1909.

NEW ZEALAND.

ADDINGTON RAILWAY WORKSHOPS

(REPORT OF THE BOARD OF INQUIRY ON); TOGETHER WITH MEMORANDUM BY THE GENERAL MANAGER OF RAILWAYS.

Presented to both Houses of the General Assembly by Command of His Excellency.

REPORT.

SIR,—

The members of the Board of Inquiry, Addington Railway Workshops, have the honour to report that, as directed by the Warrant of the Hon. the Minister of Railways, dated the 6th day of March, 1909, they have conducted an inquiry to ascertain if the work at the Addington Shops is being done as expeditiously and economically as it should be, and that, as instructed, the scope of their inquiry has included,—

Scope of inquiry.

(1.) The efficiency of plant and appliances.
(2.) The system of work adopted.
(3.) The discipline maintained.
(4.) The cost of production as compared with the cost in other establishments, whether Government or private.
(5.) The output, whether it is reasonable in quantity and quality, having regard to all the circumstances.
(6.) Generally, matters calling for alteration or improvement in the interests of efficiency, economy, or discipline.

The Board sat for thirty-one days in Christchurch, took voluntary evidence, called for certain evidence and returns, and paid visits of inspection to the Addington Workshops and the principal Christchurch foundries. Visits were also paid to the works of Messrs. Price Bros., at the Thames, and the Newmarket, Petone, and Hillside Railway Workshops.

Evidence considered, together with observations of Board.

The Board have carefully considered the evidence given at the inquiry, together with the results of observations and investigations made by themselves.

Standard for new and repair work very different.

The work done at Addington is partially repair and partially new work, and under existing conditions the Board have found it difficult to separate the results obtained, though the standard for comparison in the two cases is widely different. For instance, machines may be profitably employed on repairs, the use of which on new work would entail loss. Systems of working may be tolerated in connection with repairs which would be altogether out of place in a repetition shop. The rate of working of the men must and can be very different on repetition-work from that which can be maintained in the renewal and repairing of parts.

Manufacturing-work at Addington compared with modern practice.

The Board have thought it best to compare the conduct of new work at Addington with modern manufacturing practice, but, whilst doing so, would draw attention to the fact that at Addington (which was primarily a repair-shop) the new work has gradually increased in amount, and has up to the present, probably from force of circumstances, been conducted very much on repair lines. In this respect the history of Addington appears to be the common history of similar undertakings, in which the new work usually grows to such proportions that what is in reality a makeshift method of carrying on becomes intolerable. In such cases separation and reorganization have almost invariably followed.

Limit of present system reached at Addington.

Since the Board are of opinion that the limit of the present system has been reached at Addington, their criticism of existing methods must be regarded as being not so much a criticism of past administration as an indication of their ideas of the course to be followed if profitable manufacturing is to be carried on in the Government shops.

Proceeding to the consideration of the special matters referred to the Board as constituting the scope of their inquiry: With regard to,—

1. The Efficiency of the Plant and Appliances.

The Board find that there are at Addington, especially in the machine-shop, many modern and efficient machine-tools; also, that the shops generally are well equipped for doing repair-work. They are, however, of opinion that, if manufacturing is to be economically and efficiently carried on, very considerable alterations and additions must be made to the plant, appliances, and buildings.

Dealing with the several shops in turn: In—

(a.) The Smith-shop.

Stamping system antiquated.

The stamping appliances are antiquated and awkward in use.

New appliances required.

The Board would suggest the provision of—

Furnaces for much of the heating which is now done in open fires.

A direct steam-driven drop-stamping plant.

A hydraulic bending and forging plant.

Bar shears and bolt-making machinery; and that the strikers should be supplied with some heavier sledge-hammers than those at present in use.

(b.) The Boiler-shop.

Overhead traveller.

The rate of working of the existing overhead travellers is absurdly slow. The speeds should be brought up to—lifting, 4 ft. and 20 ft. per minute; traversing, 60 ft. per minute; travelling, 100 ft. per minute.

Lifting-magnets required.

Either the existing travellers should be electrified, or if, as is probable, their construction is found to render them unsuitable for conversion, three-motor electric travellers should be substituted. These travellers should be provided with lifting-magnets to facilitate the handling of plates, &c.

Radial cutting-head.

The radial cutting-head now used on the plate-planer is an improvement on hand-cutting, but is inefficient as compared with a plate-planer fitted with "former" bars, which should be provided if the execution of taper work is to be continued.

Large riveter. Inefficient accumulator plant.

The large riveter is a good machine, but the accumulator and pumping plant, which is apparently that originally imported for the old fixed riveter, is altogether too small, and must limit the rate of work, especially when any of the other riveters which it may be called on to supply are also in action. The provision of a sufficiently large accumulator plant is imperative.

The present performance of the riveter—200 rivets, or less, per diem—must be regarded as most unsatisfactory. An average of 500 rivets per day would, in the opinion of the Board, much more nearly represent a fair rate of work on locomotive boilers. With a sufficient supply of water this should be easily attained.

Plate-flanging.

The plate-flanging appliances are inadequate. The time taken at present to flange an "A" throat-plate—five men five days and a half—is excessive. A modern hydraulic flanging plant, capable of dealing at one heat with the largest plate used, is, on the grounds of both safety and economy, urgently required; safety, in that locally heated plates, unless subsequently subjected to most careful heat treatment, will be in a dangerous condition of crystallization and stress; and economy, in that such a press could, with suitable tools and dies, be used for many operations at present effected by hand-labour.

Plate-rolls.

