the small holders leads to deterioration of stock when they occupy the position of **"selectors" scattered about** in a large holding. Their inferior cattle and sheep, often as badly fenced or guarded as they are badly fed, break out and leave inferior crosses to mingle with the squatter's stock.

It should be remembered that **Queensland** is now the great **cattle-breeding centre,** and produces finer fat cattle than New South Wales; but stocks are also disposed of to be taken south to finish on the banks of the Hunter River, and other places suitable for cattle. Land in the humid, eastern, sea-border country is too wet to carry sheep with advantage, and cattle are resorted to. Well-bred Durham or grade-shorthorn "**stores**" or lean cattle in Queensland at four and five years old cost about £3 15*s.* to £4 each respectively.

The journey coming south from Queensland into New South Wales, at the rate of about eight to nine miles a day, occupies ten or eleven weeks, and the expenses by the way amount to about 6*s.* per head. At one place on the Hunter a lot of 800 fat cattle corresponding to these had been sold off, weighing 7½ cwts. each, at £7 13*s.* 6*d.* on the pasture. Cattle imported from the north are said to be more susceptible to *Tuberculosis* and also to *Pleuro-pneumonia* than local-bred cattle.

The prices on Monday, 29th July, 1889, in the Homebush sheep and cattle yards (situated about nine miles from Sydney) were: prime heifers of 550 lbs. weight, £5 17*s.*—lighter varieties £5 5*s.*—and bullocks of about 900 lbs., £9, or an average of about £1 per 100 lbs. It was stated on good authority that 1½*d.* per lb. for beef (12*s.* 5*d.* per 100 lbs.) paid the producer, so that a good margin was left for marketing expenses and extra profit. Dressed carcass-weight to live-weight bears the same proportion as that between the old Smithfield stone and the Imperial stone, viz. as 8 : 14.

Cattle become remarkably fat and well-favoured while on their pasture-ground, but in **bringing them down to**

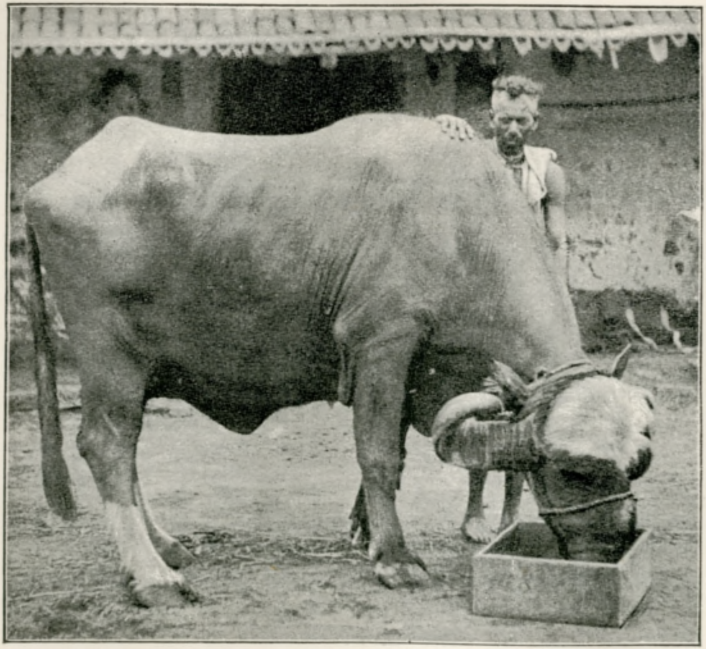
market they are subjected to sufferings to which there is no parallel in this country, unless it be found in the Irish cattle-shipping trade, and even there it cannot be so bad, because the animals transported are younger and not in a semi-wild and ferocious state. Much of the flesh is lost, but the cruelty to the cattle, apart from a consideration of money, makes an alteration of system necessary.

Horned cattle, when confined within a narrow and fenced-in space, severely injure each other by horning. The author counted no less than eleven scars on one side of an animal which had been confined with others in the railway-waggon, and, finally, in the market-yards. Not only is the system of shutting these half-wild and terrified creatures up together cruel, but the loss in quantity and quality of flesh is most serious.

Specimens of the **Zebu or humped cattle** of India, scientifically classified under the name of *Bos Indicus*, have been taken to Australia and have been bred as park cattle by a few men of means. They are sometimes erroneously called by the country people humped buffaloes. They are in no sense of the term buffaloes, and the true buffalo is not humped.

The buffalo (*Bos bubalus*) is semi-aquatic in its habits, and is consequently found to thrive in marshy or flooded land. It submerges itself more or less in water or in soft mud as a protection from the heat of the tropical sun. It is sometimes familiarly termed the mud-buffalo.

The following **description of the general characteristics** of the animal is borrowed from the author's work, 'India in 1887,' and may be more readily followed after a reference to Plate LXXVI. Buffaloes are extremely ugly. The horns, which vary in size and form, leave the crown of the head in a downward and backward direction ; they are of a dark brown or black colour, more or less flattened and marked with coarsely finished corrugations or rings indicative of age.



The Author.

LXXVI.—INDIAN BUFFALO COW.

The smooth and polished-looking skin is usually black. Frequently one or more of the legs are white, and there may be a white spot on the forehead or on the tip of the tail. Dingy white specimens, probably true albinoes, now and then appear. They are not so hardy as those with black skins.

Buffaloes are remarkable for their great girth round the heart and for their deep bodies and well-formed shoulders nicely joined on to the forward ribs. The withers are sharp and rise above the level of the back, forming a ridge but not a hump. The back also rises considerably above the general level, immediately behind the region of the kidneys. The hind-quarters, from a European point of view, are particularly defective. These are short, drooping and badly packed, and the thighs are thin and poor. The bones of the limbs are strong and well-formed.

The hair of a full-grown buffalo is long and wiry, but being sparsely distributed, it affords little protection to the body. It is usually black or reddish brown in colour, except on the patches of white skin, where it is white. A young buffalo possesses a good covering of hair usually of a lighter colour.

Buffaloes are more intelligent than ordinary cattle, and when roused and furious are consequently more dangerous; when tame they are also more docile and affectionate. When fighting they put the head well down, and charge furiously, so that in coming in contact with their opponents they butt after the fashion of fighting rams.

Indebtedness is hereby acknowledged **to Mr. P. R. Gordon**, Chief Inspector of Stock at Brisbane, Queensland, for much of the following information relating to the existence of large herds of thousands of wild buffaloes in the North of Australia. It appears that about fifty years ago **settlements were started** by the Imperial Government at Raffles Bay and Port Essington—on the Coburg Peninsula, which forms the northern extremity of the

Northern Territory of South Australia—with the view of ultimately populating the neighbouring country.

These settlements, however, had to be abandoned on account of the unhealthy character of the locality. All of the extreme northern settlements were unhealthy for a time—particularly those surrounding the Gulf of Carpentaria. It is invariably the case that **fever prevails** in a tropical country which possesses a luxuriant vegetation when the surface is broken and fresh earth is exposed to the air to give off malarial exhalations. As settlements increased and stock was imported, fever gradually disappeared from the settlements, and the country is now healthy.

Buffaloes were originally introduced into Australia from the Malay Islands, and either escaped or were left behind when the settlements on the north coast were broken up. **Port Darwin** is the centre of the region on the mainland which is now **their haunt,** but they also abound on Melville Island, which lies to the north of Port Darwin. Stray bulls have wandered as far east as Charters Towers and the stations on the Gulf of Carpentaria. Mr. E. Palmer, M.L.A., states that a bull killed upon his run weighed nearly a ton. Several have also reached Mr. Hann's Lawn Hill Station.

Dr. Leichhardt, in the journal of an expedition made in 1844–5 through the buffalo country, records the facts that they were then numerous; that they were remarkable for thickness of skin (almost an inch) and solidity of bone, "which contained little marrow, but that little was extremely savoury." The name given to them by the blacks was "Anaborro."

Mr. Spalding, the taxidermist of the Brisbane Museum, is one of the few men in Queensland who have seen the animals in their adopted Australian habitat. He found a man making a handsome income by shooting buffaloes and selling the skins. A special bullet had to be used to penetrate the hide on account of its extreme thickness. The Buffalo is the great **milch cow** of India, and it is possible that in time when the country is more settled up it may come to be the milch cow of the tropical regions to the north of the Australian continent.

The recent visit of Mr. Henry A. Howman to India, on behalf of the Dairy Supply Company, London, has brought to light the extremely interesting and important fact that buffaloes' milk is much richer than cows' milk. Analyses of buffaloes' milk, made by Dr. Barry, the Government Analyst, at Mr. Howman's request, showed $7\frac{3}{4}$ per cent. of butter-fats and about 18 per cent. of total solids. An English cow's milk gives from 3·5 to 4 per cent. of butter-fats and from 12 to 13 per cent. of solids.

The yield of butter from a given quantity of milk after cream separation confirmed the accuracy of the scientific test, as 10·43 lbs. of milk produced one pound of butter, whereas of English milk it frequently takes 25 to 30 lbs. to give one pound of butter.

The analysis of the milk of the Indian humped-cow showed it to be of a quality about equal to milk produced by Jersey cows. In flavour buffaloes' milk is different from cows' milk, but it is wholesome, and the preference for a natural flavour in one kind of milk as compared with another is merely a matter of training or upbringing.

CHAPTER XXXI.

SHORTHORN CATTLE.

The Original Durham Breed—Pure-Bred Shorthorns—Influences acting against the Increase of Pure-Bred Shorthorns—Favourite Colours—Pure-Bred Herds Visited—(1) Hill River—(2) Mertoun Park—(3) Bundoora Park—(4) Baroona—(5) Canning Downs—(6) Elderslie—(7) Windsor Park—Necessity of a Change in Breeding Shorthorns—The Illawarra Dairy Shorthorn Grade—The Bull Major—The Prize Takers—Characteristic Points—Mr. Daniel Boyd's Dairy—Dairy Herd-Book, Kiama—Conditions of Show-Yard Milking Contests—Daily Yields of Milk—Food of Cows in Milk—Calf-Rearing—Pasture Plants—Prices of Dairy Cattle—The Kiama District—Butter-Making.

The descendants of the old Durham breed imported into the Colonies early in this century form a most important element in the herds of Australia. In many cases they are kept distinct from the imported shorthorn, or the so-called improved variety of the breed ; in others they are crossed by recently imported bulls or by their Colonial-bred descendants. The names of Messrs. Fanning and Griffiths are intimately associated with the introduction of the best specimens of the old Durham in New South Wales.

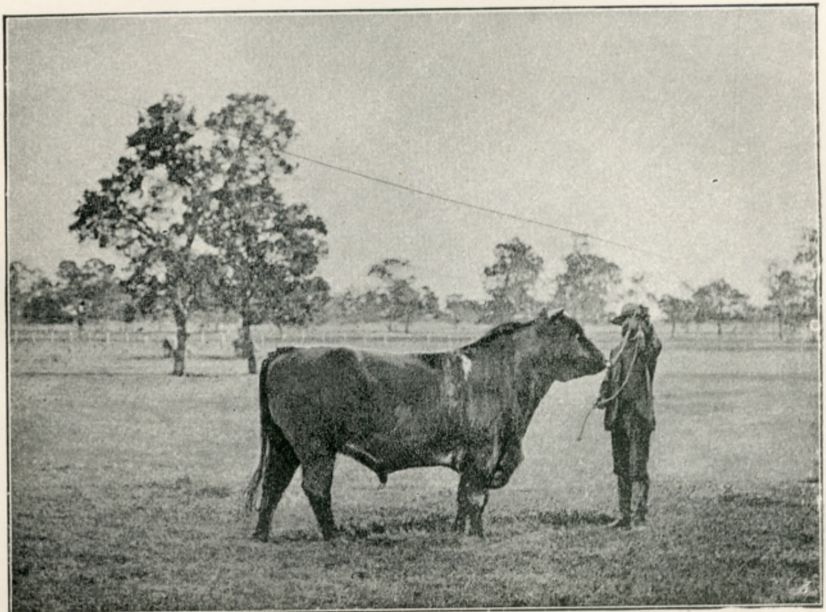
The pure-bred shorthorns, whether imported or reared in the country, are largely of **Bates** strains of blood. If it were not for the impression that **tuberculosis** is more prevalent among high line-bred shorthorns* than among

* Mr. P. R. Gordon says that tuberculosis in Queensland is pretty well confined to line-bred cattle.

The Author.

LXXVII.—BATES SHORTHORN BULL—"EARL OF SHAFTESBURY."

The property of the Hon. WM. McCULLOCH.



The Author.

LXXVIII.—BATES SHORTHORN BULL—"BARMING GRAND DUKE"—
AT MERTOUN PARK, COLAC, VICTORIA.

the ordinary country-bred cattle, no doubt more or less of their blood would soon find its way to all parts of the colony.

Another drawback to the extension of the shorthorn breed was the straitened circumstances of the large squatters due to the losses sustained through a series of years of excessive drought. They simply could not afford to pay the high prices,—100 guineas or more for a two-year-old bull—and prices of pure-bred stock have fallen, and the demand also decreased considerably. There is now an increased demand, but the prices have not gone up to a corresponding extent. For the Queensland trade dark red or deep claret-red **colours** are in favour; whereas, in the more southern colonies, although reds are abundant, the old-fashioned roan is still preferred.

The author visited the following **pure-bred herds** belonging mostly to the Bates variety of shorthorn :—

(1) **Hill River,** near Clare, South Australia, numbering about 100,—the property of the Hon. J. H. Angas;

(2) **Mertoun Park,** near Colac, in the western district of Victoria, where there are over 200 females and about six stud bulls—the property of the Hon. Wm. McCulloch;

(3) **Bundoora Park,** near Heidelberg, Melbourne, numbering 265—the property of Mr. Samuel Gardiner;

(4) **Baroona,** Whittingham, to the north of Sydney—the property of Mr. A. A. Dangar;

(5) **Canning Downs,** Warwick, in Queensland, not far from the New South Wales border—the property of the Hon. J. D. Macansh;

(6) **Elderslie,** near Oamaru, in the South Island of New Zealand, in which there are about 50 breeding females—the property of Mr. John Reid;

(7) **Windsor Park,** adjoining Elderslie—the property of Mr. Edward Menlove.

It would be invidious to draw comparisons between the various herds; suffice it to say that some of the best shorthorn blood that this country has produced is to be found in the possession of those colonial breeders.

It must be admitted by the men who are most deeply interested in this special line of breeding, that shorthorn cattle did not go ahead in the matter of improvement for a number of years, as they ought to have done. It would seem as if some strains had bred themselves out of a sufficient stock of constitutional vigour, and the breed, (although a decided improvement has again set in during recent years,) is not what it might have been had a few breeders of undoubted skill—men with the capital and the pluck necessary to destroy inferior specimens—been throughout in command of the situation.

It is granted that the indiscriminate breeding together of Booth and Bates cattle might lead to unsatisfactory results unless sound judgment and the greatest care were exercised in the elimination of all inferior animals and in the proper mating of those that were reserved as breeding stock.

The two strains undoubtedly differ very materially from one another. Booth cattle have been bred chiefly for massive frames and heavy flesh ; Bates more for early maturity, for milking qualities, and for style or carriage.

Bates and Booth both resorted to crossing with animals outside their line-bred cattle when they found it necessary to do so to restore constitutional vigour in their herds. There is no reason why an expert breeder of the present time should not do the same when necessary, and, moreover, in doing so there is no reason why he should not, if he be a Bates breeder, select an animal of a suitable type from the Booth family, and *vice versa*.

In this country we have had comparatively little systematic commingling of Booth and Bates blood, as the practice was not favoured by the majority of breeders until recent years. Prejudice had no doubt a good deal to do with the existing state of matters, and should for various reasons find no foothold in the Colonies, where the best well-bred

LXXIX.—BOOTH SHORTHORN BULL—"ROYAL STUART" (40,646).

Bred by Mr. BOOTH, of Warlaby, Northallerton.

LXXX.—Champion Shorthorn Heifer—"Augusta IV.," of Mixed Booth and Bates Blood.

The property of Mr. Hope, Bow Park, Ontario.

animal, irrespective of what leading family he belongs to, ought naturally to be the object in view.

It is highly probable that a well-conceived system of crossing Booth and Bates cattle would restore some of the suppressed vigour of the shorthorn breed and along with the impetus to improvement given by change of climate and other conditions from Britain to the Colonies, form a new starting-point from which to build up a new strain possessing the good qualities of both of the above-named old-established divisions of the breed. Mr. Angas had in his herd carried out the above suggestion sufficiently to form an excellent indication of the feasibility and usefulness of the practice.

The relative prices realised at sales of highly bred shorthorns, as compared with those got within recent times for pure-bred but not line-bred herds, form a distinct indication that something in the way of a change from old grooves is becoming an accomplished fact in England.*

Although only the Bates and Booth cattle have been here discussed in their relation to the Colonies it must not be inferred that these are the only famous shorthorns in Britain, as there exist Collings families, which Bates and Booth never possessed ; the Wilkinson sorts, which were in high repute at Sittyton (for some years the fountain head of the best shorthorn blood in Scotland till the disposal of the herd in 1890) ; the Mason families (much appreciated in Scotland and Ireland as well as in England) ; and the Knightley strains, famous for milking qualities. These are but a few out of many that could be mentioned, showing that the shorthorn, as befits its cosmopolitan

* In the north of England during the autumn of 1890 there were in the same county and in the same week two remarkable sales of shorthorns. The selection from a herd of line-bred cattle averaged £20 per head, while a mixed but pure-bred herd averaged £63 per head. It is only right to state that there was a decided difference in the ages and conditions of the animals representing the respective herds, but not sufficient to entirely account for the extraordinary results in the matter of prices.

character, has a source so wide and deep that there is no danger of any want of fine materials for suitable and successful blending whenever breeders desire to introduce change of blood.

Yet another variety of shorthorn-grade or Durham has been reserved for a special and separate notice, because in this instance—that of **Illawarra dairying** grade-shorthorn —the object for which it has been reared for generations is that of milk production. As has been too much the case in Britain, the members of the herds previously mentioned have been bred more for flesh than for milk. The district under notice is in the county of Camden, to the south of Sydney and in the neighbourhood of Illawarra and Kiama. The best milkers of the excellent class of dairy cattle there seen, are said to be descended from a famous bull called "**Major**" belonging to the old Durham breed and imported by Mr. Lee of Bathurst. He was calved during the voyage out, and it is recorded of him that he was "sow-mouthed," or in other words had a short lower-jaw. He must have been a bull of great potency in stamping milking characters upon his offspring by the common cows of the country. These cows would be mostly of the Durham breed, although Ayrshire blood was also present in some, as is evident from their descendants. It is extremely interesting to notice, that although the milking powers which the bull "Major" transmitted have been perpetuated, there appears to have been no correlated recurrence of the defective jaw among his progeny.

The prize-takers as a rule belong to a special type of animal. The colour is commonly red with patches of white, mostly in the region of the under-line, although light roans of the finest quality also appear. The horns are usually small and bent downwards and inwards so that when the cows fight, which they frequently do, the horns become locked, and the horny sheath gets torn off, to the injury of the appearance of the head, which at the

LXXXI.—SHORTHORN BULLS—"WILD PRINCE 6TH" (42,620)—"DUKE OF HAZLECOTE 62ND" (4,9312).
The property of the Hon. J. H. ANGAS.

LXXXII.—Group of Shorthorn Cows.

The property of the Hon. John Howard Angas.

best, according to modern ideas, is too long to be handsome.

These cattle are small for shorthorns and comparatively thin-fleshed while in milk, although they get into good condition when not in "profit." They are well and not too highly set on their limbs, and have good length of quarters and depth both in barrel and flank. Though by no means too heavy, they are not conspicuously light in the breast and forequarters. In general appearance they are not unlike some of the shorthorns bred in this country by Mr. Stratton, and for which he claims special milking proclivities. The mammary glands or udders resemble much more the udders of Ayrshires than of shorthorns.

It has been asserted that this breed is not the old Durham breed in its purity, but that it was through crossing with the Ayrshire that the reduced size and superior milking qualities were obtained. Be that as it may, there is now a distinctly marked type common to the best animals, that is freely transmitted to their descendants. All that is required is the steady maintenance of purity by the owners of the best herds, so that the true type may be preserved and encouraged to perpetuate itself.

A number of places were visited where a few good **dairy cows** were seen, but the largest number of really good cattle * were found at the Freehold of **Mr. Daniel Boyd,** who milks, by the aid of his own family, a dairy of 100 cows from which butter is made by churning the whole milk. The work of churning is all done by hand and must entail an enormous amount of labour of an unnecessary kind, upon a family which for hard work and plodding

* Mr. J. T. Cole, at Poplar Grove, won the second prize for a milking cow of the district, with a yield of 63½ lbs of milk secreted within twenty-four hours and given at two milkings, the first prize cow yielding 69 lbs. Mr. Hugh Dudgeon of Minnamurra also possesses a number of good cows of the type referred to.

industry may be taken as a tvpe of what the young Colonial agriculturists ought to be, if they are to keep up and carry forward the reputation of the early pioneers, and successfully compete with Great Britain and the other chief centres of agricultural production, for a share of the good things to be had by a connection with the markets of Europe. This gentleman owns a number of cows of the local breed, which are pictures of symmetry, and as milkers approach as near to the present limit of perfection as has been reached in the case of dairy cattle kept and treated in a natural and ordinary way. If Mr. Boyd and his rivals in the breeding of these animals are only careful about purity of blood for a few years, and continue upon the same lines on which they have worked in the past, a class of cattle which will make a reputation for itself, will certainly be the outcome. A large proportion are prize-winners and some 15 of the 100 cows milked are entered in the Herd-Book of the Kiama Agricultural Association

When the standard of merit is considered in the light of the rules of the Association it will be admitted that to possess 15 per cent. of pedigreed milking-stock is to occupy a position worthy of credit. **The herd-book** was started in November 1883 and its wonderful success, like that of the co-operative system of butter factories so largely adopted in the same locality, was in a great measure due to the indomitable enterprise and energy of the President of the Kiama Agricultural Association, Mr. David Lindsay Dymock, J.P.*

The two most important **rules** governing the entries are: (1) "That the animals entitled to a place in the Herd-Book shall be—any cow which has produced at least 12 lbs. of butter or 350 lbs. of milk in one week; the progeny, male or female, of all cows qualified as above for a place in the Herd-Book; and any bull, four of whose progeny have passed the required test." (2) "That tests for the above

* A native of Edinburgh who went to the Colonies when a boy.

purpose shall take place in the same locality, the object being to place competing animals on an equal footing."

Though it would be quite impracticable upon a large scale, to comply with the second regulation, still there is much in the conditions of entry in this herd-book to encourage a high standard of proficiency and to induce us in this country to follow somewhat on similar lines. The weak point in the arrangement is that there is no effort to keep distinct breeds pure. A mongrel cow that would not breed true has a perfect right to enter the herd-book, provided she comes up to the required standard as to milk or butter production. In this country the system could be applied to members of distinct breeds, and the drawback would then be obviated ; blood and performance would go together.

In show-yard milking contests all animals competing have to be milked three times within twenty-four hours, in the presence of two members of the Committee—the second and third milkings only being weighed. By this means the true yield for twenty-four hours is obtained and any attempt to "heft" or leave milk in the udder during the time of trial to increase the yield above a normal amount, is prevented. A "mealy" roan cow which took the first prize in 1889, the property of Mr. Boyd, produced at the milking trial 35 lbs., 35 lbs. and 36 lbs. at the three milkings, respectively or with the first milking set aside, 71 lbs. of milk, equal to almost seven imperial gallons,* as the produce of twenty-four hours.

Another heifer at two and a half years old gave 91½ lbs. of milk at three milkings—even a more remarkable amount, taking age into consideration, than in the case of the cow. When it is remembered that few dairies of ordinary cows in Great Britain average more than three gallons of milk per cow, per day, even at the height of the grass season, it will be seen what a margin over and above

* An imperial gallon of milk weighs about 10 lbs. 4 ozs.

this amount the successful Kiama breeder has in the case of his best cattle. In the district under discussion cattle are not artificially fed with concentrated food. While on grass, if this is not plentiful, they are supplied with green corn or an allowance of *Sorghum saccharatum*, (the Chinese sugar-cane,) which is grown pretty extensively and yields under favourable circumstances, up to 40 tons per acre of green succulent forage.*

Full milk is so valuable for butter-making, that, after the first few days, the calves are reared at pasture and kept in excellent condition, on two gallons of separated milk per day.

During certain prize competitions, in addition to pasture consisting of grass or grass and clover, cracked corn (maize) and bran are added to the cow's food, and, in some instances, sour milk. Butter being the prominent marketable commodity, it is difficult to dispose of all the skim milk to advantage. This question is now one of the greatest urgency in butter-making districts in our own country.

It is a well-known fact that cows get very fond of, and do remarkably well upon either skim milk or whey, given to them as part of their food. Though some are shy at

* So far back as 1879 the Kiama Agricultural Association offered five prizes of £6, £5, £4, £3, and £2, in order of merit, to the five best butter-producing cows on home pasture. The following figures are selected from a published result of the competition :—

Date of Test.	Weight of Milk per Week.	Weight of Butter.		Food in Addition to Ryegrass Pasture.
	lbs.	lbs.	ozs.	
March	420½	18	4	Broadcast corn.
December . . .	359	18	3	Green corn and barley.
October. . . .	391	18	4	Nothing but pasture.
July	262	17	1¼	Corn and hay.
December . . .	357	16	8	Nothing but pasture.

first, they can all be trained to drink it. In a slightly soured condition it is more easily digested than when sweet, and the mildly acid flavour makes it all the more palatable to the animals.

In periods of drought this addition of skim milk to the ordinary dry food must prove to be a conspicuous advantage, because, even with an abundant supply of water and dry food a cow will not come up to her normal yield. Some portion of what she consumes ought to be in a green, moist or sloppy condition.

Cows should, however, not be allowed any unusual food of this kind until they have passed the stage after calving when there is danger of milk fever—many a good cow of our heavy milking breeds has had this scourge of the dairy induced by being allowed to drink "beastings" of her own secretion, because they were of no value for other purposes.

On the other hand, a lean and poor cow is often much strengthened after calving by drinking her own milk for a few days, even when it is not intended to continue the practice of giving it to her.

The pastures broken up in former times have been partly laid down in English grasses and clover. At one time white clover was extremely luxuriant, but it has not maintained its vigour. Ryegrass grows well as a rotation grass, and as such is fed to cows, but it cannot hold its own in permanent pasture against the so-called couch-grass or Indian dúb (*Cynodon dactylon*, Pers.). Ryegrass being a surface feeder, suffers seriously from drought.