The work has outgrown the capacity of the plate-rolling plant.

Pneumatic tools.

There appears to be a fair supply of pneumatic hand-tools, but it is desirable that these should be maintained in better order than at present.

Tube cutting, expanding, &c.

For tube cutting and expanding a modern, balanced, power-driven plant should be installed. Plate-shears and multiple drilling-machines are also required in this shop.

(c.) The Machine and Fitting Shop.

Shaky roof. Poor transmission and lifting-gear.

The shafting is caried on an old and unstable roof, and a large amount of power is lost in transmission. The lifting-arrangements at the machines can only be regarded as makeshifts. The height of the shop is insufficient for the development of a satisfactory handling scheme. The arrangement and grouping of the machines are bad. The congested state of the shop is a contributing cause of these defects.

Tool-room, &c., unsatisfactory.

The tool-room and tool-room equipment are not what might be expected to be found in a shop professing to turn out accurate work. (This mater is dealt with under heading II.)

Lathes obsolete.

The majority of the older lathes are unsuitable for use with high-speed steel. A few of the lathes might be modified with fairly satisfactory results (this has already been done in one case); the remainder should be replaced by modern machines.

Remodelling of shop recommended.

The Board would also recommend the complete remodelling of the buildings, the lay-out, the power-transmission, and the material-handling arrangements of this shop.

(d.) The Erecting-shop.

Overhead travellers.

The overhead travellers are far too slow in action to be made general use of. The same remarks apply to these as to those in the boiler-shop, and similar action should be taken regarding them.

(e.) The Points and Crossings Shop.

This shop is well equipped for the work to be done. It is, however, desirable that a level laying-out floor on concrete foundations should be substituted for the pieces of rail at present in use.

(f.) The Foundry.

Lifting-appliance faulty.

The lifting-appliance, a single overhead traveller, hand-worked, is an extremely poor one, twelve men being required to deal with the larger ladles.

The Board is informed that an air-lift has been ordered for this traveller, but is of opinion that a modern three-motor electrically driven crane is required. Independent wall cranes below the traveller are also desirable, but the small amount of head-room available will make their introduction difficult.

At present the pig is being broken by hand, and, with the fuel, carried by manual labour up to the charging-platform. It is understood that cupola lifts and a pig-breaker are in hand. These should be completed without delay.

A bolting-down floor and a watertight casting-pit should also be provided.

The position of the rattlers involves a large amount of handling of castings.

(g.) The Car-shop and Mill.

More modern machinery required.

More modern woodworking machinery is required at the mill, also a pneumatic shavings-collecting and boiler-feeding system.

In the car-shop a system of lifting-beams, trestles, and transport bogies should be provided for dealing with cars whilst their own bogies are removed for repairs.

(h.) Wagon-underframe Manufacture.

New shop required.

Wagon-underframe manufacture is at present carried on in a shed in connection with the boiler-shop. A well-equipped shop-section is required for this class of work and for dealing with car and wagon bogies and undergear generally. Here should be installed a complete multiple drilling plant, with drills capable of being set to template, so that no marking-off of the work is required.

(i.) Motive Power

Motive-power arrangements wasteful.

The motive-power arrangements at Addington are wasteful in the extreme. The presence of the many independent overworked boilers and non-condensing steam-engines, together with faulty belt transmission, fully accounts for the enormous fuel-consumption of 3,700 tons per annum for power purposes alone.

The Board would recommend the abolition of the existing arrangements, and the establishment of a central producer-gas electric power generating station with electric transmission to, and drive in, the different shops. The larger machines to have independent motors, the smaller machines to be group-driven. An approximate investigation points to a saving of nearly £3,500 per annum being effected in actual working-expenses by such a change.

II. The System of Work adopted.

Defect of grouping new and repair work together.

The practice existing at Addington of carrying on together new and repair work, and of transferring men and machines from one to the other must tend to level down to repair standard the general rate of working of the shop and in other ways to increase the cost of production. The wholesale transference of men from new to repair work in connection with holiday rushes is an especially bad feature of the system.

The practice which obtains of manufacturing parts during the period of assemblage of the whole, and to ordinary rule and caliper measurements, is faulty.

There is a lack of system in connection with the machine-shop tool-room and the method of dealing with tools for the machines. The equipment of the tool-room is unsatisfactory.

Whilst the drawings furnished from the Chief Mechanical Engineer's office for the manufacture of rolling-stock are generally excellent, the practice of requiring the blacksmiths to work from other than full-size detail drawings leads to much loss of time.

Time and cost keeping unsatisfactory.

The system of time and cost keeping in use is, in the opinion of the Board, complicated and unsatisfactory, in that information as to time and money cost is difficult to extract and cannot be obtained for any portion until some time after the completion of the whole job, and even then detailed information is not available to the Works Manager.

Foremen spend too much time in office.

In connection with this system the foremen seem to spend 25 per cent. of their time in their offices going through and initialling the workmen's time-books.

The pattern-book is not kept in the best or most convenient manner for reference.

To effect necessary improvements in the system of working, the Board would recommend,—

System of working to limit-gauges and into store recommended.

The complete separation of the new from the repair work, separate shop sections to be allotted to each. The systematic manufacture of new work to limit-gauges, each portion as completed being inspected, and, if satisfactory, sent into stock (the smaller parts actually into store), from which the whole of the various parts would be drawn before the erection of the complete machine was commenced. True interchangeability and rapid assemblage would thus be assured.

Tool-room system recommended.

The abolition of the existing tool-room and the adoption of a system which would necessitate the provision of a well-equipped room, furnished with modern tool-room machines, in which all tool-room repairs would be done. Under such a system the machine-shop would be divided into sections, to each of which a labourer would be allotted, whose duties, in addition to cleaning and giving necessary assistance at machines, would include the replacement of all dulled tools by fresh ones from the tool-room; where all tool-room grinding would be done by a tool-room hand to pre-determined standards. The machines would in this way be kept constantly at work, all delays due to machinists being absent grinding tools being prevented.

Cost-keeping system recommended.

For cost-keeping the adoption of a production order and card system, under which a card issued by the foreman for any particular part of the work accompanies that portion through the shops and receives upon its face a record of the time expended in the operations upon it. For each part such a card is issued, and on the completion of the job these cards, together with similar cards upon which the material is charged, are returned to the office bound up in the production order, and the time and cost summed up by the Cost Clerk in a few hours. The whole being filed, a detail record of time and money cost for any portion of the work is readily available. It is desirable that the Cost Clerk should be located and the records filed at the works.

III. Discipline maintained.

No systematic loafing.

Though a general air of leisurely movement is apparent at Addington, the Board are satisfied from the evidence put before them and from their own investigations that there has been no systematic loafing on the part of the great bulk of the workmen, and in view of the small amount of real power for exercising authority possessed by the workshop manager and foremen, are of opinion that the fact that greater advantage has not been taken of the security of their position by the men is creditable alike to themselves and their officers.

Centralisation, following Classification and Superannuation Acts, robs foremen of power.

The Board consider that the centralisation of control, which has followed the passing of the Classification and Superannuation Acts has virtually taken all power of exercising authority out of the hands of those directly in charge of the men, and cannot be conducive to the maintenance of the discipline of the workshops. They believe that a great improvement could be effected if the workshops managers were held personally responsible for the results obtained by the shops, and as a consequence given greater powers of control. They consider that he should be furnished with the list of approved applicants for employment, and have a free hand as to the individuals chosen, and also have power of punishment and dismissal, subject to the approval of the Chief Mechanical Engineer and the right of the workman to appeal to the Railway Appeal Board.

Interference of outside persons.

The Board deem it necessary to direct attention to the fact that the interesting of themselves on behalf of particular men, or particular bodies of workshop men, by persons outside the Railway service is not calculated to improve the discipline or the smooth working of the shops.

IV. The Cost of Production as compared with the Cost in other Establishments, whether Government or Private.

33⅓ per cent., and not 15 per cent., should be allotted to "fixed charges."

In comparing the cost of production at Addington with the amounts charged for similar work by private establishments, the Board are of opinion that, instead of the 15-per-cent. commission allotted at present to cover "fixed charges," in which no provision is made for insurance, rent of buildings and ground, upkeep and depreciation of buildings, cost of new machinery, and depreciation of plant, a minimum charge of 33⅓ per cent. on wages and the cost of material should be added. It must be understood that this amount is intended to cover only what are known as "fixed workshop charges," and that no attempt has been made to allow for the business expenses and the amount of profit which the private manufacturer has to provide for.

Sufficient data has been available to enable the desired comparison to be made in the costs of (1) locomotives, (2) iron castings, (3) points and crossings. The cost of smiths' work and boiler-work has also been dealt with.

(1.) A Comparison of the Costs of Locomotives.

The cost of the first batch of "A" Class locomotives built at Addington, on which it is stated alterations and improvements were made, has not been considered.

The cost of the second batch of three engines, 33⅓ per cent. instead of 15 per cent. being added to cover "fixed workshop charges," averages £5,747 per engine, or £100 6s. per ton. The cost of twenty similar engines building by Messrs. Price Bros., completely equipped for the road, will average £4,228 per engine, or £73 16s. 4d. per ton. An engine of somewhat similar size, the "Q" Class, built in America, cost on the rails in New Zealand £2,791 per engine, or £57 18s. 5d. per ton.

The average cost per engine of each of six Class "B" engines built at Addington, "fixed charges" being allotted on the basis of 33⅓ per cent., was £5,558 17s. 3d., or £111 6s. per ton. Four Class "B" locomotives obtained from Messrs. Sharp, Stewart, and Co., were placed on the rails for £3,378 per engine, or at the rate of £67 12s. 7d. per ton.

Class "U" locomotives: The average cost of nine engines built at Addington Workshops was £4,938 per engine, or £104 7s. per ton. Engines of practically the same class obtained from Sharp, Stewart, and Co. have been placed on the rails in New Zealand in 1900 for £3,199 13s. 4d., or £67 12s. 7d. per ton; and in 1901 for £3,396 each, or £71 15s. 7d. per ton. And "U" Class engines obtained from America averaged £2,655 each, or £59 16s. 7d. per ton.

"WF" locomotives: The cost of ten "WF" locomotives built at Addington has been £3,500 each, or £103 13s. 4d. per ton; that of six similar engines built at Hillside was £3,048 each, or £90 3s. 4d. per ton; and that of ten engines built by Price Bros. was £2,940 each, or £87 per ton.

Cost of Addington engines greater than those built elsewhere.

From the foregoing it will be evident that the cost of locomotives built at Addington is in all cases greater than that of similar engines constructed elsewhere.

The cost of the Addington-built Class "A" engine exceeds by 36 per cent. that of the Class "A" engine supplied by Messrs. Price Bros.

The Addington Class "B" engines cost 64½ per cent. more than the Class "B" engines imported from England.

The Class "U" engines made at Addington cost 54 per cent. more than the imported English, and 74 per cent. more than the American engines of this class.