Good dairy cows are worth about £12 at the ordinary spring calving season, or £15 in autumn, for winter milk production. In-calf heifers or "springers" of an ordinary kind, two-year-olds, often sell at times as low as £5 each. Good cattle are usually kept away from the bull till they are two years old, and sell when they approach calving time at sums up to £15 each.

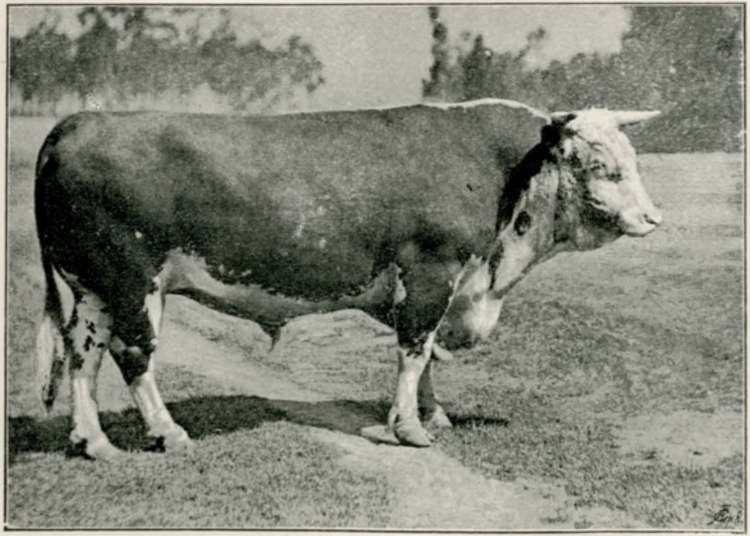
CHAPTER XXXII.

HEREFORD, DEVON, POLLED-ANGUS, AND AYRSHIRE CATTLE.

The Hereford Breed—Qualities as Colonisers—Difference of Butchers' and Graziers' Opinions—Crosses and Pure-Breds—The Devon Breed—Favourable and Unfavourable Characteristics—Herd of the Hon. J. D. Macansh—Aberdeen-Angus Breed—Value of their Crosses—Balgownie Herd—Angus Cattle in New Zealand—Prejudice against a Black Colour—Appearance of Angus Crosses—Value of Young Bulls—The Ayrshire Breed—Early Imported Variety—Associated with Scotch Settlements—Recently Imported Cattle—Expenses of Importation of Cattle and Sheep.

The Hereford breed, next to the Durham breed, (the common or non-pedigree Shorthorn,) is the most largely represented pure-bred variety of cattle in the Colonies. The fact that it is seen in abundance in Australia, that it has been so largely used in breeding ranche cattle in the Canadian North-West Territory and in the Western States of the North American union, and that quite recently it has along with the Shorthorn been exported in considerable numbers to the Argentine Republic, shows that it possesses inherent qualities, in addition to powers of adaptability to new surroundings, which mark it out as among the foremost of our British breeds for colonisation purposes.

Herefords are greater **favourites** with the **runholders** than with the **butchers.** The latter object to them because of a deficiency of their internal packing or finish. They lay on exterior flesh satisfactorily but are, judged by their internal appearance, disappointing when they come to the



Burman, Melbourne.

LXXXIII.—HEREFORD BULL—"CHARLIE DEANS."

The property of the Hon. JOHN HOWARD ANGAS, M.L.C.

LXXXIV.—Hereford Cows.
The property of the Hon. J. H. Angas.

shambles. They lack the supply of internal fat and also the long hind-quarters of the Shorthorn or Durham.

The graziers appreciate Herefords because they consider them hardier and better able to travel than Shorthorns under certain conditions; for example, on the coast-line country of New South Wales and Queensland where the ground is coarse and rugged and where there is at certain seasons an excess of moisture. When Herefords are **crossed** with the Shorthorn or Durham, they produce excellent station bullocks, which fatten readily, as, in the first cross at least, the defects of both breeds are minimised.

The pure-bred cattle descended from recently imported stock are of excellent quality. The author had the pleasure of closely examining the Kingsford herd in South Australia numbering 250, the property of the Hon. J. H. Angas. A number of the animals of both sexes were in no respects inferior to corresponding representatives of many of our best herds.

The "**History of Hereford Cattle**," by Macdonald and Sinclair, 1886, gives—in a great measure on the authority of Messrs. McConnell and Wood of Durundur, Brisbane—an interesting account of the introduction of the breed into the southern hemisphere in 1825 by the Cressy Company of Tasmania.

Among the most prominent of the early breeders may be mentioned the following: Mr. Hobbler, of the Hunter River, N.S.W.; Mr. C. Reynolds, of Tocal, Paterson, N.S.W.; Messrs. Robertson, Bros., of Colac, Victoria; Mr. W. Lyall, of Western Port, Victoria; Messrs. Barnes and Smith, Bros., of Dyraaba, Richmond River, N.S.W.; the Hon. G. H. Cox, Mudgee, N.S.W.; Mr. J. D. Cox; Mr. Beattie, Victoria; Dr. Dobie; Messrs. Myles, Bros., of Eatonswill; Mr. George Loder of Abbey Green, Singleton, N.S.W.; Mr. John Nowlan of Erlah, West Maitland, N.S.W.; the Hon. James White of Martindale, Denman, N.S.W.; the Messrs. Rouse of Mudgee; Mr. Reginald Wyndham of

Leconfield, N.S.W.; and in South Australia, Mr. C. Price and the Hon. J. H. Angas, whose herd has just been referred to.

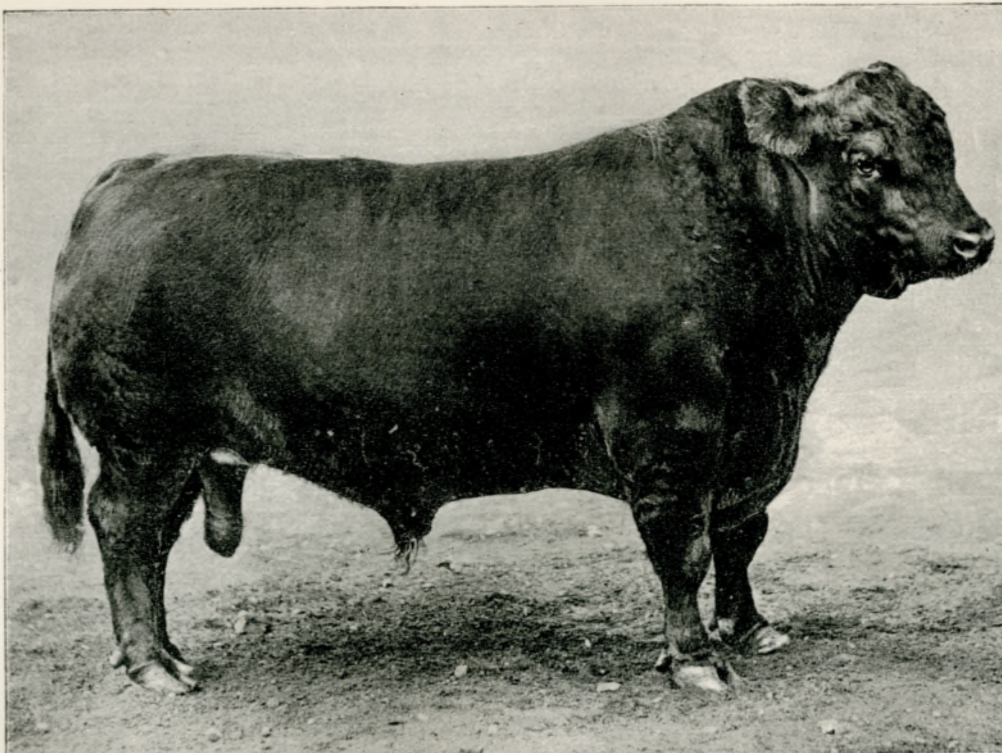
In passing through the country one may distinctly notice that Herefords bred from cattle imported in the early days are quite a **different type** from the fashionable Hereford of the present time. There is a contraction of the area of white hair where white ought to be, and a tendency to spotted faces—both peculiarities, if not appreciated, are generally tolerated rather than objected to. No doubt this is the effect of custom, which has trained the eye of the Colonial observer.

Importation of the best blood from England is steadily proceeding, one of the most valuable of the recent introductions being an English royal winner, Figaro, bred by Mr. Rankin, M.P., and imported by Mr. Henry Beattie, of Mount Aitken.

Devon cattle and their crosses are greater favourites than Herefords with butchers. Although the length and size of quarter are made subjects of complaint, there are no grounds for extending it to the internal condition of the dressed carcass. Stockmen object to Devon cattle on account of **wildness** and too great activity when kept in large herds. This character, however, greatly depends upon the method of treatment, because at Ben Lomond—a large station on the heights of the New England ranges, traversed by the line of railway from Sydney to Brisbane—the common cattle are almost pure Devons, and no difficulty as to wildness is experienced under the gentle treatment which, during recent years, has been adopted.

The only pure pedigreed breeding herd in New South Wales is at Canning Downs, near Warwick, the property of the Hon. J. D. Macansh, M.L.C. The nicely rounded outlines and compact and faultless figure of the breed are there reproduced in true perfection.

LXXXV.—First Prize North Devon Cow—"Fairmaid" (9,351), D.D.H.B.
The property of Sir W. R. Williams, Bart., Heanton, Barnstaple, North Devon.



XXXVI.—CHAMPION ABERDEEN-ANGUS BULL—"CASH."
The property of Lord TWEEDMOUTH.

Aberdeen-Angus crosses with ordinary cattle are more appreciated than even the favoured Hereford, where they have been tried, in New South Wales. In Melbourne in 1889 there was a regular "boom" in a small way upon the northern polls, in the same manner that there was a run upon Alderneys a couple of years before. This again was preceded by a mania for Durhams or their crosses, in fact anything that was roan in colour.

No apology is necessary for going more into matters of detail connected with the early history of this breed in Australia and New Zealand. The Aberdeen-Angus Polled cattle are slowly but surely working their way to the front in the Colonies as they have done in both Great Britain and America since the memorable occasion when at the Paris Exhibition McCombie of Tillyfour secured against all breeds in 1878 the champion prize for the best breeding animals and also the cup for the best group of animals for beef-producing purposes. The following note of the early history of the breed was supplied by Mr. **William Hogarth** of Balgownie.* It conveys information of a general kind which will in time come to be valuable in tracing the early history of Polled Cattle in the Antipodes.

A curious instance of atavism has recently occurred in this herd, in the case of a heifer with a grey patch on the neck and shoulders, descended from a famous ancestor of the herd, called "Grey-breasted Jock," No. 2 in the first volume of the Herd-Book. It appears from an article published in America by Mr. John S. Goodwin, that this bull acquired his name on account of "his having a large grey ring enclosing his neck-vein on the left side." It is further stated that a "number of his descendants even at this late day showed the same peculiar marking." In this respect the Australian heifer resembles his offspring in America.

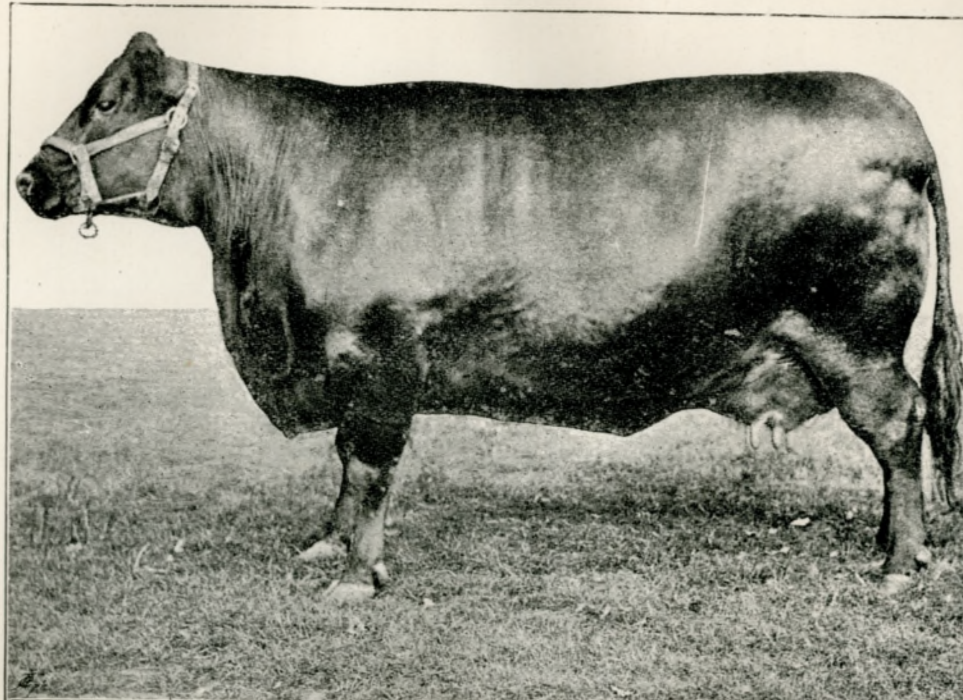
* On the Darlington Downs, Queensland, inland from Brisbane.

The Balgownie herd, containing about 120 females, of Polled Aberdeen Cattle, originated in 1882 by the purchase of two small herds owned by the late Mr. G. Dines of Merriwa, and Mr. E. B. Woodhouse of Mount Gilead, both of which traced their origin to the importation, about 1869–70, of six heifers and four bulls by Mr. J. G. Dougherty, Melbourne, Victoria, selected from the herd of Mr. W. McCombie of Tillyfour, and brought to this country by Mr. J. L. Thompson, now Principal of the Ham Common Agricultural College, New South Wales, who had been for some years with Mr. McCombie at Tillyfour. Failing health necessitated Mr. Petty, into whose hands they had come, to dispose of his property and stock, and the Polled cattle were purchased by Mr. Dines, part of which purchase eventually went into possession of Mr. Woodhouse.

These cattle were carefully selected from the Tillyfour herd, and were, as Mr. Thompson asserts, "the best Tillyfour could produce at the time."

The next addition to the Balgownie herd consisted of two bulls and a heifer, purchased from the well-known herd of the New Zealand Land Company, at Totara, New Zealand. This herd of cattle was commenced twenty-three years ago by the importation of the bull Druid, and the cows known as numbers 1, 2, and 3, that were purchased from Mr. McCombie and the Earl of Southesk. The company imported another draft in the year 1875, comprising the bulls Blackleg and Robin Hood, and the cows Nancy of East Mains, Sweet Grapes, and Tillyfour Lass; Robin Hood and Nancy being prize takers at the Highland and Agricultural Society's Show in 1875. Their present herd are the progeny of these cattle.

In the year 1884 the entire herd of Aberdeen Polled Cattle belonging to the Hon. Matthew Holmes, of Castlerock, New Zealand, forty-two head in all, were purchased and added to the Balgownie herd. These also trace their origin to the cattle first imported by the above-named company. Mr. Holmes purchased from them one bull and four cows, known as numbers 1, 2, 3, and 01. He also imported in 1880 two bulls, "Knight of the Thistle" and "Glenbarry," bought at the dispersal sale of the Tillyfour herd. Knight of the Thistle was got by Hollins (1493), out of Pride of Aberdeen 5th, which was purchased at the dispersal sale at Tillyfour, when twelve years old, by the Earl of Airlie, at 135 guineas. Glenbarry was used by Mr. McCombie in his own herd, and was by Dragon (1178), one of the best Pride bulls ever bred, out of Rosa Bonheur (2565). All the bulls and heifers in the Castlerock herd were the progeny of these two bulls. Two bulls and two heifers were imported in August 1888 from Scotland, as a further addition to the Balgownie herd.



LXXXVII.—CHAMPION ABERDEEN-ANGUS COW—"WATERSIDE MATILDA 2ND" (6312).
The property of Mr. GEORGE WILKEN.

Mr. Hogarth goes on to say that—About nine years ago (1882) the only representatives of pure bred Aberdeen-Angus stock in Australia and New Zealand—so far as it was possible to find out—in addition to those he purchased (twenty females imported), were: 1st, the Totara herd, comprising about fifty females, the property of the New Zealand and Australian Land Company; 2nd, the Castlerock herd, possessing thirty females, belonging to the Hon. Matthew Holmes, the whole of which ultimately went to Balgownie; and, 3rd, a small herd of about twenty females, which belonged to the New Zealand Agriculture Company. The latter were bought and shipped to Victoria about three years ago by Mr. Syme of Melbourne. The herd at Balgownie now numbers 112 females, of one year old and upwards. The produce of 1889 from fifty-five breeding cows was fifty-four calves, including two pairs of twins—three cows being without calves—which is an indication that Angus cattle are fully as prolific in Australia as they are at home. To lose a calf at birth is a rare occurrence. Two bulls, Dunnottar (5315) and Auckland (5848), bred respectively by Mr. Hannay of Gavenwood and Mr. J. Grant of Methlick, and also two cows from the herd of Mr. G. J. Walker, Portlethen, were imported about three years ago.

Other important recent importations have taken place, viz., six heifers and one bull, purchased from Mr. Clement Stephenson, of Newcastle-on-Tyne, and Mr. Wallis, of Bradley Hall, for Mr. Clarke, of Victoria; a similar number went to New South Wales to Mr. Smith, of Tukka-Tukka, from the herd of Mr. Hannay, of Gavenwood, and another lot was sent out by Mr. G. J. Walker, of Portlethen.

The breed has been found admirably suitable to New Zealand. It is noted for great hardiness to withstanding either cold or scarcity of food during seasons of drought. The late Mr. Dines, of Merriwa, remarked that during the late bad seasons in Australia, the crosses between the Polls and the station cattle were invariably the fattest, and that it was a common remark on the station during the worst period of the drought, that there was no use getting in any but a cross-bred beast to kill, as they were the only ones with any pretensions to fat.

The New Zealand and Australian Land Company say, in relation to the breed in New Zealand:—Polled Angus cattle have come very rapidly into favour during the last few years. Their hardy constitution, aptitude for fattening, the evenness of their flesh, and the advantage they possess for railway travelling on account of their want of horns, have made them great favourites not only in America, but in England and on the Continent; and this company has proved, from twenty years' experience, that there are no cattle more profitable or suitable for the

Colonies than the cross between the Angus bull and the Colonial-bred cow. Many thousands of them were bred in Southland by the company, and it is well known that the Polled beef is worth considerably more in the home and Colonial markets than any other.

It is worthy of notice that the cattle of this breed taken to the Colonies were from the **best strains of blood**; and, with a climate so suitable for successful cattle-rearing as that of the Australasian Colonies, it will now be only a matter of time till we see a large number of animals of the first rank, either for the show or the shambles. Polled cattle are of **special value**, not only on the station, but also during transit from their inability to horn or bruise each other. Though Scotch Polled Cattle have already proved themselves to be special favourites in Australia in spite of their unfashionable black coats, they are yet in too small numbers for large runholders to invest in them, as there is no certainty that they could continue to secure a sufficient number of bulls to maintain uniformity of character. For the present therefore the breed where it is used for crossing is practically confined to the small run-holders.

The fresh blood of fashionable strains recently imported from Scotland was not, as it has been remarked, so much to improve the breed as to please the customers who may come to purchase the produce.

Two herds of pure-bred Angus cattle were visited in the South Island of New Zealand; one numbering about ninety breeding females at Totara near Oamaru, belonging to the New Zealand and Australian Land Company, and the other even more numerous at Morton Mains, near Invercargill, the property of Mr. A. R. Wallis.

Black cattle are not all confined to the South Island. Mr. Thomas Cross of Porangahan, Hawke Bay, possesses a pure-bred herd, from which it was rumoured he intended to plant an off-shoot in the neighbourhood of Woodville.

There exists in the Colonies a strong **prejudice against black** as a colour among cattle. It remains for the Angus

LXXXVIII.—First Prize Ayrshire, Two-year-old Heifer—"Nellie of Barcheskie."
The property of Mr. Andrew Mitchell, Barcheskie, Kirkcudbright.

breed to dispel the prejudice—which by the growth of the frozen-meat trade it will be all the more easy to do. In an ordinary mixed mob of country cattle the **Angus crosses** with their hornless heads, long faces and black, dark roan, or grey skins, are as conspicuous among other cattle, from their superior quality, as from their unique appearance. Good young bulls, of pedigree blood, at two years old sell readily in New Zealand for breeding purposes, at from £30 to £60.

The Ayrshire breed is to be seen represented among dairy cattle, both in Australia and New Zealand, but where the importation took place before the days of an Ayrshire Herd-Book, only yet a few years in existence, special care had not always been taken to keep them pure. **A cross cow**, the produce of the Ayrshire with any one or other of the breeds already mentioned may be looked to as likely to possess superior milking qualities ; and, therefore, among a class of unskilled breeders, such as the small holders who adopt dairying frequently are, there appeared to exist no conspicuous inducement to keep the stock pure, in the absence of the higher prices associated with a long pedigree. Where Scotch settlers predominate in a district, the Ayrshire cow may generally be found, and where the ancestors of settlers or freeholders have been farmers at home, Ayrshire cows are frequently of excellent quality, although their progenitors might not have been recently imported ; such a district is to be found in Aaman near Oamaru in the South Island of New Zealand ; a place also famous for the production of another class of Scotch stock, the Clydesdale Horse. The Hon. William McCulloch has within the last two years imported to his breeding station of Mertoun Park, near Colac, Victoria, twelve well-selected young specimens of the breed, for which he paid twenty-five to fifty guineas each in Scotland.*

* A number of the best came from the herd of Mr. Andrew Mitchell of Barcheskie, Kirkcudbrightshire.

The expense of importing pedigree cattle from Great Britain is decidedly high, amounting to about one hundred guineas per head, owing in a great measure to the expense of maintenance during the rigid quarantine which all live-stock have to undergo after being landed in the Colonies. A Shorthorn bull thus costs as much as a first-class passenger, by Orient or P. and O., would pay for his return ticket—London to Melbourne and back. For sheep, freight and expenses amount to twenty guineas each. This would raise the average cost of a small flock of pure bred ewes bought in this country for ten or twelve guineas, to a considerable sum.

CHAPTER XXXIII.

THE DISHORNING OF CATTLE.

The Extension of the Practice—Illegal in England, but Legal in Scotland and Ireland—Travelling Cattle apt to become Savage—Dishorning in Chicago—Reasons why Practical—Its Prospective Importance in the Colonies—Plate showing Parts involved in the Operation—"Tipping" and "Half-Horning"—Suitable Ages to Operate—Advantages—Method of Operation—Modification Necessary for the Colonies—Hornless Short Horns.

The practice of dishorning bullocks is extending in Scotland, Ireland, Canada, and the United States of America. **In England,** for the present, the law has been interpreted by the Lord Chief Justice and Mr. Justice Hawkins, in the light of evidence led in the case of The Royal Society for the prevention of Cruelty to Animals *v.* Wiley, Blomfield Petty Sessions, November 1888, as forbidding the operation on the ground of cruelty to animals. **A perusal of the report** of the proceedings will show that the learned judges had not sufficient evidence before them to enable them to arrive at a satisfactory conclusion, and it may confidently be expected that sooner or later the judgment will be reversed, and dishorning not only permitted but encouraged as a humane act in the cases of all horned animals shut together in a confined space, either in the process of fattening or during the period of transit to, or exposure at, market.

Lord Morris, Chief Justice of Ireland, has decided that it is a necessary operation, and not in the eye of the law a cruel practice; and in **Scotland** in February 1890, before the Sheriff of Haddington, the whole bearings of the question were fully brought out, and a decision, which was confirmed on appeal to a higher court, given once for all, that dishorning is quite as justifiable as any other operation of a more or less painful kind practised by man for his own ends or profit upon the domesticated animals.

Cattle which are moved either by rail, road, or steamship from one district or country to another, are rendered ill-natured and savage in their behaviour to their weaker companions, by the excitement and discomforts, avoidable and unavoidable, that are met with by the way. **The increase of the trade** in store cattle into England and Scotland from the American Continent and from Ireland makes the operation of dishorning now more necessary than formerly, when cattle were to a greater degree bred, reared, and fattened upon the same farm or within the same district.

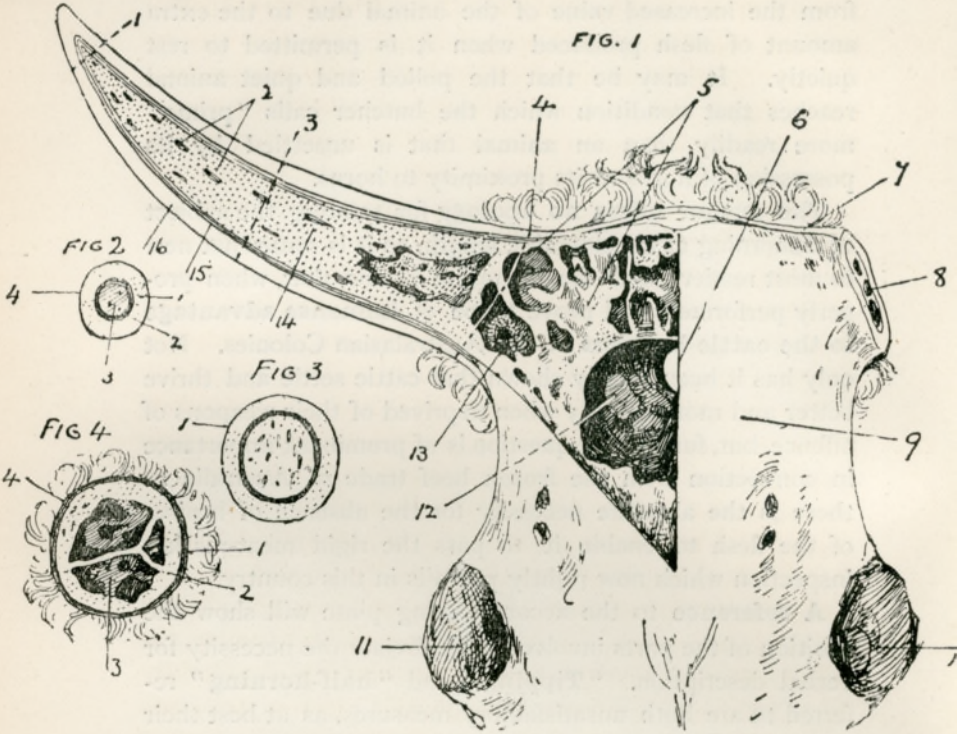
The rate at which the practice of dishorning has spread during the last three years in the district from which the **Chicago** cattle market is fed is truly marvellous. There are several inducements which have pushed it forward—(1st) The increase in number of the naturally **polled cattle** which get injured in flesh when "shipped" by rail among horned strangers, and (2nd) the **rigid system of inspection** in the market carried out under three distinct bodies of officers—municipal, state, and national—who attend the slaughter-houses to find and condemn as unfit for human food all carcasses that exhibit the slightest bruise or injury. Each body acts independently, and looks jealously upon the work of the others, and the result is, that complaints are made of over-inspection rather than of neglect of duty. There is a third prominent reason which has not yet been scientifically explained, although widely asserted by authorities in the meat trade both in America and in London, viz.: **the quality of the flesh** of a polled animal is better than that of a similar animal with horns, and fed along with horned animals. This is altogether apart from the increased value of the animal due to the extra amount of flesh produced when it is permitted to rest quietly. It may be that the polled and quiet animal reaches that condition which the butcher calls "prime" more readily than an animal that is unsettled by its possession of horns or its proximity to horns.