The Addington-built Class "WF" engines are 14¾ per cent. dearer than similar engines built at Hillside, and 19 per cent. dearer than engines of this type constructed by Messrs. Price Bros., of Auckland.

(2.) Iron Castings.

Average cost, iron-castings.

An investigation of the working of the iron-foundry shows that if 33⅓ per cent. of the cost of labour and material be added to meet "fixed charges," the average cost of the castings produced is £13 per ton.

The rate therefore at which it was stated that cylinder-castings were charged out to locomotives —viz., £12 10s. per ton—is far too low (£15 per ton would be more nearly the value), and it would appear the so-called profit in the working of the year has only been arrived at by neglecting a portion of the charges which the foundry account should have been called upon to carry.

Cost of castings too high.

The average shop cost of £13 per ton is, in the opinion of the Board, too high, and exceeds considerably the shop cost of many private firms. It also exceeds the average rate at which castings have been supplied under contract before the Department undertook its own iron-casting. A rise in the price of pig iron has, it may be mentioned, contributed to this result.

(3.) Points and Crossings.

From observations and investigations of evidence and returns the Board have come to the conclusion that the manufacture of points and crossings is being carried on at Addington in a satisfactory manner, and that the cost of the work compares favourably with that done by private firms. They, however, consider that 33⅓ per cent., and not 15 per cent., should be the amount allotted to "fixed charges" when computing the actual shop costs.

The relative success of this work is an example of the effect of working on manufacturing lines and making use of modern machinery.

(4.) Smith and Forge Work.

Available data point to the cost of smith and forge work at Addington having increased, rather than, as stated in evidence, decreased, during recent years.

A comparison of the equipment and methods of Addington with those of Petone, Hillside, and the various private shops visited has convinced the Board that the cost of production of smiths' work at Addington must be greater than at the other establishments mentioned.

The method of cost-keeping in vogue at Addington does not permit of accurate relative figures being given.

(5.) Boiler-work.

The boiler-work at Addington is being carried on under grave disadvantages, which undoubtedly have the effect of causing the cost of production to be high. These matters have been fully dealt with under the heading "Efficiency of Plant and Appliances."

V. The Output.

The association of repair with new work at Addington renders it, with a few exceptions, almost impossible to arrive at figures of any value in connection with the output. The prejudicial effect of such association has already been referred to, and the transfer of workmen from one class of work to the other to meet momentary outside demands must seriously reduce the output per capita. From the returns which are available it would appear that the output from Addington has not increased at a rate corresponding to the increase which has taken place in the number of men employed; also, that the weight of iron castings turned out per man employed in the foundry is lower than that which is attained in private shops engaged on somewhat similar work. The Board are therefore of opinion that with changes in method and equipment a considerably increased output per labour-hour may confidently be expected.

VI. Generally, any Matter calling for Alteration or Improvement in the Interests of Efficiency, Economy, and Discipline.

Knowledge of cost of work.

The Board have been surprised by the small amount of knowledge of cost of operation and manufacture shown by some of those under whose immediate direction the work is being carried on and the apparently small amount of importance attached to the possession by them of such knowledge. It is desirable that steps should be taken to insure that managers and foremen are fully acquainted with the details of costs of production, and that in the operation of the shops it should be recognised that the cost of the work is a controlling factor in its production.

It would appear that in some cases the supervision of manufacturing work has been placed in the hands of officers who, however efficient they may be in the execution of their ordinary duties, have had no experience beyond the shops of the New Zealand Governmnt Railways, in which manufacturing dates from a comparatively recent year.

Suggest Home training.

The Board would suggest that the persons whom it may be intended to place in control of new work should receive, for a period, training in one or other of the railway manufacturing works of the older countries. They view with approval the sending by the Department of its workshops managers and foremen on a visit to the railways of Australia, but cannot consider that the results of such a trip will be comparable with those which should follow a period of, say, two years' active work in an English manufacturing shop.

Workmen's inventions.

An idea appears to be prevalent among the workmen that invention, or the scheming on their part of contrivances to reduce the cost of work, will not be favourably received by those in authority. This idea probably arises from a limited knowledge of what has been invented and is in use elsewhere.

Advisory Board recommended.

Since much valuable assistance can undoubtedly be derived from those actually engaged in the production of work, the Board would suggest the establishment of an Invention Board, to whom all such suggestions should be conveyed, and who would advise the Department as to the value of the ideas submitted to them. The mode of communication with the Board might be through the medium of suggestion-boxes placed in the various shops.

Final Conclusions.

Summing up the results of their inquiry, on the lines of the references made to them, the Board are of opinion,—

Work at Addington.

That the work at Addington is not being done as expeditiously and economically as it might be. This applies especially to the smith-shop, the boiler-shop, the machine-shop, the erecting-shop, the car and wagon shop, and the foundry.

Plant and appliances.

That the plant and appliances (with the exception of the power arrangements) are suitable for the carrying-on of repair-work, but that considerable additions are required before they can be classed as efficient for manufacturing purposes.

That the system of work adopted is faulty in,—

The association of repair with new work;

The methods of dealing with and carrying on the manufacture of new work;

The system of cost-keeping;

The tool system.

The discipline maintained.

That the discipline maintained under the present conditions is creditable to both officers and workmen, for the Board believe that the existing system of classification and control is calculated to dishearten the better class of officers and men, and to give an undesirable security of tenure to inefficient units.

That the cost of production is, speaking generally, greater at Addington than at private and the other Government workshops.

That the output is smaller in proportion to the number of hands employed.

As compared with the other Government shops the position occupied by Addington with regard to cost and production is partially explained by the fact that the amount of new work (which, as stated, is carried on under a faulty system) is greater.

Supply of locomotives.

Dealing with the supply of locomotives, the fact that Messrs. Price Bros. can supply the "A" Class locomotives at £73 16s. 4d. per ton would appear to justify the manufacture of these engines in the Dominion, for it is probable that similar machines could not be imported from England and placed on the rails here for less than £70 per ton. The cost of the local engine would thus be only 5½ per cent. in excess of that of the imported one.

Cost locomotive-building, Addington, prohibitive.

The present cost of manufacturing locomotives at Addington (over £100 per ton) is prohibitive, and in the opinion of the Board no more engines should be built there under present conditions.

The Board considers that, if the Department determines to itself continue the manufacture of locomotives, either—

Additional appliances required if manufacture to be continued.

The additional appliances already enumerated should be installed at Addington in new manufacturing-shop sections, distinct from the repair sections, with which there should be no interchange; or

An independent general railway manufacturing-shop should be set up in a suitable locality.

Failing one of these courses of action, contracts should in the future be let to private firms for all the locomotives which may be required; in which case many of the new appliances recommended for Addington would not be wanted.

With regard to other descriptions of rolling-stock, the Board are of opinion that the manufacture of the same can, with a suitable system and the special appliances and arrangements suggested, be profitably carried on at the Addington or at other of the Government Railway workshops.

Board's indebtedness to private firms.

The Board desire to express their indebtedness to the proprietors of the private shops visited, both for the facilities given them for becoming acquainted with the methods adopted therein and for the liberal manner in which, in more than one case, the results which were being obtained were furnished to the Board.

We have, &c.,

Robt. J. Scott,
M.Inst.C.E., M.Inst.M.E., M.Ass.E.E.,
Chairman.

Edward Roberts, M.I.Mech.E.

Jas. J. Niven.

The Hon. J. A. Millar, Minister of Railways.

MEMORANDUM FOR THE HON. THE MINISTER OF RAILWAYS.

Railway Department, Head Office, Wellington, 6th May, 1909.

WITH reference to the report of the Board of Inquiry into the administration of the Addington Railway Workshops, I desire to say that the difficulty the Board admits it has been confronted with in the matter of arriving at the results obtained, owing to the fact that both repair and manufacturing work are done in the shops, has been recognised by the Department as existing from the outset, and as having an appreciable effect on the operations carried on.

The shops as originally laid out and equipped were essentially repair-shops, and until the year 1900 only an odd locomotive had been manufactured. The equipment and general lay-out of the shops were determined by the purpose for which they were originally projected, and in considering the question of efficiency or inefficiency due regard must necessarily be had to the circumstances and the purposes for which the shops are provided.

When the business of the country began to expand by leaps and bounds in 1895, coincident with the resumption of the railways by the Government, the Department was confronted with the fact that the rolling-stock was totally inadequate to meet the requirements of the business. The position was brought under the notice of the Government, and instructions were at once given for the placing of an order for the building of a large number of wagons, carriages, and locomotives with the leading firms in the United Kingdom and America.

The Government at the same time decided, as a policy matter, to supplement the rolling-stock ordered from abroad by stock to be built in the workshops of the Dominion, thus giving employment to its own population. The establishment of a purely manufacturing shop, equipped with the best modern machinery, would have involved a very large expenditure that would have been quite unjustifiable, having regard to the facilities that existed and the amount of rolling-stock required to bring the equipment of the railways up to the standard necessary to enable them to cope with the business. It was therefore decided that it would be wiser to devote any funds that were available to the provision of rolling-stock, and to utilise the existing shops and appliances therein for the manufacture of that stock, than to expend a large amount of money on the establishment of a manufacturing shop, the very existence of which would have necessitated,—

(*a.*) A large addition to the capital cost of the railways.

(*b.*) The laying-down of a large rolling-stock programme, and the commitment of the Government to continue such a programme annually to provide employment for the large number of men that would necessarily require to be employed in the shops.

(*c.*) Imposing on the Government the necessity of providing annually and for all time the money required to meet the expenditure incurred in connection with the manufacturing shop.

The wisdom of the course adopted has now become apparent, it having been found that the quantity of rolling-stock turned out of the existing Railway workshops during the last nine years has put the Department in a position to meet all the demands of the traffic, and I confidently anticipate that when the programme for 1908–9 is completed, a further large rolling-stock programme will not be essential for the purpose of enabling the Department to meet the requirements of the traffic, although a certain amount of new work must be done in the shops in order to provide full employment for the staff that has necessarily to be kept on in anticipation of repair-work, which fluctuates considerably.

With regard to the standard for new and repair work, it is recognised in all establishments where both classes of work are undertaken that a uniform standard cannot be maintained, the conditions under which the operations have to be carried out being so widely divergent. It does not, however, necessarily follow that, because the rate of working of the men varies owing to the divergence of the conditions, it is unsatisfactory, or that a fair amount of work is not being done. In the ordinary course men who can be kept regularly employed on a given class of work for a lengthy period become more expert at that particular class of work than they would do if shifted about and called upon to undertake all-round work.

With regard to machines, some of those in use at Addington are undoubtedly not of the newest types. They are, however, efficient for the purposes for which they are principally used. In contradistinction to these, however, there are many excellent machines of the most up-to-date character installed in the shops. This will be apparent when I point out that on additional plant and machinery for Addington £31,000 has been spent in the last eight years.