The author offers no apology for treating the subject of dishorning at considerable length, as it is somewhat new to most readers, and the operation is one that, when properly performed, will prove to be of **immense advantage to the cattle-breeders** of the Australasian Colonies. Not only has it been clearly shown that cattle settle and thrive better and more quickly when deprived of their weapons of offence, but, further, the question is of prominent importance in connection with the frozen beef trade of Australia as there is the absolute necessity for the absence of bruises of the flesh to enable it to pass the rigid meat-market inspection which now rightly prevails in this country.

A reference to the accompanying plate will show the position of the parts involved, and obviate the necessity for verbal description. "**Tipping**" and "**half-horning**" referred to are both unsatisfactory measures, as at best their efficacy is only temporary and partial. Although an animal thus treated cannot tear the skin of its victim, it can, soon after the operation, bruise the flesh as injuriously as formerly.

The best time to perform the operation of dishorning is when a well-fed calf is about a month or six weeks old—then the horns are budding and protruding through the skin. **The knife** used should go deep enough to remove the whole of the base of the limpet-like horn, and with it a little of the skin all round to make certain that no growth of "scurs" should afterwards occur. **A bullock** in good health may however, be with perfect safety **dishorned at any age**, and as closely to the skull as possible, so as to remove the

PARTS INVOLVED IN THE OPERATION OF DISHORNING.*



DRAWING SHOWING TRIANGULAR PIECE OF FRONTAL BONE REMOVED, RIGHT HORN LONGITUDINALLY BISECTED AND LEFT HORN REMOVED.

FIG. I.—1. Position for "Tipping"; 2. Sections of Blood Vessels; 3. Position for Operation of "Half Horning"; 4. Position for Operation of "Dishorning"; 5. Plates of Bone; 6. Opening for Exit of Spinal Cord; 7. Skin; 8. Left Horn Removed; 9. Bone of Forehead (Frontal Bone); 10. Left Orbit; 11. Right Orbit; 12. Cavity for Brain (by actual measurement, 2½ inches from Position for Operation of "Dishorning," but differing in different animals); 13. Cavities (Sinuses) of Skull (filled with air and opening into the nasal cavity); 14. Horn Core (an insensitive structure if cut in a normal state of health, but like all bony substance, extremely painful when in an inflamed or diseased condition); 15. Sensitive Layer of Corium corresponding to true Skin; 16. Insensitive Horn.

FIG. II.—1. Horn; 2. Sensitive Layer of Corium; 3. Horn Core; 4. Section obtained by "Tipping."

FIG. III.—1. Section obtained by "Half Horning."

FIG. IV.—1. Skin; 2. Bone; 3. Sinuses or Spaces filled with Air; 4. Section obtained by "Dishorning."

* From the *North British Agriculturist*, February 19, 1890.

whole of the horny part and with it a fringe of skin and hair, as shown at Fig. 4 of the plate. **The advantages** of this over the other partial operations are—(1) There is no cellular material left in which pus can lodge and produce inflammation and pain, as in the few cases in which it does form it finds free vent either externally or into the frontal sinuses, and thence through the nostrils. (2) The wound heals and the skin covers the whcle surface, and closes the openings within four weeks, so that only an expert could be certain that a horn had ever been present. (3) The object sought is fully achieved, and all the animals, not only those that were bullied, but the bullies also, rest and feed quietly and quickly.

The operation is best performed in the case of animals **older than calves** by throwing them in the usual way on a soft floor, as in a yard well covered with manure or on abundance of litter. A fine-toothed saw with a rigid back should then be used, while the head of the animal, resting on a cloth or mat is pressed tightly to the ground, and the cutting done entirely by the saw beginning at the side of the horn next to the ear, sawing through, and coming out at the side next to the crown. **The saw** makes a slightly ragged wound in cutting through the blood-vessels, and much less bleeding takes place than when a knife is used to cut a course for the saw through the skin, which is of necessity first severed. **It is important to cut** in the direction indicated, as the main artery (an auricular branch of the temple artery) and also the main trunk of the nerve supply of the horn pass into the base of the horn at the side on which the ear is placed.

When one horn has been removed, the animal is rolled over on its back to the other side and the second horn cut away in a similar manner. Ten to fifteen seconds is ample time for the removal of each horn, even in full-grown cattle, and the whole operation, after casting, is over within one minute. **The pain** is no doubt acute for the few seconds while the sawing lasts, but within ten minutes after an animal is set at liberty, it gives no indication of severe suffering, and will usually begin to eat almost immediately.

When suppuration takes place, as may be the case when beasts are kept in a badly-ventilated house or yard, the temperature may rise 2° or 4° Fahr., from normal—say from 101° Fahr. to 103° Fahr., or 105° Fahr., but usually begins to fall again about the fourth day, or when suppuration or the discharge has fairly set in. This disturbance of the normal temperature rarely occurs when the operation is skilfully performed, and a little carbolised vaseline is smeared over the wound. **Treatment** afterwards is not absolutely necessary, though no doubt bathing and dressing the wound, should it not be progressing favourably, would give some relief. Care should be taken not to operate during frost, nor yet in hot weather, when flies are abundant, unless in cases of absolute necessity. In such a case a piece of strong sticking-plaster must be placed over the wound for protection. After the work is done, the animals should have shade from the sun or shelter from wind and rain, and nature will provide for the rest.

The method of working will no doubt have to be **modified** to suit colonial conditions ; the crush-pen may be introduced, and the operation performed while the animal continues to stand. Under any circumstances the **saw** alone should be used to remove the horns if they have passed the stage of mere buds. The use of powerful **shears** is most objectionable, especially when the horns are totally removed as they leave the wounded bone ragged and bruised, and the injured parts are most liable to suppurate, and not heal properly. It is true that the tips of the horns can be clipped off without serious results, but partial dishorning is not an operation to be recommended for the colonists under any circumstances.

In America it is reported that a breed of hornless high-grade shorthorns has been established under the name of

"**Polled Durhams.**" The red and hornless female members of the produce of a shorthorn bull on black-polled cows were bred to a shorthorn bull, and the selected female hornless produce was again put to shorthorn bulls, so that the calves of the third generation possessed one-eighth of polled blood and seven-eighths of pure-bred short-horn blood. Polled bulls bred in a similar way were then put to the heifer produce of the above crosses, and the female offspring of the hornless sire and dam were finally bred to a shorthorn bull, by which step in the process of dilution of the polled blood only one-sixteenth was left which was not pure shorthorn ; the polled character, by the aid of selection, was meanwhile maintained.

For the purpose of breeding station-cattle, the method seems admirable. The bulls produced in this way would be a vast improvement on the great majority of bulls at present used on cattle-stations and all the advantages of dishorning would be secured without necessitating the operation. Although it would be out of the question to mention such a thing in this country, yet it would be worth the while of some of the large colonial shorthorn breeders to try the experiment in view of the distinct tendency of the times to get rid of horns.

CHAPTER XXXIV.

PLEURO-PNEUMONIA.

Importation into Australia—The True Function of Slaughter as a Means of Destroying the Disease—Bruce's Report, 1869—Means of Collecting Information—Pleuro-Pneumonia in India—Nature of the Disease in Australia—Inoculation—Opinions of Cattle-Owners regarding it—Difference between Pure and Impure Virus—Cultivation of Vaccine on a Calf—Sale of Vaccine by Government—Inoculation on the Tail—Success of Inoculation—Disease among Dairy Cattle—The Interests of Dairymen—Inoculation Experiments by Professor S. Schütz of Berlin.

Pleuro-pneumonia first found its way to Australia in 1858, and about a year or more after the outbreak a herd of 14,000 cattle were killed with the object of stamping out the disease; but it had already got too far. **The slaughter order**, as in the case of the slaughter order intended to exterminate the present outbreak in Great Britain, was too long delayed. Wholesale slaughter can only be effectual (unless extreme measures are resorted to) in ridding a country of this disease during the early stages of the outbreak, or when it has been narrowed down and localised by the less expensive method of inoculation, which does not induce owners to hold back information and thereby perpetuate the presence of disease in the background, whence it is bound sooner or later to break out.

So long ago as 1869 the Government of New South Wales issued a **report** by Mr. Alexander Bruce, chief inspector of stock for that colony, in which the subject of inoculation for this disease was treated in the most exhaustive manner. The object of the report was to focus the results of the enormous mass of practical experience which had been accumulated by the owners of cattle. With this object circulars were addressed to these owners, requesting them to return answers to a series of questions well calculated to elicit the information sought.

The replies, as a rule, were most explicit, and contain, as reproduced in the blue book, a vast amount of information of a thoroughly practical kind, and leave no doubt as to their value as a record of the nature and natural course of the disease as it affects the cattle of Australia.

In India pleuro-pneumonia is local in its actions. It does not spread over the country like other contagious diseases, such as foot-and-mouth and rinderpest. No doubt the difference of climate, as compared with that of Europe, is sufficient to account for this fact.

In Australia, it would seem from quite a number of the reports, that the disease is often **less virulent** and less persistent than it is in this country. In some cases it is reported to have died out naturally in certain herds without any remedy being attempted. The disease seems to be under complete control under a perfect system of inoculation.

The want of a Compulsory Inoculation Act, or of some inducement for men to inoculate cattle kept in the proximity of disease, by giving them immunity from stringent regulations in the case of inoculated animals, has prevented the complete extinction of the disease ; for however careful the great majority of breeders may be, a very few careless stock-owners are sufficient to keep up affected centres, from which in a little while the disease may again be spread abroad.

As the **climatic conditions** and also the conditions under which cattle are kept in the Colonies are so different from those prevalent in Great Britain, it would **not be safe to draw inferences** as to what would be directly applicable to this country; still, much may be learned and more may be partially presurmised by a study of the Colonial results and experiences. **It is interesting to note** that the practice of inoculation was at first attended in the days of Colonial inexperience by the same kinds of failures from unskilled operators and from bad systems of operation with which we have in recent years been far too familiar in Great Britain. There was the same form of confident assertion on the part of those who had failed to obtain a satisfactory result, that inoculation is unreliable, and even that it had proved to be a complete failure. The evidence, however, is overwhelmingly in favour of inoculation associated with slaughter of affected animals as the best or, in fact, the only means of coping with the disease under Colonial management and conditions.

Of those who sent replies twenty years ago to the list of questions already referred to, 237 cattle-owners were in favour of inoculation, 25 were neither for nor against, and only 17 against it—or about 14 for, to 1 against. This was in the days when certain professed inoculators were not only unskilled, but unprincipled; and when not a few inoculated animals died of **blood poisoning**, as many have done in this country, and have thereby added to the want of that confidence which inoculation ought to command.

The method of inoculation now successfully practised, involves the use of absolutely **pure virus** untainted with blood, degenerate tissue, or any foreign deleterious matter. **It is secured** by the stock department of Government * constantly having a calf of about nine months old under the influence of inoculation. A poor and inferior specimen is usually **proof against inoculation**, and a healthy thriving calf is consequently selected. **Inoculation is done** by inserting under the skin, on a part immediately behind the shoulder, sixteen drops of pure virus from a diseased animal. One calf is allowed to live for twenty-

* The following information relates to Queensland.

one to twenty-five days, till the temperature is perhaps 107.8° F.; then it is killed and the **subcutaneous lymph** is taken to fill sterilised tubes for the use of cattle-owners who may want the virus to inoculate their herds.

Four tubes are carefully packed and despatched to any part of the colony for the fixed fee of one guinea. On receipt of the lymph tubes, the cattle-owner, to insure a supply large enough to meet the requirements of his herd, proceeds to **cultivate the virus** by inoculating a calf on the station in the same manner as already described. The **œdema** (or large watery swelling) which forms when the animal is inoculated behind the shoulder, may extend from the foreleg (which it sometimes involves) along the belly and side to the hipbone. This enlargement is beaten with a mallet or hammer, to break the lymph cells to enable the liquid to flow out on the skin being cut.

Ninety tubes have been filled from one live calf by piercing the sharp end of each tube through the skin, and then sucking up the lymph by placing the lips to the open outer end of the tube. When sufficiently filled, this open end is heated, and drawn out while soft, so that it becomes hermetically sealed. If permitted to live, **the calf sometimes recovers**, while at other times, but rarely, true pleuro is produced, associated with the regular lung lesions.

Inoculation in the case of the whole herd is done near to the tip of the tail. The blade of the **knife** used is lanceolate in form, and has a notch cut in one side of it to hold a piece of pure white woollen stocking **yarn**, which is soaked in the **lymph** taken from the calf. When the knife is withdrawn, the yarn containing the vaccine fluid is left in the wound, and lies longitudinally for about the space of an inch underneath the skin of the tail. When the operation is properly performed, it is rarely that the tail has to be cut off. **Should blood poisoning** supervene, or disease in the bone of the tail follow from the knife going too deep, amputation is then necessary to prevent the gangrenous condition extending to the body of the animal.

The operation is performed on cattle that have never been handled, by driving them closely together into crush-pens, so that they cannot get away.

Should disease break out among uninoculated cattle on the way from the interior (a common occurrence as they pass over *very recently* infected ground, though they may not come actually in contact with the diseased animals themselves), the operation may with safety be performed by the way; but the rate at which the "mob" moves should then be reduced, and all animals actually diseased, destroyed at once.

There is some evidence to show that **inoculation** is not only a preventative of disease, but that it actually checks it in its early stages, while it does not succeed at all in cases in which disease is well developed. The possibilities thereby indicated, certainly lack confirmation, and should meanwhile be received with caution.

When the operation is skilfully performed, few deaths result from it. The percentages of deaths given at "not more than one or two," probably contain a number of animals which died of the disease itself, and not of the effects of inoculation. **The success of inoculation** may be understood from the statement of the Chief Inspector of Stock for New South Wales, that "In no case can it be gathered that the disease lingered over six months in a herd which had been properly inoculated." In fact its disappearance in a few weeks after inoculation is quite frequent. These remarks apply to cattle in their natural free state on the run.

The difficulty of coping with the disease and getting free of contagion in town dairies is greater, and more like that with which we have to deal in this country. It is hard to secure the hearty **co-operation** of the dairymen, a matter of necessity whatever be the method adopted for getting rid of the disease. **If compensation** is allowed to the owner of a herd of bullocks, his loss is practically at an end ; but it is quite different with the dairyman. Although full value is given for a herd of cows when they are slaughtered, the owner still suffers a **loss** almost equal to the value of his cows, through the **severance of his trade connection.** It is in a case of this kind that inoculation of all unaffected cows together with the slaughter of all that have taken the disease, becomes so valuable, because the whole herd can be placed under the strictest quarantine, gradually prepared for the butcher as the yield of milk becomes small, and only permitted to leave the spot to be transferred to the shambles.

By this means risk is obviated, the country is not put to the expense of paying compensation to the owner for the loss of his animals, and his trade does not suffer by the instantaneous stamping-out process.

A most instructive and interesting series of **inoculation experiments** was carried out in Germany under the direction and supervision of the well-known bacteriologist, **Professor Schütz**, of the Berlin Veterinary College. **The** methods adopted and the **results** obtained are of such practical and urgent importance to the Australasian Colonies that the published report of the same, as it appeared in the *Scotsman*, is appended almost *in extenso.*

Sixteen cattle were purchased in October 1888, and twelve of these were inoculated in Magdeburg on the 8th and 9th October, the remaining four being kept as control animals—that is to say, these four were not inoculated, in order that they might subsequently, along with the inoculated, be exposed to the infection of pleuro-pneumonia, by housing them with cattle known to be affected with that disease. All the instruments employed, the hands of the operator, and the tails of the animals were so treated as to insure that only germs actually present in the lymph taken from the lung of a newly-slaughtered animal should be introduced under the skin of the tail. Previously the lymph had been examined with a view to cultivating the pleuro-pneumonia germ or any others that might accidentally be present. A great many culture soils, such as meat-extract, blood-serum, and vegetable decoctions, were used in these experiments, but it was not found possible to grow from the lymph any germ which gave evidence of its being the causal microbe of pleuro-pneumonia. In some instances a coccus was obtained, but it was not constantly present, and it had no power of exciting disease. These experiments may, therefore, be placed alongside those of Pasteur, who found that the germ of pleuro-pneumonia, like that of rabies and smallpox, cannot be cultivated in artificial media.

Six of the twelve animals were inoculated with liquid from the diseased lung, two receiving 1 cubic centimetre of lymph each, two others ½ a cubic centimetre, and the remaining two 3-10ths of a cubic centimetre. The other six animals were inoculated with solid pieces of various sizes taken from the diseased lung. The object of this was to determine whether the germ of pleuro-pneumonia resides, chiefly in the solid textures or in the liquid of the diseased lung, and whether the phenomena that follow inoculation are in any way dependent upon the amount of material introduced under the skin. Further, in three of the above cases the lymph was used "warm," while in the other three it had been kept under antiseptic precautions, for twenty-four hours before it was used. The same variation was made in the case of the six animals inoculated with solid pieces of lung. The result of this experiment showed that a stronger effect was produced at the seat of inoculation by warm than by cold lymph, and that inoculation with solid pieces of lung had the least effect. None of the twelve animals succumbed to the operation, but in several the local inflammation was so severe that the end of the tail mortified.

On the 9th of November twelve other oxen in Löbnitz were experimentally inoculated, and in this case all the lymph was used warm, but in varying amount, the liquid in some of the cases being diluted in different proportions with sterile water. After an interval of from four to eight days the usual signs of inflammation began to show themselves at the seat of operation. In most cases the process extended to near the root of the tail, and in one case it passed beyond that and invaded the body, the animal dying on the thirty-fifth day after inoculation. But neither the rapidity with which the process excited in the tail set in, nor the extent to which it spread appeared in any way dependent upon the quantity of inoculating material used, or the extent to which that had been diluted. The ox in which a fatal result ensued had been inoculated with a small quantity of much diluted lymph, and the diseased process did not begin in the tail till the seventh day. A careful *post-mortem* examination showed that the inflammatory process, which in this animal had spread from the tail to the body, was of an exactly similar character to that which is met with in the lung and pleura in the natural disease.

On the 10th November 47 oxen and 7 cows were inoculated with undiluted warm lymph, and in one of these oxen a fatal result ensued on the twentieth day after the operation. In this animal, as in the preceding fatal case, the process set up in the tail had invaded the trunk, but, in addition to this, the *post-mortem* revealed four centres of pleuro-pneumonia in the lungs, the largest being as big as a child's head. This case is interesting as showing either that inoculation may sometimes set up virulent pleuro-pneumonia in the lung, that an animal may contract pleuro-pneumonia by inhalation after it has been inoculated, or that an animal that is already the subject of pleuro-pneumonia in its lungs may "take" inoculation in the tail.

The conclusion drawn from these experiments is that inoculation with warm lymph, even with the most scrupulous attention to cleanliness and the use of the best inoculation materials, is associated with danger. Putting aside the loss of the end of the tail, there is still the possibility that the erysipelatous process arising after inoculation may gradually extend and produce an acute peritonitis, with a fatal ending.

It remains now to describe shortly the after history of the surviving experimental animals. The twelve animals above referred to as having been inoculated in Magdeburg on the 8th and 9th October 1888, and the four control animals, were, on the 26th of that month, taken to a locality where pleuro-pneumonia existed. Here they were tied for some hours each day nose to nose with cattle known to be affected with pleuro-pneumonia, and this was repeated several times on succeeding days the object being to allow the experimental animals to inhale the germs of pleuro given out in the breath of the diseased animals. The experimental animals were killed on different dates between the 20th November, 1888 and the 29th January, 1889, and in the case of each animal a careful *post-mortem* examination of the lungs was made. The result was that no trace of pleuro was found in any of the 12 inoculated cattle, while 3 of the 4 uninoculated control animals were found to have contracted that disease. Regarding the control animal which remained sound, it may be observed that probably 10 to 20 per cent. of cattle in the natural circumstances escape pleuro-pneumonia when exposed to the infection, apparently as the result of a natural immunity or insusceptibility to the disease.

The 12 oxen which were inoculated in Löbnitz on the 9th November, 1888, were transported on the 1st December to a district in which pleuro prevailed, and they were here stalled between diseased animals. On the 14th December one of these 12 experimental oxen died, this being the animal already referred to as having had simultaneously pleuro lesions in its lungs and severe affection extending from the seat of inoculation to the body. On the 27th January, 1889, the 11 surviving oxen were taken to another district and again stalled between animals suffering from pleuro-pneumonia. On the 12th March 3 of the experimental animals were a second time inoculated in the tail, and 3 others at the dewlap. Very slight reaction followed in those inoculated in the tail, while considerable swelling and inflammation were set up in those inoculated in the dewlap, but in none were the results such as to threaten life. This experiment afforded evidence that the first inoculation in the tail had protected the animals ; for when the lymph of pleuro-pneumonia is introduced under the skin of the dewlap of an animal not previously inoculated, the effects are always formidable and the result frequently fatal. To still further test this point, the surviving 11 inoculated animals and two newly-purchased uninoculated cattle of the same breed and age were all inoculated at the dewlap. The result was, that in three of the eleven previously inoculated oxen no reaction at the dewlap took place, and in the other eight the effects were only slight. On the other hand, the effects in both the uninoculated control animals were very formidable, and in one of them a fatal result ensued. Lest it might be objected that, although the 11 experimental animals had been stalled between diseased cattle, the former had inhaled little or none of the virus, the following experiment was carried out. A quantity of warm lymph taken from a pleuro-pneumonia lung was mixed with fifty times its volume of sterile meat infusion, and the whole was by means of an instrument for the purpose sprayed before the nostril of each animal.

On the 13th May the 11 experimental animals, and the control ox which in the above experiment survived inoculation at the dewlap, were again transported to a locality where pleuro-pneumonia existed, and stalled between diseased animals. Here, on the 31st May, one cubic centimetre each of virulent lymph was injected through the chest-wall into the lungs of 3 of these experimental animals, but no symptoms of disease were thereby excited. On the 15th June, one of the experimental animals had to be killed, but the *post-mortem* showed that its illness was due to liver disease, and that it was free from pleuro-pneumonia. On the 18th June the surviving 11 animals were again moved to another locality and housed with cattle suffering from pleuro-pneumonia. On 26th June the whole 11 previously inoculated animals and two newly-purchased control animals were directly inoculated in the lung with warm lymph. This inoculation had no effect on the previously inoculated oxen, while in the two control animals it excited an adhesive pleurisy, with death in one of the cases. Lastly, the experiment was brought to an end by the slaughter of the eleven experimental oxen, this being carried out between the 19th and 26th July. Notwithstanding that these animals had for more than half a year been housed with cattle suffering from pleuro-pneumonia, and otherwise exposed to infection, the *post-mortem* examination proved that the whole of them were free from pleuro-pneumonia. This result, confirming as it does many previous experiments of a similar nature, must be held to definitely settle that inoculation confers, for an undetermined period, a very complete immunity when performed on cattle that are sound and uncontaminated at the date of operation.

CHAPTER XXXV.

THE FROZEN MEAT TRADE.

Benefits of Cheap Meat to the Labouring Classes—Numbers of Carcasses and of Live Sheep Imported—The First Frozen Mutton from New Zealand—New Zealand the Chief Source of Supply—The Quality of New Zealand Mutton—The Effects of Freezing Mutton and Beef—The Breeds of Sheep producing the New Zealand Mutton—Winter Food Supply and its Effects—Evil of Killing Ewe Lambs—Prospects of the Trade in Frozen Lamb—Sheep Land in the North Island, New Zealand—Return of Frozen Meat imported since 1882—Cost and Profits of the Trade—Table of Monthly Prices and Stocks of Frozen Mutton—Influence of High Prices and of Low Prices on New Zealand Mutton—The Leading Freezing Companies in New Zealand—Cunningham's Summary of Frozen Meat Imported from New Zealand—Table of Total Sheep Stocks and Frozen Mutton since 1882—Erratic Course of the Australian Meat Trade—Table of Numbers and Capacities of Vessels in the Trade—Rates of Increase of Population and Sheep—Annual Surplus of Sheep for Slaughter in Australia and in the United Kingdom—Average Dead Weights of Sheep—Prospective changes in the Composition of Colonial Flocks—Proportions of Population to Live Stock in Great Britain and in the Colonies—Meat Consumed per Head of Population—Waste of Meat in the Colonies—Future Prospects of the Meat Trade—Preparations—Experiences of Water Supply—The Replacement of Cattle by Sheep Explained—Probable System of Meat Transportation in Chilled Cars—Cost of Production of Australian Mutton—Conclusion arrived at from the Study of the Question of Meat Supply—Sensitive Nature of the Frozen Meat Trade—Necessity for its Expansion in the Provinces—Possible Extension to the Continent of Europe.

The grandest aim of the British Policy of Free Trade is, that the British workman may secure at the lowest possible price the food necessary to sustain his system in the "hard" condition that is compatible with good work, done with ease, with a light heart, and not as drudgery. The blessings which a plentiful supply of food confers upon the labouring classes are not sufficiently appreciated in a country like Great Britain, where none need starve and where few have to be satisfied with a bare subsistence. The plenty which has been enjoyed for generations, has driven from our midst many of those loathsome diseases from which in olden times even kings suffered and died; and we know of the terrible nature of some of those baneful scourges of our race only from the pages of Lew Wallace's "Ben Hur," the wails from the pollagra-stricken districts of protectionist Italy, or from the reports of some of our heroic missionaries in the South Sea Islands.

It is claimed, for an abundance of good food and for the strength and comfort it brings, that, in some cases at least (we must own there are many exceptions), it allays that craving for strong drink which is recognised as being the source directly or indirectly of the majority of the criminal offences in this country.

The cycle of prosperous times which preceded 1873, saw the development of a greatly increased consumption of butchers' meat by the mining and manufacturing population of Great Britain. Prior to that period of prosperity beef and mutton were consumed to a great extent only by those in socially higher spheres than the ordinary labourers, but when the latter were enabled to earn high wages they spent their money in purchasing the best. When wages declined many of those who had kept high festival during the period of prosperity, had to return to pork and cheese, and leave butchers' meat to those who could better afford to buy it. They had not, however, forgotten the flesh-pots of Egypt, and now, with the general improvement of trade and more constant employment, many men find they are again able to add mutton or beef to their food supply.

The arrival of large quantities of good and wholesome meat—**beef** from America, New Zealand and Australia, and **mutton** from Australia, New Zealand, and the River Plate—has enabled many to return to the eating of flesh, and has also encouraged many to take to it who had no former experience of it as an essential part of their daily food. It is generally believed that a large proportion of the imported frozen meat has made a new market for itself and has only to a limited extent ousted the home product. The author is inclined to believe that full credit is not given to the extent to which frozen meat is made to fill the place of home-grown, and of that imported fresh from the continent. Our population has been steadily increasing and the number of home-bred sheep has been decreasing. About twenty years ago **sheep in the British Isles** were numbered at 35,600,000: fifteen years ago they had come down to 34,800,000, and in June 1890, 31,667,195, notwithstanding the fact that in comparison with the previous year there was an increase in round numbers of 2,180,000 on the total for 1889. In the face of these facts it is safe to infer, in consideration of the steady increase of population, that had no supplies been brought in from New Zealand the price of home-grown mutton, with the general improvement of trade and steady employment of the labouring classes, would have materially advanced.

The number of **carcasses**, and the rate of **increase** of the trade with Great Britain from the three great centres of frozen mutton supply, may be seen from the following table, extracted from the excellent report on the subject by Major P. G. Craigie (now of the Board of Agriculture), in the Royal Agricultural Society's Journal for 1889, and brought up to date from the circulars issued by Messrs. W. Weddel and Co.,* 16, St. Helen's Place, London, E.C.

* To Major Craigie's Report, to Messrs. W. Weddel & Co.'s circular, and statistical tables compiled by Mr. P. Cunningham, Christchurch, New Zealand, as well as to the Government Statistical Returns, the author is also indebted for a number of figures that follow, more especially those arranged in tabular form.

TABLE OF SHEEP STOCKS AND FROZEN MUTTON.

Year.	Number of sheep imported alive.	Number of Carcasses of frozen mutton imported.	Carcasses from the Argentine Republic.	Carcasses from New Zealand.	Carcasses from Australia.
1883	1,116,000	201,791	17,165	120,893	63,733
1884	945,000	632,917	108,823	412,349	111,745
1885	751,000	777,891	190,571	492,269	95,051
1886	1,039,000	1,187,547	434,699	655,888	66,960
1887	971,000	1,542,646	641,866	766,417	88,811
1888	956,000	1,975,448	924,003	939,231	112,214
1889	678,000	2,164,769	1,009,936	1,068,286	86,547
1890	358,000	2,980,177	1,196,531	1,562,647	210,831

In 1880, Australia sent 400 carcasses ; in 1881, 17,275 carcasses ; in 1882, 57,256 carcasses ; while in the latter year New Zealand also contributed 8,839 carcasses.

The first cargo of frozen mutton which arrived in London from New Zealand, was sent by the New Zealand and Australian Land Company from Totara, near Oamaru, in the South Island. In 1882 a sailing-ship, the *Dunedin*, was chartered and fitted up for the trade. She was kept regularly employed until 1890, when she was lost at sea. The sheep are now sent to the nearest freezing work to be killed, and the frozen carcasses are railed down to the port. This is less expensive, and yields a more marketable product than the original method of taking the sheep alive to port and, after they have been killed and dressed, freezing them on board.

There has been a considerable decrease in the weight per carcass since 1882, brought about for the mutual convenience of producers and consumers, but recently the change has gone too far. Many carcasses now received are much too light. The first cargo averaged over 80 lbs. each, and sold in London at *7d.* per lb. Now the average sheep sent by this Company weighs about 65 lbs., the average for New Zealand, as a whole, being probably about 57 lbs. In the early days of the trade there had been delivered some individual carcasses of three-year-old wethers weighing 200 lbs., dressed.

New Zealand is the chief source of the Australasian mutton supply at present, and there is a very general impression that even the best of the New Zealand mutton is far inferior to our own. That this is due to a want of knowledge of the facts of the case, to a lingering prejudice, and to a sentimental hankering after something that long use has made familiar to us, there is not much room to question. Neither is there the slightest doubt that connoisseurs in the flavour of the varieties of mutton have been repeatedly deceived by having the imported article served up as the best home-fed. It is also said, on what appears to be reliable authority, that the dislike to imported meat was, to some extent, fostered by unscrupulous butchers, who found a lucrative trade in the supply of the best foreign mutton for "real English." As will appear from the following pages, the disadvantage yet attaching to the trade in frozen mutton, of being unable to command comparatively higher prices in proportion to the intrinsic value of the article, is due to defective market organization and to arrangements which are capable of adjustment. Those who are building false hopes on the supposed distinctly inferior quality of Colonial mutton may prepare to be undeceived before long. The process of freezing does not to any extent, if at all, injure the quality or flavour of the mutton, provided that due care be taken in the treatment of it and of the animals from which it is produced; and also that the carcass be allowed to hang with the neck uppermost, to dry for a few days after thawing, before it is cut. This latter precaution is necessary to prevent the escape of juice and the subsequent excessive shrinkage during the operation of cooking. If these facts were known and admitted, the foundation for the assertion that the meat is distinctly inferior would be removed, unless in instances in which the animals had been killed when too old or when not in prime condition. One great objection of the housewife to frozen meat is that it shrinks more in cooking than the home product. This remark applies more to the mutton of thin Merinos, not properly prepared for the trade, than to the plump well-fed mutton of New Zealand.

The fact that **frozen mutton keeps** admirably for months after thawing, when salted or pickled in brine in the manner usually adopted by families living in country districts, is one indication of the good condition in which it arrives.* This opens up another channel into which a portion of the increasing imports must, with advantage to a vast rural population, gradually find its way.

It is admitted that **beef is injured by freezing,** as on thawing much juice separates and runs out of it. **American beef,** which is only a few days in transit, is not frozen through, but **chilled** and kept in chambers at a temperature of three to four degrees Fahr. below the freezing point. **Australian beef** would not keep in this manner long enough to enable it to be landed in good order in this country; it has, therefore, to be thoroughly frozen. The resulting **loss of substance** is one of the drawbacks to the development of the frozen beef trade of Australia and New Zealand, and it is no doubt one of the chief reasons why beef has gone down in price in New Zealand since the development of the frozen mutton trade. Perhaps this is not to be regretted, as mutton is the natural product of the Australasian Colonies (unless where cattle are required to trample down new country, or in the few

* The author had the privilege of seeing and tasting an excellent mutton-ham (cured by Mrs. Wm. Glover, Tynron, Dumfriesshire), made from the "gigot" of a prime New Zealand wether. Nothing could have been more perfect both in flavour and appearance.

districts unwholesome to sheep) while beef is the natural product of North America. It yet remains to be seen to what extent the inferior quality of frozen beef is due to the method of freezing. Beef in a hot climate takes longer time and is much more difficult to cool, and consequently to consolidate, than mutton, on account of its greater size. If freezing is begun before it is properly cooled, the quality and keeping power must suffer.

The texture of beef is no doubt more open than that of mutton ; and, again, it is shipped in quarters, leaving the part at which each quarter is separated from the carcass without that filmy, parchment-like covering which, except of course at the extremity of the neck from which the head has been severed, forms the exterior surface of a whole carcass. **The film** acts in the case of a sheep's carcass like a waterproof bag or casing and prevents the escape of juices, if the carcass is not hung up with the neck, or in other words the opening into the bag, downwards.

With the exception of the mutton produced by the Merino breed of sheep, that sent from **New Zealand**—and by far the larger share of our imports belongs to this class—is produced by a selected number of the favourite breeds of our own country ; and not only so, but from the descendants of the best blood of these breeds that could be bought. Let no misapprehension arise on this point. The Long-wool, Down, and Cross-bred mutton we get from New Zealand is the produce of the best ovine blood of England, selected from those breeds which are found to thrive best in the conditions peculiar to the colony. Though Cotswolds, various Down, Cheviot, and other breeds are represented, yet the Lincoln, the Romney-Marsh, and the Border Leicester are, generally, the greatest favourites—the Lincoln for its large frame and the abundance and quality of wool ; the Kent sheep for its hardiness and comparative freedom from foot-rot, and for the all-round usefulness of its products ; and the Border Leicester for its adaptability to new surroundings and general good quality alike in wool and flesh production. The liability of the Merino to suffer from **foot-rot** on low-lying rich land, and the change, in some instances, of systems of farming to something more like the European plan, gave the initial impetus to the **increase** in numbers of the **long-wool breeds**; and the development of the frozen meat-trade, associated with the greater weight and enhanced value of long-staple as compared with merino wools, has strengthened and perpetuated it. In addition to all this, the **change of climate** and general surroundings lends a renewed vigour to the constitutions of most classes of imported European stock and, it might well be added, of living things generally. A familiar illustration is found in the **rabbit plague** which still costs the country a large sum of money to keep within bounds. Another example is that of the gigantic size of the **humble bee** recently imported by the acclimatisation societies (after various unsuccessful attempts) with the object of bringing about the fertilization of red clover.

The natural advantages in Australia for the production of **food for stock** must not be lost sight of. The best British grasses share with imported animals the tendency to extra vigour of growth in their new quarters. Red clover assumes more the nature of a perennial plant than a biennial, and grows in a condition of luxuriance not often seen in the latter-day cultivation of this country. To maintain a fairly regular supply of meat during both summer and winter, turnips are now largely grown as winter food for stock. The movement in this direction is steadily expanding in the North Island as well as in the South Island of New Zealand, and it is yet capable of considerable extension.

The present system of providing a better supply of **winter food**, as compared with that of a few years ago, is rapidly bringing about a change in the age at which sheep are killed, and will ultimately raise the average quality of the mutton. While wool was the chief product derived from sheep, they were kept till a much greater age than would have been the case had the quality of the mutton been an important consideration. Again, when there is no sufficient supply of winter food, and sheep, consequently, wastefully decline in condition during the period of scarcity, they require to attain a considerable age before they will take on sufficient condition for the market. It should not be forgotten in passing that the fat of the long-wool breeds is grosser and heavier in flavour when derived from "three-shear" sheep (thrice shorn), than from those of a year or two younger.* At one time few sheep were killed before they were "six-tooth" (two years off), and the great majority of those frozen and sent to this country are still four and six "tooth," while Merinos are often "full mouth"; but the tendency is to kill at younger ages (as "two tooth," or one year off), when the carcasses are not quite so heavy as those of older sheep, and the quality of the mutton is decidedly superior. It must be admitted that while the change has been going on, sufficient care has not been taken to keep up the quality; but this mistake has been fully pointed out, and is probably now being remedied.

The slaughter of sheep at younger ages improves the quality of the mutton, it does away with the waste of food entailed in keeping sheep a year longer than necessary, and, although larger numbers are killed, it makes room in reality for the maintenance of larger flocks than ever.

A substantial **increase** has already begun to take place, as the following figures, representing the total numbers of sheep in New Zealand for each of the last four years, indicate:

1890	(31st May)	16,120,423	sheep.
1889	"	15,503,263	"
1888	"	15,122,133	"
1887	"	15,155,626	"

* Merino mutton is said to be like Scotch Blackfaced Highland mutton, in this that the wethers producing it are all the better to be three or four years old.

In the North Island of New Zealand some breeders who used to rear two-year-old wethers, have, during last season, got quit of their hoggets, so that they might be able to keep larger flocks of ewes to produce lamb for freezing. This change is natural when facilities for freezing are brought within reach, as at Gisborne, where Nelson Brothers have recently erected a freezing work.

In the South Island the shipments in the early part of 1889 were believed to be in excess of the numbers that the existing stocks could continue to supply. Time must therefore be allowed where this is the case to breed up the number reduced by the tendency to early killing; but, once it is made up, the increase should steadily advance, as it is only the wether sheep that are, as a rule, subjected to the change as regards an earlier age for slaughter. It is true that certain of the "cockatoos," or small farmers, have been blamed for killing young ewes to get ready cash.

When a pinch comes, the small occupier—even of his "own land," so-called—is found to be hard up (if he is not supported by some larger owner for whom he can work and thereby earn the means to purchase his independence from the storekeeper and money-lender). This fact must hang like a millstone about the necks of those who advocate a universal system of small freeholds.

The practice of killing ewe lambs where increased numbers of stock are wanted is so hostile to a man's best interests, not to speak of those of the country, that it will no doubt immediately cease. The returning prosperity of New Zealand, due to the development of the meat trade, and the rise in the price of wool, will also aid in putting an end to it.

Of the imported Australasian meat, **New Zealand frozen lamb** is likely to be the first to compete directly and successfully with the home product.

The imports for 1887 (the first year for which separate records for lamb are available) amounted to 110,816 carcasses, weighing 34,366 cwts., or an average of 34·7 lbs. each; and were valued, as shown in the accompanying table of New Zealand meat exports, at £57,708, or a little less than 3¾*d.* per lb., f.o.b., *i.e.* free on board and frozen.

The Frozen Lamb Trade in 1889 was carried on at higher rates than those of some previous years, and extended over a longer period. The rise in price was due in a measure to a period in which there was a short supply, and to the simultaneous scarcity of English lamb. About the end of June prime quality New Zealand lamb rose to 9*d.* per lb., but dropped pretty steadily to 5½*d.* in December, when it stood only about ½*d.* per lb. above prime quality New Zealand mutton. A few weeks later, when no quotations for the sale of lamb could be seen in market reports, the author visited the freezing works of Nelson Brothers, 15 Dowgate Hill, London, and found excellent New Zealand lamb there stored; while at the leading restaurants he was informed that lamb was not yet on the menu. It was too early. The purveyors for these establishments could not yet venture to produce lamb on the table which was out of season, as it is termed. The fact that the prices did rise to 9*d.* per lb., showed that in what is considered the proper season, the purchase of Colonial lamb was not confined to the working classes. Another fact in favour of this view is that the increasing demand for the best quality of frozen lamb has not shifted, as in the case of mutton, to the provinces, where it is absorbed by the working population. A product so good as New Zealand lamb, is certain to find its way into restaurants as freely as into the private houses of the better classes, and into both more readily than into the houses of labouring men, owing to its not being so economical as matured mutton. In common language, it does not "go far enough" with a family. The period of the consumption of lamb, as reported by the trade, is already beginning to lengthen. This process is certain to go on until the limit is determined by the season of production, together with the extent of available storage-room for frozen lamb carcasses in this country.

The course of the **trade in frozen lamb** during 1890 was very different from that of 1889. It began in February, a month earlier than the previous year, and the highest prices were obtained in the end of February and beginning of March, when it sold at 4*s.* 10*d.* to 5*s.* per eight lbs., or a little less than 7½*d.* per lb. Prices had a pretty regular downward tendency till the beginning of September, when the lowest point of the season (with the exception of the last week of December) was reached, viz., 3*s.* 2*d.* per eight lbs., or little more than 4½*d.* per lb. There was a temporary rally to 3*s.* 8*d.* about the middle of October, but it was not sustained.

Not only is it possible to **increase the mutton producing capacity** of land now stocked with sheep in New Zealand by the means already detailed, but in the North Island it is capable of very considerable extension in Maori reserves, and in unoccupied Government lands that will be taken up within a few years. The value of the North Island as a sheep country has, for a variety of reasons, never been properly acknowledged. Certain parts have been difficult of access, and, consequently, little before the notice of the public ; and, again, it has been in the interests of holders to say as little as possible of the superior qualities of their soil, to obviate any increase in the rate of taxation. The fact remains, nevertheless, that no inconsiderable portion of the country in the neighbourhood of Hawke Bay (which may be taken as a type of a much larger area) is, when sown with English grasses and clovers, as fine a sheep country as any that could be found in any part of the world —the land carrying a stock of six sheep to the acre on an average all the year round, and in some parts of special excellence as many as fifteen large long-wool sheep per acre during summer and eight in winter.

RETURN OF FROZEN MEAT EXPORTED FROM NEW ZEALAND SINCE THE TRADE BEGAN IN 1882.

Year.	Mutton.		Lamb.		Beef.		Total. Weight.	Total Value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
	cwts.	£		£	cwts.	£	cwts.	£
1882	..	..	..	..	..	..	15,244	
1883	86,994½	116,106	..	..	937	2,155	87,931½	118,261
1884	252,422	342,476	..	..	1,644	2,605	254,066	345,181
1885	286,961¼	339,648	..	..	9,169½	13,678	296,130¾	353,326
1886	336,404¾	413,713	..	..	9,391¼	12,843	345,796	426,556
1887	Carcasses. 656,823 cwts. 360,656¼	387,039	Carcasses. 110,816 cwts. 34,366	57,708	6,630	10,195	401,652¼	454,942
1888	Carcasses. 885,843 cwts. 472,668¼	527,613	Carcasses. 94,681 cwts. 34,692½	45,583	44,612½	54,914	551,993¼	628,110
1889	Carcasses. 990,486 cwts. 547,281	641,888	Carcasses. 118,794 cwts. 41,243	59,965	66,298	81,521	654,822	783,374
1890	1,365,689		266,212					

The volume of the export trade in frozen mutton during the year 1889 would have been about 1¼ million carcasses from New Zealand alone but for the burning of the Belfast works, Canterbury, in December 1888. There is no reason why, in a comparatively short space of time, the amount should not exceed 2,000,000. It was estimated by a competent authority that before the end of 1890, there was **freezing space**, on board ships plying between this country and Australia, New Zealand, and South America, sufficient to carry 4,432,000 carcasses of mutton.

The trade is established on such a basis that there is no possibility of its collapse. The **New Zealand producer** earns a satisfactory **profit** at *2d.* per lb.; so satisfactory that it is asserted that this trade was the means of raising the value of land 25 to 30 per cent. and of thereby redeeming much of the loss sustained by land-owners in the recent depression. An additional $2\frac{3}{8}d.$ to $2\frac{1}{2}d.$ per lb. covers all expenses, *e.g.*—freezing $\frac{1}{2}d.$, freight $1\frac{1}{4}d.$ and five per cent., selling charges $\frac{1}{2}d.$ per lb. including insuring, loss in weight, say, $\frac{1}{10}d.$ per lb. Consequently, if New Zealand mutton sells in London at $4\frac{1}{4}d.$ to $4\frac{3}{4}d.$ per lb. everyone connected with the trade is abundantly paid and ought to be satisfied.

With the recent improvements in ship accommodation and freezing plant, the freight could be reduced to 1*d.* per lb. and still leave a fair profit to the shipping company. This reduction will no doubt be given effect to in the immediate future. The great reduction in the prices of meat of all kinds will hasten the change.

It may be gathered from Messrs. W. Weddel and Co.'s circular for 1888 that, even in December of that year, carriage and other charges had fallen so much that the return was as remunerative with New Zealand mutton at $3\frac{3}{4}d.$ per lb. as in 1883 to 1885 when it sold at $5\frac{1}{2}d.$ to 6*d.*; although it is not asserted that a profit was made by the producer in either of the years. It would be unreasonable to suppose that should the price fall short of the figure named, or even considerably short of 4*d.* the trade would suddenly or seriously diminish. Contracts between the freezing and shipping companies extending forward for months would check any sudden tendency in this direction. Forward contracts for space have proved so disastrous for shippers who were bound by them, that they will probably be discontinued or materially modified in the immediate future, nevertheless it would pay all concerned better to take a much smaller price, say even $3\frac{1}{2}d.$ per lb. for a time, than to discontinue the trade altogether.

Large sums of money have been spent in fitting up ships and in erecting freezing centres, and we may rest assured that so long as these institutions pay working expenses, although nothing in the way of profit or dividend on the capital invested may be secured by the owners, the frozen meat trade will continue to exist. So long as the freezing plant is at work it maintains a prospective value in the hope of a revival of prices; but with the discontinuance of operations a large proportion of the capital could not be realised, and would be absolutely lost.

The enormous dividends which have been paid by the **foreign meat companies** in this country, show that there is a considerable margin of profit to come and go upon. Eastman's, Limited, paid in 1889, twenty per cent. of dividend and bonus on the ordinary shares of the company, after carrying £20,000 to a reserve fund.

Another safeguard of the trade is the sliding scale adopted by the freezing companies, whereby the producer, the freezing company, and the shipowner participate (though not to the same amount) in the profits, when more than average prices are realised for the meat in London, and on the other hand share the responsibility of losses, in varying ratios according to the terms of contract.

Every risk in transit as regards condition is now covered by the insurance* policies; every risk in fact that can be imagined except that of meeting a bad market; and even that responsibility can be passed on by the producer to the shipper, as in the case of the stock-owners at Gisborne, who, on condition that a freezing work would be erected, contracted to supply Nelson Brothers, with a given amount of sheep for three years at 1½*d.* per lb., dressed.

The comparatively high price of New Zealand mutton during the year 1889, has stimulated the development of the trade with this country to a greater extent than we

* The original cost of Insurance, viz., six guineas per cent., has now been reduced to sixty shillings per cent. by steamers and eighty shillings per cent. by sailing-vessels.

are likely to realise until its fruits more fully appear. Not only has the want of experience in the frozen meat business to be contended with, but the sentimental prejudice of certain classes has to be overcome. The enhanced prices have to some extent supplied the means to overcome these difficulties. When capital has once been embarked in an enterprise of this kind, the advent of a period of depressed times, bad trade, and low prices, is not calculated to lead to its speedy withdrawal; and at present no other condition of things can be conceived which would seriously affect the prospects of the trade in question. Although capital could be relieved without loss (a circumstance not likely to occur) there is no inducement to withdraw it or to employ it in another branch of business.

TABLE SHOWING THE MONTHLY STOCKS IN THE LONDON MARKET OF ALL KINDS OF FROZEN MUTTON AND AVERAGE QUOTATIONS* FOR NEW ZEALAND MUTTON FOR THE LAST SIX YEARS.

—	1885.	1886.	1887.	1888.	1889.	1890
Average monthly stock of carcasses	55,000	91,000	128,000	112,000	91,000	179,000
	d.	*d.*	*d.*	*d.*	*d.*	*d.*
Highest monthly average	$6\frac{1}{8}$	$5\frac{5}{8}$	$4\frac{5}{8}$	$5\frac{3}{8}$	$6\frac{1}{4}$	$5\frac{1}{16}$
Lowest Monthly Average	$4\frac{1}{2}$	$4\frac{1}{4}$	$3\frac{7}{8}$	$3\frac{7}{8}$	4	$4\frac{1}{8}$
Average for the year . .	$5\frac{1}{4}$	5	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{7}{8}$	$4\frac{5}{8}$

The period of low prices for New Zealand mutton has not shaken the foundations of the trade but rather widened and solidified them by making it necessary for the various traders interested to reduce their charges in such a fashion that it is possible for the producer to continue the supply without serious loss even in the worst of times. Had the low prices been experienced in the earlier years, before

* The above average quotation is an *average top quotation for prime quality.* Ordinary qualities realise $\frac{1}{4}$*d.* to $\frac{3}{4}$*d.* per lb. less.

STATISTICS BY MR. P. CUNNINGHAM, CHRISTCHURCH, NEW ZEALAND, JULY 5, 1890.

SUMMARY OF FROZEN MEAT EXPORTED FROM NEW ZEALAND FROM 1ST JANUARY, 1890, TO 30TH JUNE, 1890.

Ports.	Mutton.				Lamb.		Beef.
	Carcasses.	Legs.	Pieces.	Weight.	Carcasses.	Weight.	Weight.
				lbs.		lbs.	lbs.
Auckland	6,964	..	..	419,081	1,320	49,132	59,858
Gisborne	33,290	..	..	2,208,509	1,661	56,164	..
Napier	212,770	4	..	12,995,895	25,920	843,959	591,556
Wellington	146,248	59,801	..	9,387,987	25,738	907,227	4,380,665
Lyttelton	177,724	722	2,863	10,220,807	149,463	5,463,004	163,577
Timaru	20,391	..	..	1,205,500	9,335	319,664	..
Oamaru	53,059	..	..	3,022,637	22,388	768,245	54,947
Port Chalmers	41,332	..	..	2,503,672	10,538	400,606	..
Bluff	26,547	..	..	1,645,221	3,058	123,188	..
	718,325	60,527	2,863	43,609,309	249,421	8,931,189	5,250,603
Lines of vessels.							
S.S. & A. Co.	275,644	26,344	1,496	16,483,723	124,462	4,465,410	2,310,332
N.Z.S. Co.	219,659	34,183	1,367	13,307,667	84,533	3,075,132	2,643,244
Colonial Union Co.	157,087	..	..	9,884,724	15,868	529,849	297,027
Shire Line	65,935	..	..	3,933,195	24,558	860,798	..
	718,325	60,527	2,863	43,609,309	249,421	8,931,189	5,250,603

Shipments.							
From 1st July, 1889, to 31st December, 1889 .	494,477	29,522	52	30,139,118	10,783	393,077	3,384,229
From 1st January, 1890, to 30th June, 1890 .	718,325	60,527	2,863	43,609,309	249,421	8,931,189	5,250,603
Total for the year .	1,212,802	90,049	2,915	73,748,427	260,204	9,324,266	8,634,832
Stock stored in freezing works waiting shipment June, 30, 1890 .	111,590	..	..	..	16,456	..	1,359,924
Total shipped and awaiting shipment 30th June, 1890	1,324,392	90,049	2,915	..	276,660	..	9,994,756
Shipments for year ending 30th June, 1889 .	874,102	62,321	400	..	132,645	..	7,941,657

Exports of Frozen Meat.

1882	1,707,328 lbs.	1887	45,035,984 lbs.
1883	9,853,200 ,,	1888	61,857,376 ,,
1884	28,445,228 ,,	1889	73,564,064 ,,
1885	33,204,976 ,,	1890*	100,934,756 ,,
1886	38,758,160 ,,		

* Brought down to the end of the year from more recent returns.

the trade had been so well established, the results might have been very different. **As the importance** of the frozen meat trade continues to be more widely felt, it seems natural that the force of circumstances should induce **organization** amongst those conducting it. Shipments will in time be graded in such a way that some of the largest cargoes, at least, can be disposed of by **forward sales**, as grain and other classified commodities are sold. **It is also possible**, by means of properly constituted committees of those to whom the meat is consigned in this country, to **regulate the market supply** so as to prevent a reduction of prices out of proportion to that which may be experienced for the home product.

The following particulars of the **leading Companies** engaged in the shipment of frozen meat from New Zealand are extracted from the *New Zealand Trade Review*, of 5th March, 1891.