I note that the Board in reviewing the Addington Workshops has compared the conduct of the new work with the modern manufacturing practice. In my opinion, such a comparison is unreasonable. Modern manufacturing practice is to entirely disassociate new work from repair-work. The conditions of this country, as previously pointed out, have not been such as to justify or warant the establishment of separate manufacturing shops; and, although it is true that, to meet the exigencies of the largely increased mileage of railways opened during the last few years, and a consequent expansion of business, the new work undertaken in the Railway workshops in the Dominion (and at Addington particularly) has materially increased, it does not necessarily follow that the same rate of manufacture can be maintained. In such circumstances the incurring of a large expenditure in establishing and equipping a separate manufacturing shop would, in my opinion, be entirely unwarranted. I take it that in making their criticisms the Board was unaware of this aspect of the question, which, I submit, has an important and material bearing on the whole subject under review.

Dealing now with the question of the efficiency of plant and appliances, I observe that the Board finds there are at Addington, especially in the machine-shop, many modern and efficient machine tools, also that the shops generally are well equipped for doing repair-work. Their

criticisms appear to be mainly directed to the manufacturing of new locomotives, to provide efficiently for which the Board considers large alterations and additions to the plant, buildings, and appliances will be necessary. This resolves itself into a question of expenditure and expediency, and I have already dealt fully with these aspects of the question.

Dealing with the stamping appliances in the smiths' shop, much of this class of work is done by the steam-hammer. The steel castings, being cheaper, have to a considerable extent superseded the stampings.

With respect to the new appliances suggested, the requirements of the present time are being reasonably met, and the results obtained by using the steam-hammer are found to be both economical and efficient for our purposes. A direct steam-driven stamp-dropping plant in connection with which the furnaces recommended might be required is not essential at the present moment, nor can such a plant be regarded as an indispensable adjunct. Any slight economy that might be effected by the installation of such appliance as against the present method of working would, in my opinion, be insufficient to justify the expense of installing it.

With regard to the installation of a hydraulic bending and forging plant, I would point out that the Department has benders in use at the present time, also a forging plant and steam-hammer. Bar-shears were ordered through the High Commissioner some considerable time ago, and are expected to arrive in the Dominion at an early date.

It is not the practice to manufacture bolts in the workshop in any considerable quantity. The supply of bolts is obtained through the Stores Department under contract, this having been found to be the most economical.

With regard to the weight of sledge-hammers, those in use in the Addington Workshops are of the usual standard weight. Many years ago sledge-hammers of a heavier type were in use in almost every smiths' shop. The tendency of recent years has, however, been to reduce the weight of the hammers, it having been found by experience that the men could not effectively use the heavier hammer all day.

Boiler-shop: It has been recognised that the overhead travellers are somewhat slow, and on more than one occasion the question of adopting electricity or producer-gas plant for the purpose of providing motor and electric lifting-power has been under consideration. The matter is, however, one that involves a large amount of expenditure, and, as already stated, it has hitherto been considered to be better policy to put any funds available into rolling-stock to meet the public requirements, rather than into machinery for the workshops which were already equipped with appliances that reasonably met the requirements and could only be scrapped if discarded.

The radial cutting-head machine now in use is a very efficient tool, fully capable of meeting all the immediate and prospective requirements of the Department. In the construction of the boilers of the "X" locomotives, however, the use of 8 plates of exceptional strength and thickness was considered desirable. Our machine, owing to the shape and special nature of the plates, was unable to deal efficiently with those particular plates. The Department was aware of this at the time the plates were ordered, but knew that a private firm in New Zealand had installed in its workshops a special plant capable of dealing with thicker plates than any likely to be used by the Department, and it was undoubtedly more economical to get the bending of these particular 8 plates done by the private firm than to install an expensive machine for the special purpose of dealing with the plates. It is most improbable that the necessity for the Department using similar plates will again arise in the near future.

Large hydraulic riveters: The Board has apparently been under some misapprehension in so far as the accumulator and pumping plant are concerned. The plant originally imported for the old fixed riveter is still in use, but the pumps were duplicated in 1901 and are regularly used. The power obtained from the two accumulators is sufficient for ordinary purposes. There are, however, exceptional cases in which greater power would be of advantage. The number of instances in which the power momentarily runs out are so infrequent as not to cause either loss of time, or trouble, and, generally speaking, the hydraulic plant works satisfactorily. The question as to whether the performance of the riveter is satisfactory depends to a very large extent on the nature of the work on which the machine is employed and the size of the rivets used. An average of 500 rivets per day might, with safety, be made on certain jobs, but where the work in hand is one that involves the safety of a locomotive, the train which it is hauling, and the lives of the people travelling therein, it must, I think, be conceded that the greatest possible care should be taken to insure the efficiency of the work done. It was shown in evidence submitted to the Board that on certain classes of work four rivets per minute could be put in, but that rate did not apply to boiler-work. The boilers of our locomotives have to be built to withstand the strain of a working-pressure of 250 lb. per square inch, and to insure good work and absolute tightness of the boiler it is the practice of the Department to keep the pressure on the rivets for quite an appreciable time while they are cooling. This affects the rate of riveting, but, on the other hand, it insures an absolutely satisfactory job and obviates the necessity of subsequently having to cut out defective rivets or of calking the boiler to obviate leaks resulting from inefficient riveting. Having due regard to the importance of boiler-work, the interests involved, and the very awkward position in which portions of the riveting have to be done, and also to the size of the rivets used, I am of opinion that an average of at least 200 rivets per day on boiler-work is reasonable; on other work of less important character the rate is very much higher.