NORTH ISLAND.

——	Full capacity of works.	Frozen last year.	Estimated out-turn present year.
	Sheep.	Sheep.	Sheep.
Gear Meat Co., Wellington . . .	360,000†	144,315	200,000
Meat Export Co.	350,000*†	284,601	280,000
Nelson Bros. (three works), Hawke Bay	700,000*†	290,000	350,000
North British and H.B. Co., Hawke Bay	130,000	88,460	130,000
N.Z. Frozen Meat Co., Auckland .	100,000	16,000	30,000
Mt. Egmont Freezing Co., Waitara .	65,000‡	..	60,000
Wanganui Freezing Co., Wanganui .	150,000‖	..	50,000
Longburn S. and F. Co., Longburn .	200,000§	..	100,000
Totals North Island	2,055,000	820,376	1,200,000

* To be increased within the current year. † Increased recently.
‡ Not worked last year. § New works. ‖ In process of erection.

SOUTH ISLAND.

—	Full capacity of works.	Frozen last year.	Estimated out-turn present year.
	Sheep.	Sheep.	Sheep.
Canterbury Frozen Meat Co. . . .	443,000	342,328	228,000
Christchurch Meat Co.	448,000†	145,600	230,000
South Canterbury Refrigerating Co. .	275,000†	86,035	200,000
N.Z. Refrigerating Co., Dunedin and Oamaru	300,000	222,385	195,000
Southland Frozen Meat Co. . . .	144,000†	56,967	75,000
Totals South Island	1,610,000	853,315	928,000
Totals Colony	3,665,000	1,673,691	2,153,000

† Increased recently.

"The quantities given include beef and lambs, represented by their equivalent weight in sheep. The years referred to are not coterminous, but the last year in each case is the year last closed."

The usual dividend of these Companies for the last two or three years has been from eight to ten per cent., and they have been extending their works and building new ones at convenient centres to suit the growth of trade.

The extraordinarily erratic course of the Australian meat trade as seen from the following table, has given rise to numerous speculations and also to many mistaken impressions as to its future. To begin with, the extremely meagre contribution of, in round numbers, 42,000 cwts. of mutton in 1887, was out of all proportion to the amount supplied by New Zealand when the total number of sheep in Australia is known to have been over 80,000,000 as compared with 15,000,000, in New Zealand. The greater proportion in Australia of Merino sheep, the mutton of which, owing to its thin condition and dark appearance, has been at a discount in the British market, will account

TABLE SHOWING THE TOTAL SHEEP STOCKS IN THE COLONIES OF VICTORIA, NEW SOUTH WALES, AND NEW ZEALAND, AND THE TOTAL EXPORTS OF FROZEN MUTTON SINCE 1882.

—	Victoria.		New South Wales.		New Zealand.	
	Sheep.	Mutton Exported to Britain.	Sheep.	Mutton Exported to Britain.	Sheep.	Mutton Exported to Britain.
		cwts.		cwts.		cwts.
1882	10,174,000	23,133	36,115,000	8,336	12,408,106	
1883	10,739,000	10,371	37,916,000	21,376	13,306,329	86,994½
1884	10,637,000	35,094	31,660,000	26,364	13,978,520	252,422
1885	10,682,000	44,489	37,821,000	9,085	14,546,801	286,961¼
1886	10,700,000	32,947	39,169,000	4,762	15,174,263	336,404¾
1887	10,624,000	21,518	46,965,000	20,927	15,155,626	395,022¼*
1888	10,600,000	Nil.	46,503,000	44,435	15,503,263	551,936
1889	10,882,000	Nil.	50,107,000	30,999	15,433,328	Carcasses. 1,068,286; cwts. 568,499
1890	..	Nil.	55,477,404	cwts. 70,289; carcasses. 157,447†	16,120,423	Carcasses. 1,633,357

* Of this 34,366 cwts. consisted of lamb, numbering 110,816 carcasses, weighing 34½ lbs. (fully) each. The sheep in the same year (1887) averaged about 61 lbs. each.

† Besides carcasses of sheep, estimated at 50 lbs. each, there were sent 1,152 carcasses of lamb weighing 30 lbs. each, and 588 p.c.s. of beef at 100 lbs. each.

to a certain extent for the fact; but, in addition, the natural climatic difficulties tend to retard those changes in the system of management which are necessary for the full development of the capacity of the country for meat production. The Australian Colonies are only now recovering from the disastrous results of a period of severe **drought**, which has destroyed many of the stock, retarded the natural increase of the flocks, and further prevented the accumulation of flesh and fat in the case of the animals that remained. The latter fact accounts for the disappearance of the Victorian trade in mutton in 1888. The population of Melbourne and other large centres were able to absorb all that could be produced in killing condition.

It has been remarked that **Victoria**, with her (in round numbers) 10½ millions of sheep, exported, in 1887, 21,518 cwts. of mutton, whereas **New South Wales**, with her 47 millions, sent only 20,927 cwts. A glance at the map will show that much of the back country of New South Wales is tapped only by Victorian railways, and the result has been that the Victorian meat supply has been swelled by sheep from the superior feeding-ground on the New South Wales side of the Murray River.

The **fact** which stands out with greatest significance in connection with the figures dealing with the frozen meat trade of Australasia, is, that in 1888, while the export of mutton from Victoria ceased, that from New South Wales was more than doubled. As compared with the export of 1887—44,435 cwts. were sent as against 20,927 cwts. —a quantity more than nine times greater than that of 1886, the figures being, 1886, 4762 cwts.; 1888, 44,435 cwts. Too much consequence must not be attached to a comparison of the latter figures, as the low amount of 1886 was due to the reaction after the comparatively high exports of 1883 and 1884, when 21,376 cwts. and 26,364 cwts. of mutton were shipped respectively. The special point of interest is the fact that even the serious consequences of the recent droughts from which the colony has suffered have not been sufficient to neutralise the decided tendency towards meat production. With the advent of the more congenial portion of the cycle of seasons, which may be said now to have begun, an expansion of the frozen mutton trade may be confidently expected.

The rate at which the trade is growing may be gathered from the following table showing **The number** and **carrying power of the vessels** engaged in the frozen meat trade with Great Britain.

——	Number of Vessels.	Carrying Capacity each Voyage.	Maximum Annual Importing Capacity.
		Carcasses.	Carcasses.
New Zealand to London	10 sailers	128,000	128,000
	21 steamers	753,000	1,826,000
" and Australia to London	11 "	429,000	858,000
Australia to London	13 "	60,000	180,000
River Plate to London, Liverpool, Glasgow, &c.	20 "	480,000	1,440,000
Totals for 1890	75 vessels	1,850,000	4,432,000
Totals for 1889	71 vessels	1,316,000	3,391,000
Totals for 1888	57 vessels	955,000	2,405,000

It is argued by those who do not believe in the possibility of the growth of a large export of frozen mutton from Australia, that the **rate of increase of population** is greater than the rate of increase of sheep. This is similar to many assertions which form the staple of ordinary gossip and serve to gain a momentary advantage in argument; but it is not founded on fact. **A return**, presented by command to the Parliament of New South Wales, entitled "Australian Statistics 1888–89," points out that the **mean**

annual increase of population in Australia for ten years up till 1888 was 3·82 per cent. determined as follows:—

Queensland	6·55 per cent.
New South Wales	4·92 ,,
Western Australia	4·11 ,,
New Zealand	3·45 ,,
Tasmania	2·89 ,,
Victoria	2·80 ,,
South Australia	2·38 ,,

The ratio of increase of sheep for all Australia is stated by Mr. Coghlan, New South Wales Government Statistician, in the 'Wealth and Progress of New South Wales, 1887–88' at 4·22* per cent. per annum—New Zealand and Tasmania are excluded from the latter calculation, but their population returns do not materially alter the average of 3·82 per cent. of increase of population, and do not vitiate the comparison made between the annual increase of population, and the annual increase of sheep on the Australian Continent.

Even granting for the sake of argument that the statement is correct that the rate of increase of population is greater than the increase of sheep, it is, as will subsequently be shown, starting on false premises to assert that the population would soon overtake mutton production.

It should be remembered that sheep in Australia have been kept, in the first instance, for wool production, not mutton production, and that the **annual cast** or surplus of sheep as stated by **Coghlan,** available for the supply of mutton amounts to 12·34 per cent. **Major Craigie** estimates the corresponding annual "cast" or "draft" from the stocks of Great Britain available for slaughter, at 40 per cent. There is here, in comparing the two percentages, a wide margin for the colonial stock-breeder to work upon, and

* In the edition of 1889–90 the increase is stated at 4·79.

reduce to his advantage. He can never hope to rival the British percentage, as, owing to the facts that the **wether hoggets** in this country are killed when about one year old, and the Australian wethers at two or three years old, the latter must appear two or three times in the enumeration and thereby reduce the total percentages of the breeding members of the flock. The percentage of the available annual crop of sheep for slaughter will also consequently be reduced, as compared with our British flocks, which consist more largely of breeding-ewes.

The average dead-weight of sheep from Australia has been estimated at 45 lbs., and from New Zealand at 56 lbs.,* as against 70 lbs. for all ages of dressed sheep reared in the United Kingdom.

Some years ago the latter estimate might have been near the mark; but, with the growth of the demand for small quarters of lean mutton, the tendency to early maturity and greater consumption of lamb, 60 lbs. is probably nearer the true average. No doubt an average of the London market would be higher, but the light weights which find favour in the provinces and in Scotland materially alter the figures. In fact the two-or-three-years-old New Zealand wether, bred and fed as it is, ought to weigh more than the average British sheep at the age at which it is now killed.

In this country the weight of a carcass is given when cold, including the kidneys and kidney-fat. In Australia and New Zealand these are removed, and the freezing weight stated at 4 lbs. per cent. less than the cold-weight of sheep and lamb.

The rapid increase of sheep in Australia affords one explanation of the small percentage of cast sheep annually

* The great bulk of the consignments received from New Zealand are entered at the Custom House in London upon the estimated basis of 60 lbs. per sheep and 30 lbs. per lamb. This practice vitiates the Customs returns to a degree which makes them unreliable.

disposed of in the flesh-market. All the young ewes are there kept for breeding purposes, whereas in Great Britain a large percentage of "Cross-bred" and "Half-bred" ewe lambs are killed annually without being allowed to breed. As the Colonies become filled with stock, an increasing number will be set free to form the annual surplus. Wethers can then be sold at younger ages, and the room thus secured will naturally be occupied by breeding ewes.

Taking all these matters into consideration, there is no doubt but that the Australian 12·34 percentage of cast sheep can, with the inducement of a ready market for mutton, be very considerably increased. Many sheep which by the present system, would be left to die of old age, will in future be disposed of to kill. This will also raise the average quality and quantity of the "clip" of wool throughout the Colonies.

Proportions between population and live-stock.—It may here be fitly recorded that Great Britain, with her population, in round numbers, of 38,000,000, is supplied with mutton from flocks of less than 30,000,000, plus amounts of imports, estimated (Craigie) by two different methods at 14½ and 18 per cent. of the total supply; in other words, from about one-seventh to less than one-fifth of the whole amount. When these figures are contrasted with corresponding figures in Australia — 3,000,000 of population and about 110,000,000 of sheep—the idea that there is any immediate possibility of the population outgrowing the mutton supply must vanish from the mind of the most doubtful.

Without going into similar details in the case of **beef-production,** it may, by parity of reasoning, be accepted that the Australian and New Zealand herds of nearly 10,000,000 of horned cattle will be fully able to provide for the 3,800,000 (roundly) of population, and supply a substantial surplus for exportation as well, especially when we remember that in the United Kingdom there are little more than 10,000,000 head of cattle to 38,000,000 of inhabitants. The imports of foreign beef into this country have not, until 1890, materially changed on the average since 1880, when it stood at about 10½ lbs. per head of the population.

It is interesting in this connection to contrast Coghlan's figures representing the **consumption** of **butchers' meat** per head of the population in New South Wales as compared with that in the United States of America and some of the leading nations of Europe :—

New South Wales.	Britain.	France.	Germany.	United States.
lbs.	lbs.	lbs.	lbs.	lbs.
278	105	74	69	120

The figures demonstrate a fact well-known to those who have visited the country—viz., that there is in the Colonies an enormous amount of **unnecessary waste of mutton and beef.** The early days in the bush, where flesh formed the most important part of the diet of the pioneers, and the impossibility of being able to secure a market for mutton at almost any price, unless in the vicinity of a town, are no doubt in a great measure responsible for the existing state of things. It is natural to expect that, as facilities for the sale of mutton increase in connection with the export trade, a saving in the amount of meat consumed per head of population will be effected without in any way curtailing the useful home supply.

That the **increased population** of the Colonies will require an increased home-supply of mutton and beef, every one will admit, but the great bulk of the increased meat product of the vast grazing-lands of Australia will naturally find a market in Europe, where the population is also increasing, and where the total numbers of the flocks for some years have actually been decreasing. **The one thing wanted** to bring about the traffic indicated is a complete system of cheap and easy transport by land and sea from the grazing-lands of Australia to the European markets. The importance of providing this, as a duty of the Government of the Colonies, has already been dealt with.

Preparations have begun to be made in Sydney for the increase of the trade in mutton and beef from up-country. **The meat-market at Darling Harbour,** now being completed, with seven chilling-rooms attached (possessing a ground-floor capacity of 160 ft. by 35 ft.), has cost about £80,000, and private enterprise is also extending the accommodation for freezing and for storing mutton in the city.

The experiences of stock-breeders of the serious losses due to an insufficient supply of drinking-**water** have taught a salutary lesson, and tanks to store rain-water are being rapidly constructed. **Artesian** water has also been tapped in many places, and although this is frequently "**sweet**" or **alkaline**, stock like it and thrive upon it. It is found that long after every vestige of green growth has disappeared, sheep, if they have plenty of water to drink, can live and even do well by licking the dried up remains of the previous year's growth from the surface of the land. Without water, the dried powder adhering around *nuclei* accumulates in the rumen in the form of stonelike dust-balls, which often are the immediate cause of death.

In many of the districts of least rainfall, drinking-water is all that is necessary for stock preservation, as animals live, and do well, except in times of great extremity, upon the various species of "salt-bushes," (*Salsolaceæ*), which, as a sort of undergrowth scrub, are natural to the country of little rainfall.

The replacement of cattle by sheep is another feature in the development of New South Wales which is worthy of notice. In 1881, cattle numbered 2,597,348, but in 1889 only 1,741,592. Sheep increased in number nearly 14,000,000 during that period—from 36,591,946 to 50,106,768. It should be understood that cattle are the natural and indispensable pioneers of sheep in the back country of Australia. The remark applies equally to immense tracts in Queensland, South Australia, and Western Australia. The soil in its natural state is loose and powdery, and requires to be trodden down and consolidated by cattle before it is possible to stock it with sheep. The trampling of the cattle lays the dust which would otherwise get into the wool and seriously reduce its value. The work assigned to cattle has, in a great measure, been overtaken in New South Wales; and that being the case, sheep are there found to give less trouble and anxiety and to pay better. The natural result is as shown by the foregoing figures:—**Cattle** are going down in numbers in New South Wales, while they are increasing in Queensland, where new land is being taken in and where their presence is consequently necessary. There the increase has been from 3,618,513 in 1881 to 4,872,416 in 1889. The increase in sheep during the same period has been from 8,292,883 to 14,470,095. The stocking up of Queensland, first with cattle and then with sheep (many parts being admirably suited for the latter), will now proceed surely, though possibly at varying rates, from year to year with the variations in climate. In addition to home-bred sheep, surplus stock has been drawn from New South Wales to Queensland, and in this way the freezing companies have had to contend so far with a demand which will ultimately slacken and liberate a greater number of sheep for freezing and exportation.

For the shipment of the Queensland supply, **freezing works** are in process of construction in Brisbane, Rockhampton, and Townsville. These are situated at the termini of the trunk railways which run westward into the grazing country.

Several Queensland **meat companies** are already formed with the object of developing the trade, and in New South Wales the Australian Chilling and Freezing Company, with a capital of £250,000—of which £50,000 have been offered and subscribed—have selected a site for their works and will soon begin operations.

It is thought probable by some who have studied the possibilities of this trade, that great inland centres of the stock trade will spring up, and that, for example, **Burke** on the Darling River will become the Chicago of New South Wales.

This may or may not be realised, but as regards the hottest parts of the country, it is most probable that in due time sheep will be killed at numerous local centres, where they can be brought without loss of weight and without injury resulting from their being driven long distances, or from their being packed alive into waggons where they get heated, with serious detriment to the quality of the flesh. The cost of conveying dead meat by rail in **chilled cars** is less than the carriage of the live animals, because mutton can be packed more closely than live sheep, and the chilled cars are kept clean and serviceable for the carriage of various commodities up-country on the return journey, whereas the filthy state of live-stock cars demands that they should go back empty.

The Queensland supply will be composed largely of **Merino mutton**, owing to the special suitability of the Merino sheep to the conditions of the country; but the prejudice which has existed in England against its thin condition and dark colour will to some extent give way when the necessary precautions just named are provided, to preserve its natural excellence of flavour and the fulness of condition which can be secured when the sheep are killed at their prime on the stations. It is possible, also, by selection to increase the tendency to flesh production in the case of the Merino. No attention has been given to this, the sole object of the breeder having been for years the production of wool.

A return of 1*d.* per lb. would be a handsome profit to the Queensland or up-country runholder. For the present Australian mutton can be produced at a much smaller cost than the mutton exported from New Zealand.

A close study of this great question of **meat supply** can lead to only one conclusion, viz., that it is on the eve of a **wide, though possibly gradual, expansion,** and it remains for us to consider what influence this expansion will have upon the meat trade and upon meat production at home. In looking forward to the future, it is impossible after having studied the real causes and temporary nature of the extreme fluctuations in the price of Australian and New Zealand mutton, to concur with what has been stated of the history of the trade, viz., that it "suggests little risk of frozen mutton materially affecting the value of high-class stock here." It requires no statistical figures to bring home to one's mind the fact that if by any chance the Australasian supply of mutton, amounting to about 1,800,000 carcasses, were suddenly cut off, all the markets in this country would be so tightened that the prices of every description of mutton would be raised. If, on the other hand, the imports were doubled or quadrupled, with a well-organised system of storage and distribution to prevent a local glut in the market, unquestionably the prices all round would ultimately be lowered—inferior meat more directly and at first, but the higher qualities also to some extent in sympathy.

No two classes of consumers—one of high-priced meat, and the other of low-priced meat—can remain absolutely distinct in a community for any length of time, especially when it becomes known that much of the low-priced meat is just as good as that sold at the higher figure. As soon as there are transfers of one class to the other, so soon will the total supply of meat, following the influences of the laws of supply and demand, regulate the prices of the whole.

It would be equally good reasoning and equally easy to show a series of figures in support of the assertion that the price of beef has no influence upon the price of mutton. It is a fact that the prices of beef and of mutton do not follow each other closely in the market—for example, when mutton bounded up in price during the summer of 1889, beef took no such rise. **Messrs. W. Weddel & Co.'s Circular** for 1889 gives the advance from January to June on prime Scotch and English wethers as fully $1\frac{1}{2}d.$ per lb. The reduction in price during the latter half of the year left, nevertheless, a net gain of $\frac{1}{2}d.$ per lb. The corresponding movements in prime beef show an improvement of barely $\frac{1}{2}d.$ per lb. with a net loss at the end of the year of $\frac{1}{4}d.$ per lb.

No one will readily admit that, should beef continue to remain at the relatively low figure, this circumstance will not ultimately tend to bring down the price of mutton. Certain mutton-eaters will become beef-eaters, and thus slacken the demand for mutton.

The leading evidence in this matter seems to greatly preponderate in favour of the prospect of a substantial increase in imports of the frozen mutton from Australasia—from New Zealand in the first instance, but ultimately from Australia—in spite of the rapid growth of population. The British workman may congratulate himself upon his good fortune (for it must be considered good fortune that a labouring man can secure his quarter pound of sausages or mince for breakfast at the wonderfully moderate cost of $1\frac{1}{4}d.$ or $1\frac{1}{2}d.$) and the British farmer had better begin now to lay his plans to meet the reduction in the price of his home products, which, to all appearance, must be the natural result of the growth of the foreign trade.

A prominent feature of the frozen meat market in Great Britain is its marvellous sensitiveness to the laws of supply and demand, and consequent sudden fluctuations in prices. The breakdown of some expected steamer with a cargo when the reserve stocks are low, or delay in discharging at the dock, is credited with materially hardening market rates. The distribution of merely ordinary consignments into the hands of a large number of salesmen, has a tendency in the opposite direction to quite an incredible extent. When prices are high, all are anxious to realise their consignments, and more mutton is thrown on the market than is required by the trade, with the natural result that prices immediately recede. By a well-conceived organization among the salesmen for the regulation of the supply of frozen meat offered for sale, greater steadiness of prices, and therefore greater security to the producer could be secured. This has been made apparent by the way in which prices have been maintained and even raised when the consignments chanced to be for the time in the hands of a few large agents.

There is another feature of the trade which reduces its elasticity. It is confined too much in its basis of operations: that is, it is too much a London trade. Although it has begun to extend to some of the larger inland centres of population, there exist no adequate facilities for bringing the great masses of the people in distant parts of the country within reach of the benefits to be gained by participation in the Australasian frozen meat trade. The importers of River Plate mutton have been pushing the distributing branch of their business in various parts of the country with great success. The Eastmans Coy., Lim., alone has 524 shops scattered throughout certain parts of Scotland and England considered favourable for their operations. Their chief trade is in American beef and Plate mutton.

The Australasian trade must secure a connection of this kind in local centres before it can assume a position which will induce greater stability in prices. Australian mutton being cheaper—more like Plate mutton—and not possessing so much favour in the London market as that from New

Zealand, would be most directly and immediately absorbed by a local trade of this kind.

The erection of improved store accommodation at the ports of landing will also tend to steady the market. Messrs Nelson Bros. are now building an immense frozen meat store, 151 feet long, 129 feet wide and 50 feet high, at Nelson's Wharf, on the banks of the Thames above Blackfriars Bridge. The chilling chambers will possess a capacity for 160,000 carcasses, and the three storeys into which it is divided will be filled entirely from 10 hatchways above, so that the walls require no doorway or opening from which the heavy cold air can escape. This must result in a great saving of expense, and will make it an easy matter to regulate the temperature of the chambers. The building, which will resemble a great box with holes only in the lid, will be fitted up with electric light and with both the ammonia and Haslam's freezing plant.

There seems to be one ground of hope for the British stock-rearer in the possibility that a portion of the increasing current of frozen meat coming to us from the Australian Colonies may become diverted into other directions, viz., (1) to the United States of America, a country with a vast and rapidly increasing population, and not well-suited to the rearing of good butchers' sheep, while a taste for mutton is quickly developing among the people ; and (2) to the Continent of Europe, where the numbers of sheep tend to decline.

But for protective duties imposed upon imported mutton, the Continent of Europe would before this have been sharing with the United Kingdom a much greater proportion of the blessing of cheap food for the masses of the labouring community than it does.

Should the improvement of the trade of the country and with it the increased purchasing power of the labouring-classes continue to grow more rapidly than the imported-meat trade, the general lowering of prices all round may be delayed for even a considerable time. There is nothing, however, which can justify the belief that the meat-trade will not be governed by the same economic laws as the grain-trade or any other similar trade, when an opening is made to admit the competition of producers who own vast prairie or virgin lands of newly-explored countries. There is in a new country infinitely less capital invested per unit of produce, and less expense in the actual production of it. With the question of transit reduced to a "fine point," the natural result is a levelling tendency in prices, and, as regards the old country involved, this levelling tendency must also be a lowering tendency.

CHAPTER XXXVI.

FREEZING BUTCHERS' MEAT.

Haslam's Dry-Air Refrigerator—The Machine at the Glasgow Foreign Cattle Wharves—Refrigeration by Means of Cold Pipes—Ammonia Compression System—The Kilbourn Machine—Taylor's Patent Ammonia System.

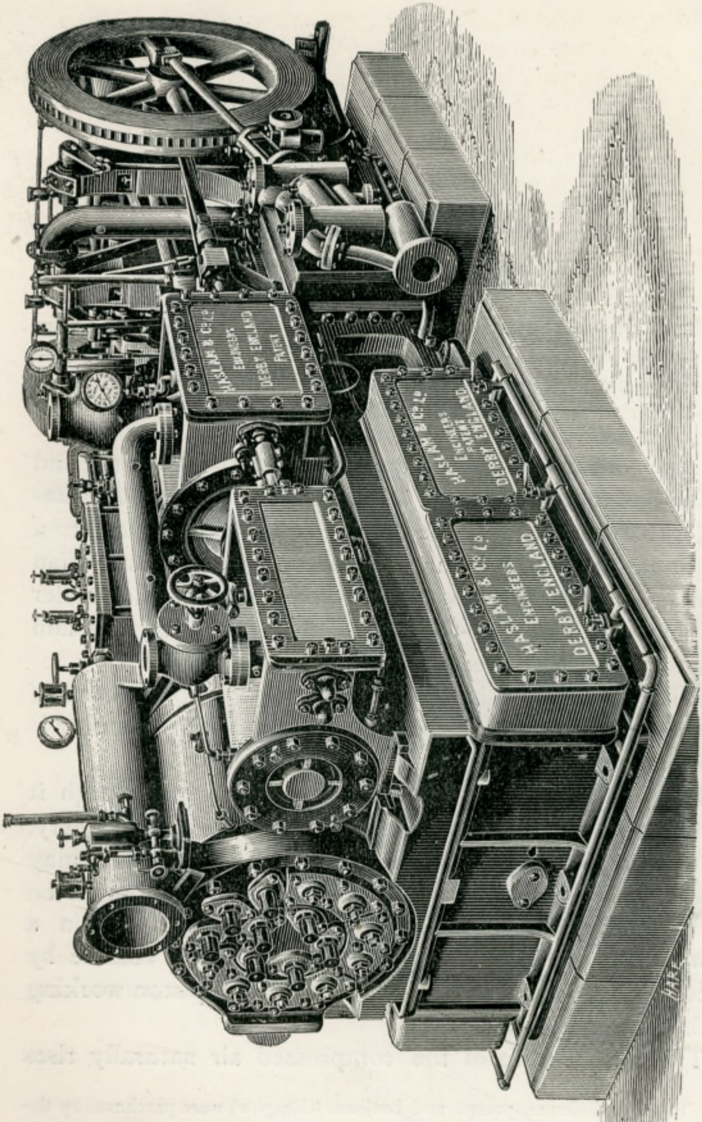
Of the various machines employed in the freezing and chilling of butchers' meat **Haslam's Patent Dry-Air Refrigerator** may be described as the first which reduced to a minimum the risk of damage in the transport of Australian meat. The machine now offered to the public, is made under the Haslam and Bell-Coleman patent,* by the Haslam Foundry and Engineering Company, Ltd., Derby.