The question of the adequacy of the flanging appliances has to be considered from the standpoint of the quantity of work to be done and the frequency with which the appliances would be used. Up to the present time the Department has found flanging by hand to meet all the requirements, in addition to being economical. The installation of a modern hydraulic flanging plant would not be justifiable under the present conditions, when not more than twenty boilers per annum would require to be dealt with by such plant. This would involve the flanging of 100

plates, a work that would occupy an up-to-date flanging-machine an infinitesimal portion of the year. In such circumstances the installation of a costly plant would be a work of extravagance. It is very much cheaper to import the flanged plates direct from the United Kingdom, and this is the practice recently followed.

The plate-rollers installed in the Addington Workshops are ample to efficiently meet all the ordinary requirements of the Railway Department. It is true that the 8 "X" locomotive boiler-cone plates, which were of the exceptional thickness of $\frac{7}{8}$ in., could not be rolled in the Addington Shops. The Department, however, was fully aware of the fact that a private firm working in the Dominion had plate-rolls of sufficient capacity to deal with the cone-plates in question, and it was much cheaper to pay that firm to roll the plates than to import special machines for the special work.

The pneumatic hand-tubes installed at Addington are maintained in good and efficient order so far as I am aware. In view, however, of the remarks of the Commissioners, I have directed an investigation to be made into the condition of these tools, and any repairs required to render them efficient will be promptly effected. The general instruction in regard to the working plant of the workshops is that it must be maintained in an efficient condition.

For tube-setting the Department has installed at Addington two machines. The first, No. 6 Little Giant Reversible Tube-expanding Machine, is specially suitable for locomotive-work. This machine expands tubes up to $2\frac{1}{2}$ in. steel, 3 in. brass, riming up to $1\frac{1}{4}$ in. The second machine, No. 7 Little Giant Reversible Tube-expanding, will deal with tubes up to 4 in. steel, $4\frac{1}{2}$ in. brass, and riming up to $2\frac{1}{2}$ in. Both are pneumatic.

Machines in fitting-shop: I have had under consideration for several years past the question of rearranging the machinery in the fitting-shop, with a view to grouping it into sets, thus effecting considerable improvement in working and economy in motive power. The generation of motor power by electricity has also been discussed. Financial arrangements have, however, so far precluded the possibility of giving effect to the proposal during the period that a large annual expenditure was required for the rolling-stock.

The lifting arrangements are sufficient and convenient for the work they have to do, and as auxiliaries to the overhead cranes. The older lathes are likewise very useful in many respects, and are sufficiently good for our work. A certain number of such machines are, in any case, desirable for the use of raw apprentices. I fully recognise that modern machines would be more efficient, but here, again, the question of expenditure obtrudes itself, and in my opinion the circumstances of the Department are not such as to justify it in discarding machines that are capable of doing reasonably satisfactory work for the purpose of installing, at very great expense, new machinery that would not be fully employed during the year.

My remarks respecting the rearrangement of machinery apply with equal force to the question of the remodelling of the shops. This question has engaged my attention on more than one occasion during the last ten years, but the expenditure that would be involved in making the alterations has undoubtedly been put to better use in the construction of rolling-stock.

The overhead travellers in the erecting and boiler shops could be made more efficient by the expenditure of a large sum of money in their electrification. I do not, however, regard such an expenditure as essential, and am of opinion that under present circumstances the machines reasonably meet the requirements of the Department.

With respect to the necessity of a level laying-out floor on concrete foundations in the points and crossings shop, I would merely remark that during my visit to England and America a few years ago I observed closely the accommodation and appliances provided in the various shops, and neither in England nor America did I see anything better for the laying-out of points and crossings than we have at Addington. I do not regard the provision of a laying-out floor on concrete foundations as being essential, and am of opinion that any expense incurred in this direction would be unwarranted in view of the fact that the work can be expeditiously and properly done under the existing arrangements.

The question of improving the lifting appliances in the foundry has been under consideration on more than one occasion, but the difficulty that obtrudes itself has been in respect to the amount of expenditure involved. Arrangements have, however, been made to provide an air-lift to work in conjunction with the overhead traveller. Electric cranes are no doubt desirable, and their installation has formed part of the general scheme of electrification that has frequently been discussed by the Department, but has been held in abeyance temporarily for financial and other cogent reasons, and, as pointed out, the want of head room limits the height of the appliances that can be installed. Lifts for handling pig iron, and pig-iron breaker, have already been provided for, and will be installed as early as possible. The number of really large castings dealt with in the foundry is not great, and it is practicable to handle them efficiently under the existing arrangements. Owing to the proximity of the water to the surface of the ground it is not practicable to sink to any depth, and the present arrangements have been adopted as the result of experience. Assuming that money were available to provide a watertight pit, which, however, I do not regard as essential, and through some unforeseen circumstance arising out of the unstable character of the ground water found its way into the pit, the pouring of molten metal on top of the water during the process of casting would undoubtedly result in disaster.

The rattlers are placed in a position that has been shown by experience to be the best and most convenient, having regard to the purposes for which they are used.

The woodworking machinery installed in the car shop and mill is ample to meet all the immediate and prospective requirements of the Department, and the expenditure that would be involved in installing new machinery would in these circumstances be unjustifiable. A system of lifting-beams, trestles, and transport bogies might be advantageous in certain shops under different conditions, but are not essential in our shops, where the lifting is done expeditiously by means of jacks. Transport bogies are not considered necessary, as the bodies of the cars are not moved after being lifted.