It is claimed by this company that about 90 per cent. of the whole frozen and chilled meat trade of this country is supplied on land and sea with their machinery.

The principle is an exceedingly simple one, although it involves the use of elaborate, powerful and costly machinery, and, therefore, a considerable expenditure—which may safely be said to be the only drawback to its adoption on a small scale. Atmospheric air is imprisoned within a powerful cylinder and considerably reduced in volume by pressure applied by means of an air-tight piston working within the cylinder.

The temperature of the compressed air naturally rises

* The Bell-Coleman patent and business (Glasgow) were purchased by the Haslam Company for £15,000 to avert litigation over patent rights, as both companies were working on the same lines.



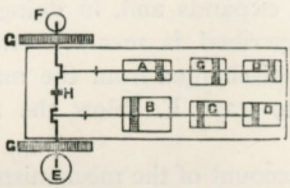
Haslam's Dry-Air Refrigerator.

during this process, or as it has been graphically described, "The whole heat which the larger volume of air contained is concentrated in the smaller bulk of air." The heated compressed air is then cooled by natural water from an ordinary source, such as a town supply, being made to circulate round the cylinder or pipes containing the compressed air. When the pressure is withdrawn from the condensed air, then reduced to a temperature of ordinary drinking-water, it expands and, in doing so, the thermal action already described is reversed—the expanding air loses heat and is discharged from the machine at a temperature of 100° to 121° F. below the freezing-point of water.

The following account of the mechanism and working of the freezing plant in question is extracted from *Industries*, of the 20th October, 1880, and refers to a machine which the writer has personally examined.

The refrigerator at the Foreign Cattle Wharves, Glasgow, is of the largest size made, being capable of discharging 110,000 cubic feet of cold air per hour. It consists of six horizontal cylinders, placed on a massive box-shaped bed-plate. These cylinders consist of two steam cylinders, high and low pressure, two air-compressors, and two air expansion cylinders, placed in the order named, as shown in the accompanying figure.

This arrangement really provides two complete machines on one sole-plate connected to the same crank-shaft; but by disconnecting a coupling in the centre of the crank-shaft, one side of the machine consisting of one steam cylinder, one compressor, and one expansion cylinder, can be worked independently of the other side. The air during the act of compression, has part of the heat resulting from compression removed by water-jackets round the compressors; it is further cooled by being passed through a cooler situated in the sole-plate, consisting of tubes surrounded by water. It then passes to the well-known Bell-Coleman "drying pipes," which are placed in one of the compartments of the chill-room, and from these it returns to the expansion cylinders, in which it expands, pressing forward the pistons, and so helping to drive the machine, and, while performing this work, becomes cooled. The cold air discharged from the expansion cylinder is led by wooden "trunks" or ducts into the chambers, to the various compartments of which it is conveyed by means of further "trunks," which are provided with sliding doors at intervals, so that the quantity of air discharged into any special compartment can be regulated according to the temperature required. The compartments are usually kept at a temperature of from 32° F. to 40° F. The chambers are constructed of double boardings of pine, the space between the boardings being filled with Campbell's flake char, which is a specially good non-conductor of heat; the whole thickness of the walls, including wood and char, being about 10 inches.



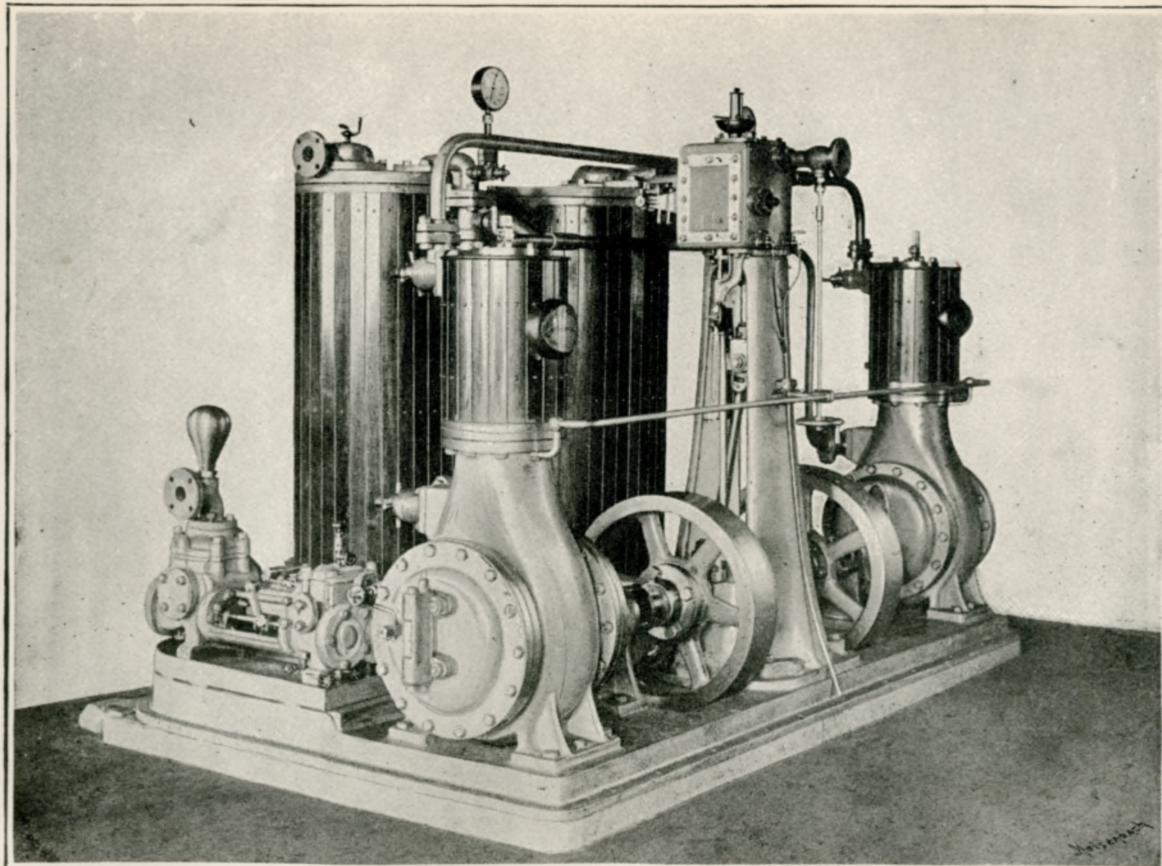
A = High-pressure steam-cylinder; B = Low-pressure steam-cylinder; C C = Air-compressors; D D = Air expansion cylinders; E = Steam condenser; F = Pump for circulating cooling water; G G = Fly wheels; H = Coupling on crank-shaft.

Overhead rails, with switches, are erected in all the compartments, so that a side of beef can be run direct from the killing-rooms into the chill-room without any lifting. The capacity of the chambers is about 45,000 cubic feet. The steam-cylinders can indicate up to 250 h.-p. when the machine is working at full speed and full pressure. The pressure of steam used is 100 lbs. per square inch, and is provided by two externally-fired horizontal multitubular steel boilers, 12 feet long by 6 feet 6 inches diameter.

The machine which has been thus described is on the same plan as that fitted up by the Haslam Company in the meat-market at Darling Harbour, Sydney, for the Government of New South Wales.

This market has been erected at a cost of about £80,000 and contains two floors of 160′ × 150′ each. There are seven chilling or freezing-rooms on one floor, with a total floor space of 160′ × 35′. The cost of chilling carcasses of beef in large numbers is *2s. 6d.* each, and of sheep *2d.* each.

Owing to the machine being double, so that each half can



LXXXIX.—THE KILBURN REFRIGERATING MACHINE.

FITTED UP IN THE S.S. "CITY OF NEW YORK" AND "CITY OF PARIS."

work independently of the other, there is practically little risk of a total break-down of the plant, a circumstance which would be fatal to a cargo of meat in crossing the tropics. Although an engine may remain idle from twenty to twenty-four hours in this country and keep the chambers cool, no such stoppage could be permitted in a hot climate. The effective power is so great that the temperature of the freezing chambers is completely within control.

One of the most conspicuous advantages of the cold-air method of freezing in the case of meat is the fact that a current of pure dry air is kept circulating in the chamber, and the stale atmosphere charged with the exhalations from the meat is regularly driven out to make room for the fresh supply coming in.

Refrigeration by means of cold pipes involves the cooling (to about 10° F.) of some liquid which does not freeze except at very low temperatures. A saturated brine of common salt or more frequently a strong solution of *Calcium chloride* is employed and made to circulate through a large number of wrought iron galvanised pipes placed along the walls and roof of the freezing-chamber. Equalisation of temperature takes place between the air of the closed chamber and the pipes, and the low temperature of the chamber and its contents is maintained by the circulation of the brine or freezing mixture, in the pipes.

One of the best known and most convenient methods employed for cooling the brine in this country is the **ammonia compression system**, the plant for which is made by the **Kilbourn Refrigerating Machine Company, Ltd.**, Liverpool. The principle involved is extremely simple and takes advantage of the large absorption of heat which takes place when liquid ammonia becomes vaporised.

A convenient volume of ammonia gas is compressed by means of a compression pump, and then passed by a pipe into a condenser, where, by the abstraction of heat, through the walls of the condenser being kept in contact with cold water, the gas becomes liquid. The liquid ammonia is conducted by another pipe from the condenser into the refrigerator, where, in virtue of the removal of pressure, it expands and, in the process, absorbs heat from the brine (the temperature of which it is intended to reduce) surrounding the coils of pipe through which the ammonia passes. The brine thus reduced in temperature is made to circulate through the tubes already mentioned, which line the roof and sides of the chilling-chambers. Both the brine and the ammonia can be subjected to the process indefinitely.

This system of refrigeration has been extensively used, both on the Continent of Europe and in America, in connection with brewing and other trades, where a small plant only has been necessary, but within recent years it has been adapted on a large scale to a few of the large ocean steamers—the "City of Berlin," "City of New York," and "City of Paris." There is, moreover, a strong effort being made to take up some of the new ground which is being opened at our large sea-ports by the vast expansion of the frozen meat trade.

Another system of refrigeration by means of **ammonia** was seen in the depôt of the "Country Milk Company," Sydney. In this instance, under **Taylor's** patent, advantage is taken of the abstraction of heat by ammonia in passing from the liquid to the vaporous condition, and a brine of common salt which has been cooled by this means, is circulated through pipes placed in the refrigerating chambers in the manner already described.

The apparatus consists of two ammonia drums which can be alternately heated by steam and reduced in temperature by a current of cold water ; a cold water cistern ; and a cistern containing brine. Each cistern is furnished with a coil of pipe inside, (connected the one with the other) through which the ammonia can pass from drum A. to drum B. Fluid ammonia in drum A. is vaporised by heating with steam. It escapes from drum A. by a tube which passes in a worm pipe through the cold water cistern, where it is condensed. It follows the pipe or tube into the brine cistern and is again vaporised in virtue of a connection between the tube containing it and an area of reduced pressure in drum B. in which it ultimately becomes liquid. The process is continued, but the direction of the ammonia is reversed when the heat is applied to drum B., and drum A. is converted into a receiver in place of the source of supply.

Not only is the importation of butchers' meat made possible, but many varieties of fruits and vegetables can be preserved in excellent condition in freezing-chambers, and can now be carried immense distances with safety.

CHAPTER XXXVII.

MEAT EXTRACT AND OTHER PRODUCTS.

Extract of Meat—Its Character and Value as a Food-Material—The Operation of Making—The Tinned Meat Industry—Its Magnitude and the Effect upon it of the Frozen Meat Trade—The Sydney Meat Preserving Company—The Operation of Tinning Meats—The Testing-Room and the Methods of Testing Employed—Disposal of the Offal—The Steaming of Bones—Manufacture of the Solid Refuse into Manure—Farmer's Desiccating Machine—The Final Product.

Extract of meat, which is practically the same as Liebig's *Extractum carnis*, is now made in Australia for British consumption in hospitals and sick-rooms.

It is surprising that more of this delicious tasty essence is not used by sportsmen and others carrying with them a light mid-day meal, to spread upon sandwiches in the manner of butter. Nothing could be more agreeable to the palate or more suitable for the purpose of a traveller on account of its strength as food and its portable character. When meat extract first became known in this country it was possibly too expensive to be used by the general public except in cases of sickness or emergency. Now, no excuse of this kind can be advanced, and the price might become lower still if it were used on a larger scale. Extract of beef can be as well manufactured in Australia as in any country in the world, and at a cheaper rate.

The Operation of Making. The meat and bones are boiled for about forty-five minutes. If the process were prolonged, gelatine, which is not wanted, would be got in the soup. The weak liquor, consisting of the water in which the meat was boiled, with the juice which it has extracted from the flesh, is passed through straining bags and conducted to the first of a series of three evaporating pans. Tin is found to be a more suitable material of which to make the vessels than copper, which is liable to corrode and become poisonous. The liquid is continually stirred during the five days required for its evaporation; in the first instance by two sets of revolving arms, working horizontally but in opposite directions; one being submerged at the bottom of the evaporator, and the other superior to it in the upper portion of the liquid. Near the end of the process, when the material becomes viscid and the mechanical stirrers cannot move it properly, a wooden spatula worked by hand is used to keep up the motion. The three evaporating pans are of different sizes, to suit the bulk of the liquor at the various stages. It is passed from the larger to the smaller sizes of the series till finally it reaches the least of all, as it contracts in volume by evaporation. Meanwhile the initial temperature of 212° F. is also gradually reduced to its final one of 140° F. This is to prevent injury to the material by its adhering to the bottom and sides of the pan, and the consequent burning and blackening of the crystals contained in it. Nothing is added either to season or to preserve the residue. The natural salts of the meat—kreatin, etc.—guarantee the preservation of the extract.

The Tinned Meat trade between this country and Australia and New Zealand has existed for over twenty years, and, although the frozen meat is likely to prevent its extension to any considerable amount, still maintains a magnitude of over 200,000 cwts. of tinned meats annually imported into the United Kingdom. Meats thus preserved have a special value in times of war and for those whose pursuits or occupations necessitate their camping out in tents; and consequently, we may be assured that a great increase in the amount of frozen mutton imported does not necessarily imply an extinction of the tinned meat trade.

It is hoped that some readers may find an interest in the following short account of the **operation of tinning meat** as carried out by the **Sydney Meat Preserving Company**, whose works at Auburn, under the able management of Mr. Alban Gee, were personally visited by the author. The Company is intended to steady the prices of meat in the Sydney market by absorbing what cannot be sold at a satisfactory rate. It participates with other exporters in sharing, *pro rata*, according to the amount of meat handled, the proceeds of a charge of ½*d.* per cent. made by salesmen on all transactions in the market.

The object in view is to preserve the meat in a cooked condition in hermetically sealed or air-tight tins of capacity varying up to six pounds. The temperature is raised repeatedly to a heat considerably above the boiling-point of water, so that all germs that would lead to putrefactive changes are destroyed. As the tin is sealed up closely before the final heating, no fresh inoculation by germs from the air can take place.

The operation. The meat, in a parboiled condition and free from bones, is packed when hot into cylindrical tins (all made on the premises), and the lids then carefully soldered on—one minute hole drilled through about the centre of the lid being left. The tins are then steamed, usually for an hour, although in some instances only for five minutes, in a solution of Chloride of calcium, which has a much higher boiling-point than water, the temperature at this stage rising to about 230° F. The tin is then hermetically sealed, a wet sponge being placed on the lid of the tin to stop the little jet of steam that, if permitted, would force its way through the liquid solder during the operation of sealing. The sealed tins of meat are then boiled in the chloride of calcium solution, which never rises above 245° F.

The tins are subsequently removed by a carriage on rails to a bath of cold water, into which they are dipped to cool, and then rubbed with sawdust to clean them. The tins are convex on the ends when warm, but tend to become concave when placed in the water owing to the vacuum formed in the space lately occupied by the steam.

Defective tins do not become hollow at the ends, but ultimately tend to bulge as gases form through the decomposition of the material within.

The testing-room where they are placed for five days after they have been filled and cooled, is kept at a temperature of 85° F. Ane xpert can then determine if the work has been satisfactorily accomplished and consequently if the meat is preserved from decay. The sound on tapping a good, as compared with a bad, tin is so distinct that the difference can be distinguished at once. Even in the dark a defective tin can be recognised by the touch of the investigator. Those with the natural vacuum yield more readily to the pressure of a man's finger on the end than one which has had air admitted through some defect. The meat, if properly preserved, also gives a peculiar click on the tin if the end of the case is struck sharply by the palm.

Sheep to the number of 2,000 can be manipulated—carcass and offal—in one day ; but it must not be imagined that the works are run as a rule at their maximum capacity. The sheep are killed by bleeding. **The blood** descending through a sparred floor, is collected in an enclosed tank and carried on rails to the desiccating department at a convenient, but, from a sanitary point of view, necessary, distance, from the main building. **The offal** goes to the same department and all the refuse products are there manufactured into an excellent animal manure.

All the bones and inside fat are cooked for six hours in closed digesters, like Papin's, into which steam is driven at a pressure of three atmospheres—forty-five pounds per square inch. The tallow ultimately runs off into vessels termed refiners, where it is dried by boiling ; then it flows into coolers where it becomes nearly granular, and is finally packed in casks of a convenient size for market. After the

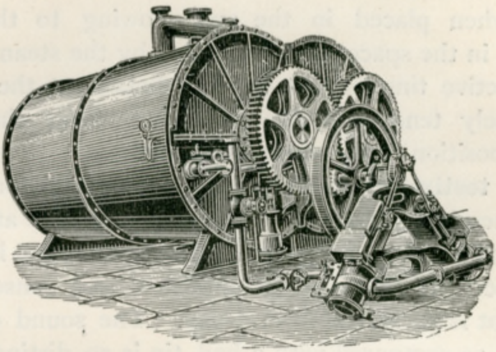


FIG. 1.—Farmer's Patent Twin Cylinder Machine for Drying and Pulverizing Blood, Bones, Excrement and Offal. Sir James Farmer & Sons, Salford, Manchester.

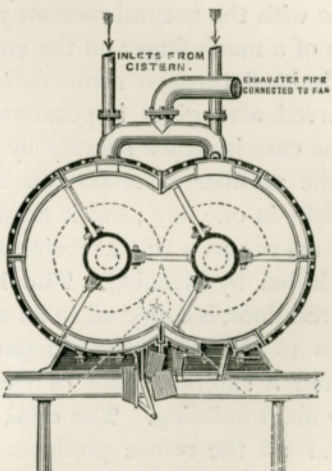


FIG. 2.—Section Elevation of Farmer's Twin Cylinder Drying Machine.

gelatinous matter is removed from the digesters, the bones still remaining are withdrawn through man-holes and put under a pressure of forty tons to separate moisture and tallow. The bones are then in a brittle condition and readily crumble and become incorporated with other refuse in the manufacture of the manure already mentioned. **The feet** and shank bones are first boiled for the purpose of extracting the "neat's-foot" oil and then subjected with the other bones to the super-heated steam process. **In drying** the residue and mixing the various refuse ingredients, the most valuable of which are the steamed bones and the blood, **Farmer's drying or desiccating machine** (see accompanying figures) is employed, being of the same pattern as those in use at the "Night Soil" Works at Birmingham. This consists, as may be seen by figure 2 of two large steam-jacketed cylinders, placed side by side, and joined together where they touch like a pair of Siamese Twins; so that there is an opening of considerable width (about one-third of the circumference) from the one into the other, extending throughout their entire length. A hollow steam-heated axle or shaft, carrying arms for stirring, passes through the centre of each in a longitudinal direction. These arm-blades, or beaters, are provided with scrapers, which are adjusted so that the whole of the inside surface of the casing or cylinder is kept clean, and the manure is not allowed to adhere to the iron in lumps or cakes. The steam jacket is strong enough to bear a pressure of seventy pounds per square inch. The blood is dropped into one of the cylinders, and the steamed bones and other refuse into the other, and all are thoroughly mixed by the two revolving sets of arms. Meanwhile the material within is being **dried** by means of superheated steam thrown into the hollow axles and the space surrounding the double cylinders formed by a steam jacket which envelopes the whole. **The vapours** escaping from the material within are drawn off to a condenser by an exhaust fan.

The resulting manure, removed by balanced doors at the bottom, is a dry, finely-divided, dark-coloured material, forming an excellent general manure, which, however, is not yet appreciated in the Colonies, as may be gathered from the fact that 3,000 tons of it were shipped in 1888 to the Mauritius at £5 10*s.* per ton, and that in 1889, 1,200 tons were despatched to the same place at five guineas per ton. The following is a copy of the analysis supplied by Mr. J. C. Newberry, Technological Museum, Melbourne :—

SAMPLE OF ANIMAL MANURE.

Phosphoric Acid	13·62
Lime	18·21
Carbonic Acid	1·05
Nitrogen (including Ammonia)	3·25
Silica (Sand, &c.)	4·20
Moisture	4·60
Organic Matter	55·07
	100·00

CHAPTER XXXVIII.

POINTS OF INTEREST IN COLONIAL GOVERNMENT.

Colonies mainly Protectionist, Reasons why—Results—Power of Money in Strengthening a Government—Unpopularity of Direct Taxation—Evil Influences of Yielding to Popular Desires in Matters of Economic Principle—Borrowed Capital—Necessary and Unnecessary Public Expenditure—The Unemployed Difficulty—Unremunerative Expenditure of Capital—Class Legislation—Land Taxes—A Universal Property Tax—The New Zealand Property Tax—The Victorian Land Tax—Proposal of an Extreme Tax upon Large Holdings—Its Fallacies—Impossibility of distinguishing Unearned Increment from Improvements made on Property—The Duty of a Colony to develop her Resources—The Early Settler and his Rights—The large Holder and the small Settler.

The Colonies, with the exception of New South Wales, **are protectionist**, and some of our politicians at home try to show that such colonies are mistaken. It is nevertheless necessary for the stability and efficiency of the government of a young country to adopt a well conceived and, consequently, moderate tariff for revenue purposes, on certain imported commodities. To raise money sufficient to meet the wants of a youthful community is practically impossible in any other way. Money is scarce and dear to begin with, and the natural tendency at first, in the back settlements at least, is to pay in kind or by a system of barter, and to do without money as much as possible. No doubt this is a cumbrous plan, and one which if too long adhered to involves expense to the purchaser, as it makes an opening for the middleman, who is sure to find ways and means of extending and perpetuating that opening.

Taxes can only be collected in money, and **money** being at a premium is given away with reluctance, or cannot be given at all, since it is not in the possession of many of those who would be called upon to pay taxes. A man may rapidly acquire wealth in stock and yet be quite unable, unless at much inconvenience, and, therefore, unwillingly to pay taxes, because to do so he would require to secure money at a sacrifice. As he meets his own engagements at first by the transfer of commodities, and even compensates his herdsmen by giving them so many cattle, he naturally feels aggrieved if asked to pay taxes in money which he cannot command for his own private purposes. When an import duty is charged, he bears his share of the burden in proportion to the amount of commodities subject to duty which he uses, and he discharges this additional indebtedness in the same manner as his other liabilities and without feeling dissatisfaction. Apart from this leading objection to direct taxation, the difficulty and expense of collecting direct taxes under the circumstances would lay a serious additional burden upon the tax-payers. When a policy has been established it is not easy to change the views of the majority of the people with regard to it, as although the minds of those who at first sympathised with a given policy, say protection, might change after a time, yet other classes may have been learning, meanwhile, to see some virtue in that policy, and decline to change with their exemplars.

The labouring classes clamour for **protection**, because they think to bolster up wages and the prices of the articles they produce. That **protection** does so to a greater or less extent is true ; but that this particular result is a good one, in some respects, for the development of the trade of the country is questionable, if protection be persevered in too long, or if it is not practised in moderation; but it is not wholly without its other advantages.

Political parties in the Colonies are pretty well defined as "free-traders" and "protectionists;" but the classes representing these two divisions are reversed, as compared with the corresponding parties in this country in olden times, when protection or free-trade formed integral parts of our political creeds. The liberals or manufacturers, are protectionists; the conservatives and country people are free-traders. **The working classes**, who are in the majority, and who, with a manhood suffrage franchise, are practically the rulers, by means of protection, impose upon themselves along with others a share of the burdens of taxation which they would not submit to in any other form, and they thus relieve certain property owners of a share of the taxes, which under other circumstances would fall upon them. It is assumed that it is only just to expect every man who has a voice in the disposal of the revenue of a country, to contribute towards that revenue to the extent to which he is able to do so.

A government which is so absolutely dependent upon popular favour, as the typical Colonial Government is, cannot maintain its stability, usefulness, or even its existence, unless it possesses well-filled coffers, and, of necessity, the money must be got without seeming to press on any class, lest their displeasure may be awakened. This is one pregnant reason why direct taxation is so unpopular. It is unpopular with governments, because it loses them support, and it is unpopular with individuals, because they prefer to subscribe to the revenue in a manner which does not bring home to them the fact that they are doing so, They would even pay a little more than necessary to secure to themselves the soothing condition of blessed ignorance of the fact that they are taxed, or at least of the time when they give their contribution. We have also seen that a whole class will at times willingly submit to be indirectly taxed so that they may gain what they fancy is an advantage in some other direction.

The necessity of governments to curry popular favour, has led to some extraordinary experiments in the matter of policy, and there is little doubt, also to serious economic blunders for which the people themselves must pay sooner or later. **The Colonies have procured** through borrowing British **capital** the means for their development. When money is borrowed strictly for this purpose, and when care is taken that it is spent to the best advantage, no one would think of calling in question the propriety of the transaction. The opinions of those who hold a neutral position must very seriously change when money is borrowed with ulterior ends to serve: when, for example, borrowed capital is taken to defray ordinary natural yearly expenses which should be met by ordinary taxation; or when, as in the case of much of the money borrowed by New Zealand, the first object of government is to find employment for labour, and where the improvement of the resources of the country are only a secondary consideration. The greatest possible difference exists between the value of a work which has been pressed for by a community after experience has shown that it is wanted, as compared with that of one undertaken by no one specially interested in its suitability for anything, in the hope that some use which has not yet been demonstrated may arise for it.

No public-works undertaking can be made economically to suit any purpose whatever when that purpose has only been named without being formulated or its details settled.

The expenditure of large sums of public money on the employment of the **unemployed** is an instance of what has just been described. In 1888 the government of **New South Wales** devoted £250,000 to the payment of the wages of men on "unemployed" relief works. It is quite possible that the pressure upon the ruling powers in favour of the trial of the experiment to relieve prevailing distress was so great that no government could have held office without giving way to it. But the evident waste of public funds, and the dissatisfaction and general want of confidence which it produced, will prevent anything of the kind being attempted again. **In New Zealand** the "unemployed" difficulty has been well settled by reducing the possible earnings of a man at relief work to 4*s.* per day — something lower than the rate of wages in the country—and applying the distance test. It has long ago been demonstrated that **unremunerative expenditure** means the dissipation of a nation's capital, in which the whole community has an indirect interest as an ultimate means for the payment of labour employed. Wealthy individuals can be excused to some extent for spending money or dissipating capital upon unremunerative labour to secure luxuries, but only within the limits which civilised society has prescribed.

The pleasures accruing to the individuals concerned are ample justification when, in our social economy, we accept the rule that a man may do what he likes with his own, always provided that the doing be accompanied with moderation and decency—terms that are easily settled in meaning by public opinion, though not easily defined in so many words.

A government is bound to show something for the money intrusted to it, and unremunerative expenditure should, as a rule, be confined to the preservation of the public safety, and (however much it may now and then be forced, as wealth increases, to coquette with and yield to the demands of **art** in the construction of public buildings,) it must avoid class legislation, which is generally most loudly demanded by the least deserving. **Class legislation** in another direction has been tried in times of difficulty and with equally bad results. **Land taxes and property taxes** that are not universal are due to the temptations offered for class legislation, and can never be maintained because they are right or just, but because the numbers of those who vote and govern are greater among those who are exempted than among those who are liable. No way of raising money for revenue purposes could be fairer than a universal property tax.

In New Zealand the property tax of 1*d.* per £ is in the right direction; but it is defective in that property under the value of £500 is exempted. This is a manifest injustice to the large owners of property, and it deprives those who are exempted, of the privileges which even a small share of responsibility to pay would confer upon them, they having an equal voice with their wealthier neighbours in the disposal of the national income.

A restricted land tax, such as has been tried in Victoria, has proved a failure, and yet something of a similar nature was in 1890 instituted in South Australia. It would seem that young colonies, like young individuals, have to pay for their own experience. It is altogether unfair to tax **Freeholders** and let Government tenants off free. It is almost as bad as the system which prevails in **India** of exempting **forest areas** from taxation while the burden of the land taxes is thrown upon the Ryots. The forest department is enabled to show a large income, not from what it has done itself, but by escaping the taxation of which it ought rightfully to bear a share, and by the disposal of forest products which were the gift of nature before conservation was even dreamt of.

The Victorian Land Tax amounts to about 1*d.* or 2*d.* per acre, according as the land is of first, second, or third rate quality for grazing purposes, but it was made a distinct class tax—and an unjust tax—when all property of less value than £2,500 was exempted. **Bribery** to obtain false valuations was so common that valuers, without any visible means of making money, soon became "squatters" themselves.

Still more iniquitous and injurious to a most important class and to the country was the proposal, which was mooted to the writer by certain individuals in each of the colonies, viz.: To **tax** the land in the possession of large owners so heavily, that they would be unable to make it pay, and be forced to sell either in small holdings or for the purpose of subdivision by land companies. It seemed to be forgotten by them that the large squatter, as he is familiarly called, was the man who first went and, at great personal sacrifice, cut the country out of the bush or wilderness and made it yield a return not for himself alone but for the support of labour, and for the general development of the colony. In the natural course of events, **large holdings get split up**—men die, and the property has to be sold or divided among the members of their families. If there is a demand for small holdings, a company buys up the land, and disposes of it in lots to suit all kinds of settlers, while a handsome profit is usually obtained to swell the dividends of the Company.

The people who are most anxious to see the squatter taxed so that he would be forced to sell, are usually those who would like to have a share of the spoil. No other milder term than **spoliation** will adequately describe what would happen if the proposal were carried out. So much land would be thrown into the market that the price would be lowered in a manner which would tempt all kinds of people to invest in land who are quite unsuited to, or take no interest in, its management, and the original owner would simply be *robbed* of the capital which he had invested in the shape of the well-earned fruits of his own early labours, and of the money that he probably borrowed in Great Britain to improve the property which he imagined was his or his descendants for all time, or until they willingly gave it up. **It is argued** that the present owners are not the original squatters, and that their claims are consequently not so good; but, as in the case of the transfer of any property either to a son or to a purchaser, the present occupant has as much right to the advantages conferred upon him as his predecessor had, or the lawful possessor of any other description of goods or property in the hands of a citizen of a well-regulated community.

It is a moral and physical impossibility to draw the line between improvements and unearned increment; for the means of improvement often bear no trace of their initial presence, and are only seen through results which are indistinguishable from those of unearned increment by an outsider, or one not familiar with the whole facts of the case, as a government valuer would be. If the principle were adopted in connection with landed property in the country districts, it would be equally right to apply it to house property in towns. There are blocks of houses in Collins Street, Melbourne, worth about £5,000 per foot of frontage. Why should government not tax this so that its present owner would not care to hold it, and thereby force him to sell it, and at a ruinous sacrifice too, as all owners would be taxed alike? Every one would be anxious to sell and there would be no one left to buy. **If this were a proper basis** upon which to hold real property, it would also be quite applicable to other property where unearned increment comes in. If a gentleman in town bought a young colt up country for £25, and the animal turned out a magnificent carriage horse worth 300 guineas, the government would have to step in and tax that horse until it would be impossible for the owner to retain him. Or the purchase might be that of a young bull for £50 which in a couple of years turns out a champion, worth 1,000 guineas. The difference between this value, and the original price, plus the cost of keep, is unearned increment, quite as much as the increased value of a property through a district being settled up; and government has as much right to the one as to the other. The "grand" bull would have to be taxed until he had to be sold. No one would be able to retain anything which became valuable, and the result could only be anarchy and confusion. Trade would be driven from the country, and the national wealth forcibly extinguished. The proposition is so absurd and suicidal in the national interest that it seems more than extraordinary that men, sensible in other things, should be found to support it. They excuse themselves by saying that they would only make the possession of large areas of land subject to such regulations, but this does not improve the position—wholesale robbery of one important class is not to be excused because the scheme is not extensive enough to involve the whole community.

The first duty of a new colony as regards trade is to open up her undeveloped natural resources by giving facilities to the most adventurous spirits to work for her and for themselves at the same time. Whatever is made by the pioneer's enterprise is a gain to the colony. It belongs quite as much to the colony if in the possession of one man as if it had been owned by fifty. Land is acquired in the early days through a process of natural selection; the best men for the rough pioneering life push forward and reap the rewards. Those who lag behind have to be contented with the crumbs. Where is the man who will honestly say, (taking the case of a man who, by hard work and self-denial, for a period of twenty-five or thirty years, has secured for himself a fine estate in the back country, while fifty who started with him have lived or simply existed from hand to mouth in town,) that it would be, right to tax this one man so that he would be forced to sell his property to the fifty townsmen at something less than half its value? This, reduced to a familiar example, is simply the case for those who would heavily tax large properties. There is a natural sequence of events in most things, and any attempt to tamper with it will most probably end in mischief. In the settlement of a new country capitalists or large occupiers are the only individuals who can now cope with the inseparable difficulties and afford to "abide developments."

A country cannot be originally settled by small holders, who, as a rule, start without capital other than their own power for work. Such men are starved out if they attempt to depend upon their own little holdings for their sole support, or else they run into irretrievable debt.

The only way that a small settler can begin without capital, is to have some large squatter in his neighbourhood who will employ him the greater part of his time, and thus enable him to live during a few of the early years of the development of his own place, while a field or two are cleared for the growth of crops and his stock is increasing. **The providing of capital by government** for house-building is a method that has been tried in New Zealand, and has entirely and naturally failed through attracting men who would never do any good under any circumstances, and who came, not to settle, but simply to secure a share of the money offered, to spend on intoxicating liquor. There is no way to prevent the abuse of those all too liberal conditions, because they do not sufficiently encourage or demand self-reliance.

The spirit of dependence is a **canker-worm** that gnaws at the vitals of more than one class in the Colonies. If an enterprise has to be undertaken in a district, the people who will reap the benefit are too apt to fall back upon government for help in place of carrying the enterprise out on their own account. It is in this way that the colonial debt of New Zealand has been so alarmingly increased. **Each parliamentary representative** was at one time expected to secure some favour for his own district, whether the case were an urgent one or not. It was for a time a most popular thing for government to satisfy the local wants of a member by consenting to some public work, which also contributed to maintenance of wages at a high rate, and at the same time secured the approbation of the labouring classes. **The proof of the fallacy** of the system is seen in the fact that, as soon as the strings of the public purse were, by sheer necessity, tightened in New Zealand, many of the parasites on the national prosperity, who had been benefited by the abnormal wages, emigrated to the Australian colonies, carrying along with them without difficulty all the patriotism they ever possessed.

In conclusion it may be said that the great interests of a new country are best served by calling the waste lands into use. It means so much more wealth to the colony, so much more labour employed, so many more members of the various classes who live by supplying the wants and requirements of rural settlers, and thus an all-round increase of population. This is the only legitimate means of attracting the necessary capital, which in all prosperous, young, and growing communities, has a right to demand more than an average return or interest near to the active point of settlement extension.

CHAPTER XXXIX.

RELATIONS OF THE AUSTRALASIAN COLONIES TO THE MOTHER COUNTRY.

Major-General Edwards's Inspection of the Internal Defences of the Colonies—The External Defences should belong to the Mother Country—Reciprocal Benefits—Preferential Import Rates on Goods in the British and Inter-Colonial Trades—Union between Great Britain and her Colonies of Mutual Advantage—Impossibility of Separation Between this Country and her Colonies—Influence of American Protection upon Trade—Result of Free Trade with the United States of America—Liability of the Colonies to follow America rather than Great Britain—A Scotchman's regard for the "Old Country," and how little of it adheres to his Descendants—The Reserve in the Manners of the People of Britain Contrasted with the Frankness of Americans and Australians—Trade Prospects in the United States—Time ripe for Closer Union of Great Britain and her Colonies—Stages in the History of Colonial Independence—Subdivision and Federation—Local Self-Government—What it leads to—Colonial Federation leads to Imperial Federation—Strength in Weakness—Colonial Necessity for Outside Protection—Proposals of the Imperial Federation League—Intercourse with the Colonies—Value of Personal Inspection—Even by the Secretary for the Colonies—Froude's visit to Australia and New Zealand—"Oceana."

The Internal Defences of the Colonies were in 1889 made the subject of special investigations by **Major-General Edwards**, an officer sent by the British Government to examine and report upon them. This report is likely to mark a new epoch in the history of Colonial defences. The opinion of an expert has been given in terms which are unmistakable and which do not mince matters. It was not to be expected that, without the quickening influences of war, everything would be found in good order and repair.

The description of the rust-charged ordnance at Sydney must have rudely undeceived any one who imagined that the Colonies were in an efficient state of defence. A young country grows so rapidly that it is apt to grow out of its original defences as a youth grows out of his clothes. Guns, like clothes, get old-fashioned, and, although they may not undergo wear, they yield to decay. When all are busy with the many difficulties and struggles pertaining to a new country—some in amassing wealth, others in a hand-to-hand struggle for existence—the subject of defences is liable to drop out of sight or shrink into a position of insignificance ; but now that the actual facts are understood, and a line of action has been laid down, no one need fear that colonial enterprise will not, within the shortest possible space of time, make good the requirements that have been indicated. The extent of country to be secured is so great, that it will require all available means to be concentrated to meet the internal demands for protection. The entire colonial energy should be expended in the reorganising of land forces and the erecting of land defences under one inter-colonial supreme authority and directorate.

In the "Times" of 6th Feb., 1890, may be seen the account of a most enthusiastic meeting on the occasion of the launch at Newcastle-on-Tyne of the *Persia*, the third of a series of five protected cruisers being built by the British government for the protection of our commerce in Australasian waters. This was one of the practical results of the Colonial conference held in London in 1887, and the agreement come to was that "the expense of the ships should be contributed by the various Australian Colonies." Since then the necessity for internal colonial defence has been brought to light. Let us not divert the attention and energies of the Colonies from this first duty to themselves by asking them to share further in the burden of protecting our own mercantile marine.

All future additional external defences of the British Colonies should be entirely and absolutely provided by the mother-country. There are many weighty reasons why Great Britain should herself undertake that responsibility. She could do it more efficiently and at less cost than the Colonies. A great Admiral is not likely to be found among a small body of men such as a Colonial navy would necessarily command for many years to come. It might easily happen that, in a case of emergency, no one could be found to fill with credit the greatest position of responsibility, as opportunities for testing the officers would be comparatively limited.

Before anything like a tangible, in contradistinction to a sentimental, **Imperial Federation** takes place, there must be reciprocal benefits offered by this country and her Colonies. By undertaking the naval defences, Britain would contribute her share, and in so doing would, at the same time be protecting her own commerce with our Antipodean Colonies, a thing she is almost in duty bound to do in any case.

Until our goods are landed they ought certainly to be under British protection, not only because they are of British production, but also because they are, to a great extent, carried in British vessels.

On the other hand, the Colonies, in arranging the import duties, ought to give British manufactures a decided preference over those of all other nations. With a well-constituted Colonial Federation, customs advantages, similar to those offered to us, would naturally be extended to the various colonies among themselves, if an agreement of a free trade intercourse in most of the materials which might be classified as essentials, can not at once be established. Whatever we do, will at first have but little visible or immediate effect in our relations with our Colonies; but it is a duty to ourselves as well as to them to secure that the little we do accomplish is in the right direction, so that, with future development, we shall not be disappointed.

It is taken for granted that it must be best for Britain and best for the Colonies that we should remain **a United Empire**, each portion having, practically, absolute freedom of action in matters relating to its own private interests. For many years to come Australasia cannot possibly be strong enough to maintain an independent existence. Should she elect to do so, **some great power** must be ready to stretch out a protecting arm ; if not during times of peace, it certainly would be necessary in times of war, of which, however, happily we have no recent experiences nor any immediate anticipations. Whatever may ultimately happen about the **maintenance of the union or the separation** of England and her Colonies, no one of any importance would ever think of cutting adrift until the Colonies are large enough and wealthy enough to maintain and defend themselves.

We have in the matter of trade competition **little at present to fear** from protectionist America ; but she is now, under the shield of protection, building up the sinews of a commercial war for a terrible struggle with this country in our foreign trade.

When the United States of America adopts free trade, as she will do sooner or later, the keenness of competition in our foreign markets must be vastly increased. No one can have the least conception of what a trade revolution will follow within a few years after America abolishes protection. She has built up an enormous internal trade on more or less artificial bases ; but this has now grown so large, having passed that stage where experience has to be paid for (except by the individual), that, to remove the measure of protection which is now maintained, would do less injury to most branches of industry in their present condition than the time of depression through which the manufacturing world has just passed. **This period of depression** has not, however, been without its benefits to the working classes as well as to the capitalists. The wholesome chastening of adversity has enabled them to make a much better start, now that prospects begin to brighten, than if they had been lolling in the lap of prosperity all the while. They have gained experience that will be useful to them when the next check in trade comes, whether it be the momentary dislocation that will ensue when protection is discontinued, the dulness which results from over production, or a variation in the value of the metallic basis of our currency.

There are those who would condemn protection under all circumstances because their local experience, which is confined to this country, teaches them that we, as a nation, have done well without it. A principle established upon a single experience is of little value, and the fact remains that the United States of America has made herself a nation of the first rank much more quickly by protection than she could ever have done without it. Her great dimensions and internal resources have minimised the evils which might have fallen upon a small and stationary community; but at the same time, for her own good, now that she has secured the position aimed at, she ought to cast off protection like an old and worn-out garment which has served well its day, and assume the new *rôle* of absolute "freedom before the law," for is it not the proud boast of that country that it is the land of liberty? There is little doubt but that this change is coming before many years have passed, and the day the change takes place will be the blackest day for British commerce that has yet been seen.

America will compete with us in our foreign trade all the world over. She will strive by devices, innumerable and yet undreamt of, to alienate the colonial trade and the colonial affections from the mother country. She will be the striking example of the result of separation—the living monument of the effects of a most rigid system of protection, and the most perfect type of a jealous friend that the British Isles possess.

Everything she does is on a different plan from that of her aged and in some respects fossilised parent. In some particulars the Colonies have more in common with the United States of America than with Great Britain; and, as time goes on, the tendency of the sympathies of those who are colonial-born must change, and become moulded on the American type rather than on that of the mother country.

The affection of an Englishman, a Scotchman, or an Irishman for the land which gave him birth is not likely to wane with himself, although his position in it might be humble as compared with that which fate, aided by his own indomitable perseverance, has provided for him in the land of his adoption, but he cannot pass on to his descendants feelings and imaginations that rest purely on sentiment. If he returns after long years of absence to the haunts of his youth, even he himself is disappointed in what he finds to be the reality, and he goes back dejected, with the household gods of his life broken and despised.

Should the family of a successful Colonist of originally humble birth come to see the ancestral home—the lonely cottage in the wilds or by the wayside—the feelings which naturally rise in them must be of profound thankfulness that an Australia or a New Zealand existed, and that their parents or ancestors were fortunate enough to go there. It would be too much to expect the mind of a cultured young Colonial who had profited by a liberal education and by all the benefits and comforts that wealth can confer, to become wrapped in a philosophical reverie over the charms and incidents in the life of a labouring rustic, when the fact is brought forcibly home to him, that but for his father's good fortune in changing his country, though not his Sovereign, he (the son) might have been between the stilts of a neighbouring plough and earning a bare subsistence by the sweat of his brow. The rigid reserve of society in this country, and the absolute indifference of people who have never travelled to the strangers who visit our shores, are in no way calculated to rouse the spirit of brotherhood and good-fellowship in those of our colonists who come amongst us.

The American, on the other hand, is franker and more hospitable. In his lack of unnecessary reserve he is much like the native Australian. What wonder then that these two should draw together! They are, as it were, two brothers of the same great family who have gained experience of the world in different hemispheres. The pace at which each moves is faster, and better suited to that of the other than the sombre tread of the parent. The countries are comparatively near to each other; their customs, their climates, and even their forms of government are in the main similar. The resources of America for gratifying the desires of the visitor from the Colonies are daily increasing, and, above and beyond all this, the American people are alive to the necessity for their own advantage of shaping the course of their relationships with Australasia or any other part of the world, as occasion may demand, after a careful "study of developments."

That the **breakdown of the protective system** in America* is at hand is clear to every one who has recently travelled in that vast commonwealth and there mixed with "all sorts and conditions of men." It cannot be denied by those who have carefully and thoughtfully studied the rise and progress of one of the greatest, though also one of the youngest civilised nations of the present time, that she has **profited**, as all youthful communities must profit, by

* The following paragraphs relating to trade prospects in the United States first appeared in the *Glasgow Herald* of 20th August, 1890.

a **protective tariff**, which, in competition with old established trades in matured countries, is as essential to the budding life of a young community as the oxygen of the air is to the lungs of the human race. The time for protection in the United States of America is now well past. The country has gained much by it, though she might have benefited to an even greater extent had a little more discretion been used in the application of the protectionist principles in certain directions in which experience long ago showed that their influence was baneful. The injury done to American shipping and shipbuilding is one of the best illustrations in this connection. Circumstances and conditions have so vastly changed in America within a few years that some alteration of policy is absolutely necessary to give the energies of the country sufficient scope to develop. **The change** must lie in the direction of free trade. It is not likely to come as a sweeping measure and take place all at once by an Act of Congress. The United States is not a nation to yield all her vantage-ground for nothing, as Great Britain did when, by the pent-up force of circumstances, she opened her arms like a flood-gate, and admitted a rush of free trade, like the descent of a river in flood, to do temporary damage so that great good, though not altogether unassociated with avoidable evil, might ultimately result from it. **America** is likely to take the slower and surer path of **reciprocity** to reach a similar but more complete result. She will use every means in her power to secure in return for concessions in her tariff corresponding concessions from every nation with which she makes a commercial treaty. Her great object, in the first instance, is to secure raw material at the lowest cost. She will yield upon raw materials to begin with, and when by this means the manufactured product can be turned out at a lower price she will gradually retreat from her position which involves a full measure of protection upon her manufactured goods. This will certainly be stoutly opposed by the great body of manufacturers, because a very large proportion of them are working on capital which is only to a limited extent their own, the rest being borrowed, but guaranteed by them to the amount of their possessions.

If protection were done away with, the manufacturers would be the first to lose; and in a great number of cases the entire capital of the manufacturer himself—the man of skill—would disappear, and possibly more or less of the borrowed capital as well. Naturally manufacturers cling to what they see to be their only hope personally—viz., Protection—and they will do so till the end; but in the history of great nations, even when a community as a whole is growing and increasing in power and wealth, an important class—even the most important class of all, when considered individually—may steadily go to the wall with little more than the begrudged sympathy of their more fortunate neighbours. When America declares free trade in machinery, factories will be furnished with thirty to forty per cent. less capital. The blow will be severe to the existing manufacturers, but they must endure or retire for their country's good. Manufactured articles will fall in price, and wages must considerably come down.

It has recently been shown that there is not so great a difference in the **wages** earned by skilled workmen in America as compared with similar classes in this country as is generally supposed. Agricultural labour is dear, and some branches of skilled labour, owing to exceptional conditions, command exceptional wages. Masons, for example, get enormous wages while they are at work; but with so much "off time" during the season through inclement weather, they are in the end little better paid than other workmen.

Though he may not at first appreciate the change, **the manufacturer** who is now working largely on borrowed capital must submit to his being converted into the manager of a limited liability company (the capital being supplied by people who do not understand the business), and cease to be a capitalist, so that in the wreck of his fortune he may secure for his country a decided trade advantage.

The **United States of America** now do a considerable foreign trade in special articles, but what they want to do is a large foreign trade in ordinary commodities, and thereby compete with Great Britain in all branches of her trade, not only in the home British market, but also in our outlying Colonies and in the foreign countries which we now control. It is for this reason that a declaration of **free trade by America** would prove to be the most unfortunate event that England has seen for the last half-century. It pays a nation to do a large foreign trade at a small profit, or often, in fact, at little or no profit at all, so as to secure the stability of the home trade. With an extensive foreign trade a temporary over-production in the home market can be at once relieved by shipment, and prices can be prevented from falling too low. America is fully alive to this important fact, as may be seen from the anxiety exhibited in the efforts to still further open up the British markets to States cattle. It was felt that the withdrawal of a moderate number of cattle for Great Britain would have tightened their home markets greatly to the benefit of the American farmers, in whose interests the efforts were made.

America has a decided advantage over Great Britain in the matter of her position in relation to our Colonies; and, as already said, there is no denying that, however **loyal** the man may be who has emigrated from this country even when very young, the Colonial-born is, as a rule, in manner of life, in sympathy, and in every respect more closely akin to the average American than to the average Englishman. It would be strange in fact, if it were otherwise. They are of the same race, they are descended from the same class of enterprising parents that did not shrink from the sacrifice of the little comforts they enjoyed for the chance of prospective success or future greatness; religion sits more lightly upon them, in appearance at least, if not in reality, than on the stay-at-home fathers of the race; they have the same aspiration after rapidly accumulated wealth; the same excitements; the same idea that they possess the greatest possible measure of individual influence in the government of the country, and the greatest amount of personal liberty, when it is too often the case that they are duped by the wily misrepresentations of a professional carpet-bagger from the great city on the one hand, and have little more than the shadow of real personal liberty on the other. It matters not whether these virtues or qualities are good or bad; all that the argument assumes is that **America and our Colonies are more like one another** than like the parent country. The manners and customs of individuals change in a generation; why not the manners and customs of nations in half a century? The tastes of the individual representative of our species change with ages; why not so the tastes of the older nationalities of our race? All this leads up to a most natural conclusion that in things commercial the two younger members of the one great human family are naturally most likely to draw together, if by mutual concessions they could come to some basis of agreement which would confer mutual advantages. Such is to be found in the fact of the unsuitability of the United States for the free and cheap **production of wool**—at least in amount sufficient to meet the growing wants of a rapidly increasing population. Australia and New Zealand, on the other hand, are prodigal in their power of wool-production, and are ready to take in return American-made implements and machines, which are often infinitely better adapted to Colonial purposes than the heavier implements of British manufacture.

We have trusted, as long as it is safe, to **mere sentiment**

to maintain a satisfactory relationship with our Australasian Colonies. The time seems now ripe for something to be done, however little, to guide that which will follow naturally and of its own accord into the proper course. Like a piece of ordnance which has been charged, the means used to draw closer the relationship of the Colonies to Britain ought now to be pointed in a given definite direction, so that the aim shall be in the right quarter, and may accomplish the ends in view. As it would be too late in the case of a cannon to begin to alter the direction of its aim when the shot is being discharged, so also in the case of the Colonies will it be too late, after they have drifted away from us, to attempt to do that which, if done now, would rouse and rivet their interest.

At the meetings in Melbourne in 1890 of representatives from the various Colonies it was declared that the time had come for some form of **Colonial Federation** which is the natural forerunner of a closer connection between the parent country and her dependencies. This decision is the result of a perfectly natural development ; it is an indication that the Colonies have reached a certain stage of national life, and one which entitles them to a greater share of consideration from us.

At an earlier stage of Colonial existence there is a move in the opposite direction which is quite as natural and useful in its own way as this—one colony after the other asks to be made an independent entity. Colonies spring into independent existence as do unicellular organisms by fission, and it is good for the various parts which have local peculiarities and local interests that they should do so. It confers upon the leading spirits in the newly separated part a healthful measure of responsibility, and encourages that spirit of self-reliance which is as necessary for the success of a colony or a nation as it is for an individual.

A movement towards the process of colonial subdivision is going on now in Northern Queensland, and has recently culminated in success in Western Australia, and it will continue to go on until each important area which possesses some striking peculiarity of position, feature, or climate, is divided off for purposes of local administration. The climatic conditions of Northern Queensland, as compared with the southern part of her territory, form a suitable basis upon which to found a claim for separation.

The position taken up on the Colonial labour question, more especially by the newspapers, but also by some of the leading statesmen whose interests are more or less centred in the requirements of the southerly portions of the colony, is no doubt, under the circumstances, one of the strongest incentives to Europeans, resident in a tropical climate and depending upon the products of tropical cultivation, to press their claim to be allowed to manage their own local affairs in the matter of the labour they choose to employ in the execution of their work.

Though local Self-Government with its limited experience has its disadvantages, especially in little things and very great things, yet, when properly constituted, it frequently abolishes abuses and hindrances to progress. The influences of public opinion can act more quickly and more directly upon those who hold the reins of power than when the central administration is at a distance and is, in proportion, more independent of local considerations. The extension of a liberal system of education makes local self-government more feasible, and it must be admitted that it is the popular direction in which changes in government are being carried out.

The eagerness for local government becomes satisfied and the majority of people after a time begin to realise that, call the government by whatever name they please, all are not summoned to take a share in the executive, but that the responsibilities, as well as the sweets of power and office, fall into the hands of an extremely limited number.

As a Colony grows in wealth and importance the fact is realised, that the function of government is not confined merely to the administration of internal affairs, but that it should bear its full share in the councils of the nations, and safe-guard its people from outside, or Imperial, as well as from social, dangers.

When a Colony wakes up to this fact, as it must do if it has continued to grow for years without any addition being made to the defences by the mother country, it immediately realises the insignificance of its own individual strength as compared with that of almost any of the older nations. In this position it is natural for a group of colonies similarly situated and contiguous to one another to realise the strategic advantage of union.

The instinct of self-preservation is no doubt the initial inducing influence, and the agreement to make common cause against a common foe the primary object, but subordinate considerations find the way to the front, and such questions as a uniform intercolonial tariff, a thing excellent in its way, is tacked on as an essential part of the subject for discussion. It is no doubt the case that the more closely two colonies are united by commerce, the stronger will be their union for purposes of defence. It is, nevertheless, essential that they should retain their individuality, as the spirit of rivalry in possessions, deeds, and accomplishments, is one of the greatest aids to national prosperity.

The advantages gained by Colonial Federation are the best possible means by which the value of Imperial Federation can be brought home to the people of the Colonies. "Union is strength," but, up to a certain point, union and its resulting strength is in reality a weakness. A nation or a colony may rely for protection on her weakness, and this is not altogether the result of forbearance on the part of the strong, but also because the weak are not likely to place themselves by direct action in positions of danger.

When a nation begins to rely exclusively upon her strength, the degree of strength is of special importance. Unless the volume of strength is considerable it inevitably assumes a position similar to that of a boat sinking by overloading.

It is clearly the case that a Colonial Federation cannot for many years to come rely exclusively upon its own resources. To be safe it must be associated with some one or other of the great maritime countries ; and, if she acts judiciously, there is no reason why Great Britain should not continue to be that country.

There is no question but that the **Imperial Federation** league is right for the present to confine itself, as Lord Rosebery so lucidly pointed out, to the fostering of social intercourse between Great Britain and her Colonies, and to the spreading of a knowledge of one another which would lead to greater mutual interests, and deeper national sympathies.

It is as true of relationships between countries as it is of other matters in this world of changes, that there is no standing still in one position. If they are not going forward, movement must be retrograde. Without a special effort our original connection with the Colonies must necessarily become less intimate in all but trade relationships, and even these are liable to change through foreign competition.

Personal and individual ties relax with years and practically die out with the generation of those who emigrated. **New ties may be formed** and new interests awakened by fresh intercourse. It is upon this new form of interest that the advocates of Imperial Federation build their hopes, and rightly so, as there seems to be no perceptible limit to its possible amount or intensity.

The greatest possible advantage to the cause of closer union between Great Britain and her Colonies lies in **Personal visitation** of residents from the one to the other. The busy man of commerce in this country cannot but be astounded at the profundity of his ignorance of the Colonies, should he chance to visit them. When he has once made a connection, and in part realised the magnitude and importance of them and of their various institutions, it becomes a source of recreation to him to pursue the study further. An interest in the Colonies becomes instinctively a part of himself, just as an interest in the British Empire grows with every subject who has a claim to the privilege accompanying a genuine feeling of patriotism.

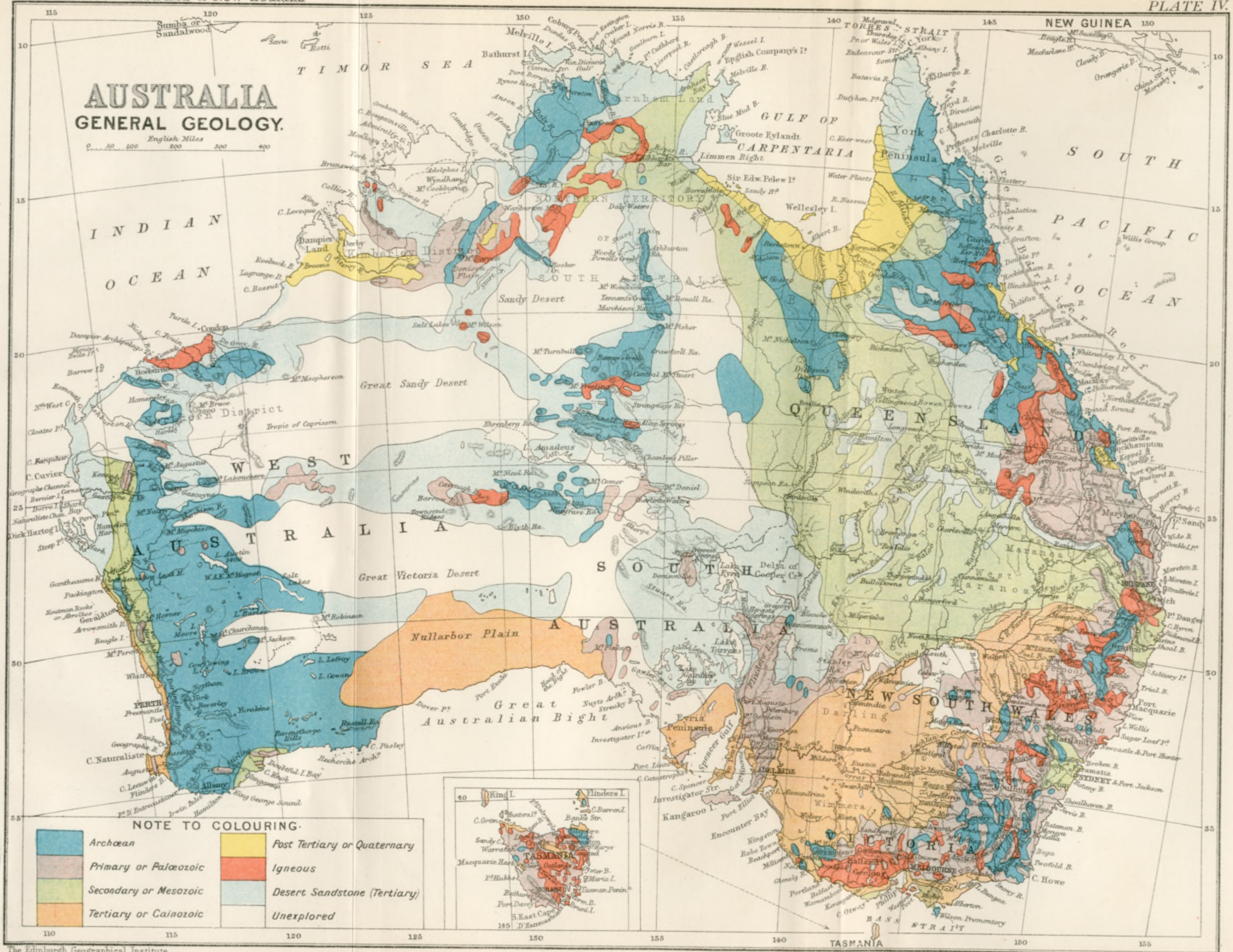
One of the greatest drawbacks to the closer intimacy which so many now advocate between this country and Australia and New Zealand, is the fact that it has not yet been made essential for a Colonial Secretary who administers the governmental affairs of the distant parts of the Empire, that he should visit those parts, and thus be able to take a better, more intelligent, and more trustworthy grasp of the business with which it is his duty to deal. It is no disparagement to any Colonial Secretary, however superior his diplomatic powers, to say that both he and the Colonies would materially gain by his making a personal inspection of the chief portions of the Colonial Empire under his control. Such an inspection would not only show him the subject to be dealt with, but it would afford him an opportunity of meeting the leading administrators, and thereby give new vigour and meaning to the routine work of that part of colonial administration which emanates from this country. It would no doubt be difficult for a Colonial Secretary to escape from his work while in office, but a tour of Colonial inspection ought to be self-imposed as an essential, and a most important one to boot, of aspirants to such an office.

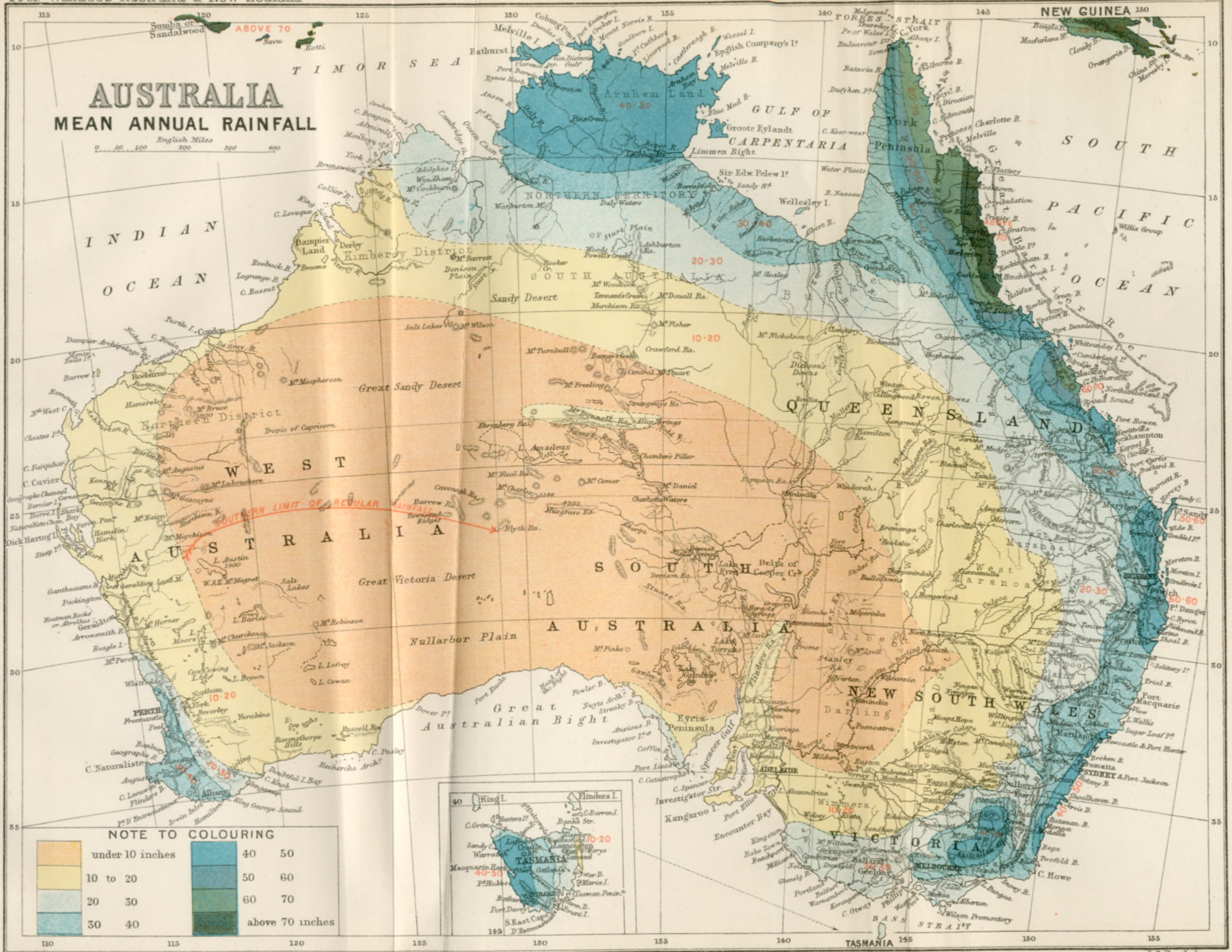
There is nothing forcible or conclusive in the argument that a Colonial Secretary who has visited the Colonies is liable to contract a party view of Colonial politics. The answer to this phase of the question is simply, that any one so narrow-minded is quite unfit to be a Colonial Secretary.

There cannot be too much intercourse between the inhabitants of Great Britain and her Colonies, provided it be of that kind which leads to wider knowledge of those things which ought to be of mutual interest and advantage. While this will be admitted as a general principle, there are kinds of intercourse and ways of gaining knowledge associated with methods of making use of it, that are far removed from what might be termed the best interests of the community. Mr. Froude's visit to Australia and New Zealand, and the subsequent publication of "Oceana," is a case in point. There exists throughout the whole book an utter disregard for the sanctity of private intercourse, or for the feelings of those met with, who, in their private lives and characters, are discussed with as much freedom as the most popular subject in an evening newspaper. The publication of a few more works like "Oceana" would be the best possible means to make Imperial Federation impossible. The disgust felt and expressed in every Colony at such an abuse of confidence, was the more embittered by the fact that much had been done to do honour to one whose name stood so high in the scale of literary fame. The colonists were, before Mr. Froude's visit, unaware that conspicuous literary talent could be so warped by such a lamentable want of common sense and common decency.

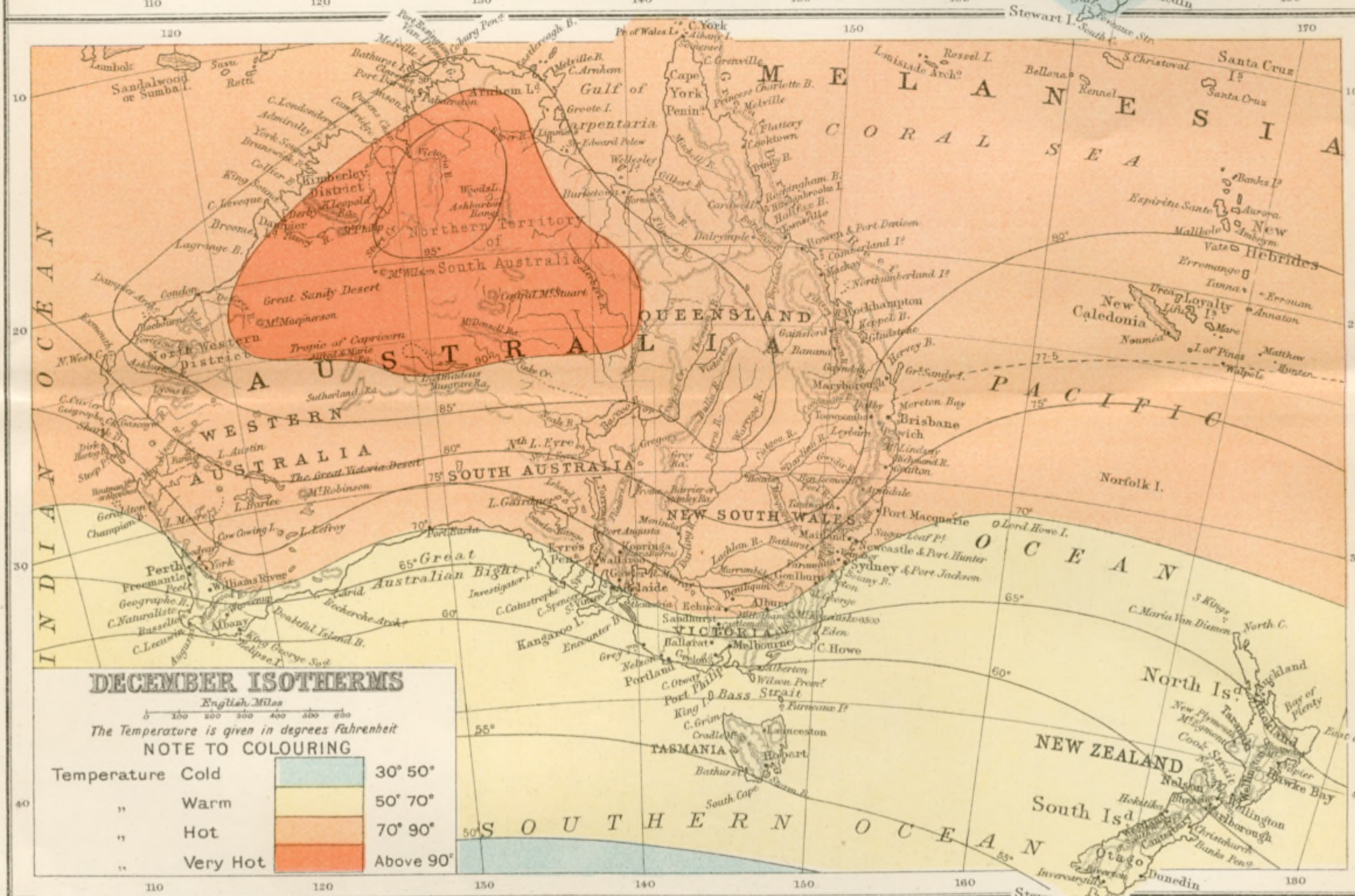

AUSTRALIA
OROGRAPHICAL FEATURES
English Miles
0 50 100 200 300 400
NOTE TO COLOURING
3000 Feet
1500
600
SEA LEVEL
TIMOR SEA
INDIAN OCEAN
SOUTH PACIFIC OCEAN
NEW GUINEA
TORRES STRAIT
GULF OF CARPENTARIA
Arnhem Land
York Peninsula
NORTHERN TERRITORY OF SOUTH AUSTRALIA
Kimberley District
Great Sandy Desert
Sandy Desert
WEST AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
Great Victoria Desert
Nullarbor Plain
Great Australian Bight
Tropic of Capricorn
BASS STRAIT
Great Barrier Reef
L. Amadeus
Spencer Gulf
Eyre Peninsula
Kangaroo I.
PERTH
ADELAIDE
MELBOURNE
SYDNEY
BRISBANE
HOBART
King George Sound
C. Howe
Wilson Promontory


AUSTRALIA
LAND SURFACE FEATURES
English Miles
0 50 100 200 300 400
NOTE TO COLOURING
Cultivated Lands
Pasture Lands
Forests
Stunted Bush & Scrub Lands
Deserts & Barren Lands
Unexplored
NEW GUINEA
TORRES STRAIT
TIMOR SEA
GULF OF CARPENTARIA
INDIAN OCEAN
SOUTH PACIFIC OCEAN
Arnhem Land
York Peninsula
NORTHERN TERRITORY OF SOUTH AUSTRALIA
Kimberley District
Sandy Desert
Great Sandy Desert
Northern District
Tropic of Capricorn
WEST AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
Great Victoria Desert
Nullarbor Plain
Great Australian Bight
L. Amadeus
Lake Eyre
Delta of Cooper Cr.
Eyria Peninsula
Spencer Gulf
Kangaroo I.
Encounter Bay
ADELAIDE
PERTH
Albany
SYDNEY & Port Jackson
MELBOURNE
BRISBANE
Bass Strait
Wilson Promontory
C. Howe
TASMANIA
HOBART
King I.
Flinders I.

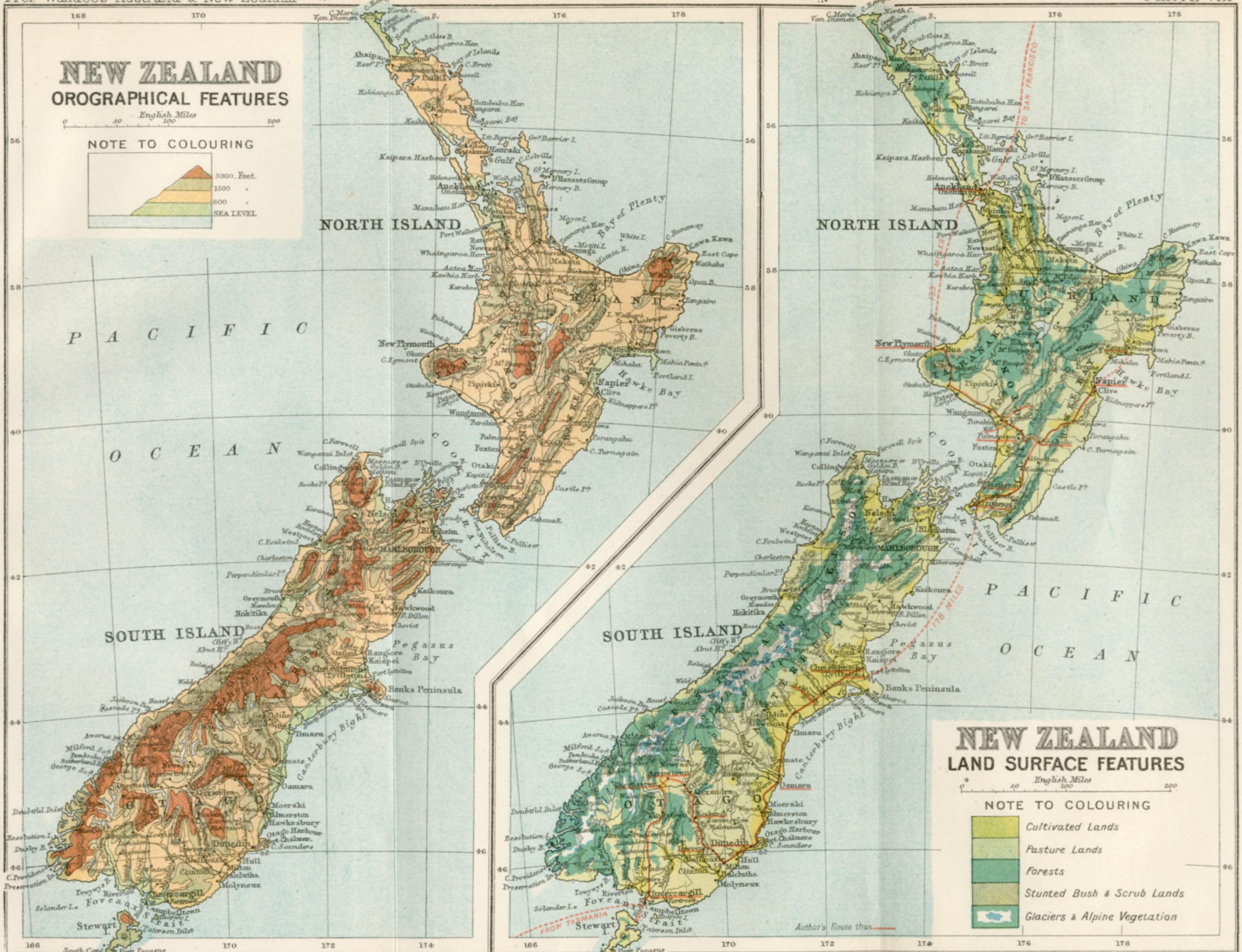

AUSTRALIA
GENERAL GEOLOGY.
English Miles
0 50 100 200 300 400
NOTE TO COLOURING.
Archæan
Primary or Palæozoic
Secondary or Mesozoic
Tertiary or Cainozoic
Post Tertiary or Quaternary
Igneous
Desert Sandstone (Tertiary)
Unexplored
TIMOR SEA
INDIAN OCEAN
GULF OF CARPENTARIA
SOUTH PACIFIC OCEAN
NEW GUINEA
TORRES STRAIT
York Peninsula
Arnhem Land
NORTHERN TERRITORY
Kimberley District
SOUTH AUSTRALIA
WEST AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
Great Sandy Desert
Great Victoria Desert
Nullarbor Plain
Great Australian Bight
Sandy Desert
Tropic of Capricorn
Eyria Peninsula
Kangaroo I.
Spencer Gulf
Encounter Bay
BASS STRAIT
PERTH
ADELAIDE
MELBOURNE
SYDNEY & Port Jackson
BRISBANE
HOBART
King I.
Flinders I.
Great Barrier Reef


AUSTRALIA
MEAN ANNUAL RAINFALL
English Miles
0 50 100 200 300 400
NOTE TO COLOURING
under 10 inches
10 to 20
20 30
30 40
40 50
50 60
60 70
above 70 inches
SOUTHERN LIMIT OF REGULAR RAINFALL
INDIAN OCEAN
TIMOR SEA
GULF OF CARPENTARIA
SOUTH PACIFIC OCEAN
Great Australian Bight
NEW GUINEA
WEST AUSTRALIA
SOUTH AUSTRALIA
NORTHERN TERRITORY
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
Great Sandy Desert
Great Victoria Desert
Nullarbor Plain
Kimberley District
Arnhem Land
York Peninsula
Torres Strait
Bass Strait
PERTH
ADELAIDE
MELBOURNE
SYDNEY
BRISBANE


JULY ISOTHERMS
English Miles
The Temperature is given in degrees Fahrenheit
NOTE TO COLOURING
Temperature Cold 30° 50°
" Warm 50° 70°
" Hot 70° 90°
MELANESIA
CORAL SEA
PACIFIC OCEAN
INDIAN OCEAN
SOUTHERN OCEAN
AUSTRALIA
WESTERN AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
NEW ZEALAND
Northern Territory of South Australia


DECEMBER ISOTHERMS
English Miles
The Temperature is given in degrees Fahrenheit
NOTE TO COLOURING
Temperature Cold 30° 50°
" Warm 50° 70°
" Hot 70° 90°
" Very Hot Above 90°
MELANESIA
CORAL SEA
PACIFIC OCEAN
INDIAN OCEAN
SOUTHERN OCEAN
AUSTRALIA
WESTERN AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
NEW ZEALAND
Northern Territory of South Australia


AUSTRALIA
EXPLORATION 1891
English Miles
0 50 100 200 300 400
NOTE TO COLOURING
Country explored and opened to Commercial Enterprise.
Country only partially explored.
Country still unexplored.
INDIAN OCEAN
TIMOR SEA
GULF OF CARPENTARIA
SOUTH PACIFIC OCEAN
NEW GUINEA
TORRES STRAIT
Arnhem Land
York Peninsula
NORTHERN TERRITORY OF SOUTH AUSTRALIA
Kimberley District
Northern District
WEST AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
Great Sandy Desert
Sandy Desert
Great Victoria Desert
Nullarbor Plain
Great Australian Bight
Tropic of Capricorn
L. Amadeus
Lake Eyre
Lake Torrens
Eyria Peninsula
Spencer Gulf
Kangaroo I.
Encounter Bay
BASS STRAIT
PERTH
ADELAIDE
MELBOURNE
SYDNEY
BRISBANE
HOBART
Rockhampton
Maryborough
Port Macquarie
Newcastle
Geelong
Alice Springs
Darling
Wimmera
Liverpool Plains
Great Barrier Reef



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THE

RURAL

ECONOMY

AND

AGRICULTURE

OF

AUSTRALIA

AND

NEW ZEALAND

PROFESSOR

WALLACE

SAMPSON LOW & Co