I do not regard the provision of a new shop, well equipped for the manufacture of wagon-underframes, as indispensable, for the reason that the volume of this class of work that has to be undertaken is inadequate to justify the expenditure that would be involved in its establishment.

The provision of complete multiple drilling plant, with drills capable of being set to template, is not necessary, for the reason that hardwood has been substituted for iron for wagon-bodies.

It has been recognised for some time past that the motive-power arrangements were not of the most up-to-date type, but, as they reasonably met requirements, and it was considered that any alteration made should be of a comprehensive kind, the matter in this case, as in many other instances, resolved itself into one of expenditure.

There is very considerable divergence of opinion among experts throughout the world as to what really is the most efficient and economical motive power for shop machinery. While many favour electricity, a number of equally eminent men have recently been of opinion that producer-gas engines driving shafting direct is just as efficient and more economical. In connection with the Addington Workshops, the question of grouping the shafting into sections and making temporary arrangements in motive power by means of producer-gas engines has been engaging attention for some time past, and investigations that have been made point to the fact that the method under consideration would be much more economical than the use of individual motors electrically driven. I do not concur in the opinion of the Commissioners that a saving of £3,500 per annum could be effected in actual working expenses by making a change such as they suggest in the motive power. Such a saving is, in my opinion, not within the scope of realisation. The plant cannot be worked on a fuel-consumption of 200 tons of coke per annum.

Dealing with the question of the system of work adopted, it is essential to point out that the primary object in view when the New Zealand Railway workshops were established was the repairing of the rolling-stock in use on the railway system of the Dominion. In later years, however, a certain amount of manufacturing work has, in accordance with the policy of the Government, been undertaken in the shops. This work, however, is of secondary importance as compared with the repair-work that is essential to enable the operations of the Department to be economically and efficiently carried on to meet the requirements of the travelling public and the commercial community. As far as possible a certain portion of the staff is allocated to the new work, but prior to the heavy rushes of traffic that occur at stated periods throughout the year, it becomes imperatively necessary for the Department to arrange that every vehicle in the shops undergoing repairs shall be rendered fit and safe for use during that period, and in such circumstances men who would, in the ordinary course, be employed at new work have to be transferred to repair-work, otherwise the operations of the Department would be materially interfered with, and grave dissatisfaction and inconvenience be caused to the public. In my opinion it is cheaper to follow the practice that obtains in this connection than it would be to staff the Department up to the maximum requirements for repair-work, and at the same time have a separate staff for manufacturing new stock. The inevitable result would be that at slack periods the repair-men would be idle for a portion of their time, and the men engaged for new work would have an insecure tenure of office, which would not tend to satisfactory results.

The question as to the advisability of manufacturing parts during the period of assemblage of the whole depends entirely on the circumstances. What would be a good practice and economical in a large manufacturing shop would unquestionably in many respects be extravagant in a shop where the manufacturing was subsidiary to repair-work, as it is at Addington.

The question of the system adopted in connection with the machine-tool room is engaging attention, and any alterations that are necessary to make the system more efficient will be promptly made. The matter of equipment resolves itself into a question of expenditure, and I have touched fully on this point in dealing with other matters, and my remarks in respect thereto have equal cogency in so far as incurring expenditure on the equipment of tool-rooms is concerned.

No complaints have been made by the blacksmiths concerning the drawings to which they are required to work, and I was unaware of their being required to work to other than full-size detailed drawings. Instructions have been given that will obviate the necessity for this in the few isolated cases that may have occurred. As a general practice full-sized drawings are supplied.

The system of time and cost keeping in use in the shops of the Department is thoroughly efficient in every respect, and as simple as possible, having regard to accuracy and efficiency. The system has been built up as the result of years of experience, and, although information has been gleaned, both by correspondence and personal inquiry, as to the system of cost-keeping adopted elsewhere, it has been found that none of these systems would meet the local requirements. None of our workshops are self-contained, and in many cases portions of manufacturing-work in hand are done at one shop for transmission to another, and a system has to be devised to meet the existing conditions. A card system that would be satisfactory in a small self-contained shop would not be so under the conditions existing in the New Zealand Government Railway workshops. The card systems for shop and other purposes have been closely investigated by different officers in the Department, who were not, however, impressed with them in so far as their application to the New Zealand Railways is concerned. The adoption of the card system would not obviate the necessity of the foreman initialling or examining the cards, and, although a certain amount of the foreman's time is occupied in doing this work, I do not consider that any foreman who did not scrutinise the time-sheets could keep himself as closely in touch with what is going on in the workshops as our foremen do under existing circumstances. No representations have, so far as I am aware, been made that the examination of the time-books militates against the efficient performance of the other duties of foremen. The evidence of one foreman indicates that his checking of the time-books is essential, owing to the fact that workmen are liable to enter wrong job-numbers on their tickets, which, if undiscovered, would cause errors in working out the costs. The full details of the work are supplied to the Workshops Manager four-weekly through district officers. The costs are closely scrutinised and checked, and investigations are made in all cases in which it is considered that the results have not been satisfactory from the point of economy.

I am inquiring into the system of keeping the pattern-book, and any alterations that are found necessary will be made.

With respect to the Board's recommendation that repair-work should be completely separated from new work, I can only repeat the remarks I have already made under this head—namely, that such a system is impracticable under the present conditions existing in this country. The Board appears to be under a misapprehension in regard to the manufacture of new work. This class of work is already done to limit-gauges and standard templates. The amount of manufacturing undertaken in the shops is altogether insufficient to justify the setting-up of a store, in which various parts of locomotives, &c., would be stocked and drawn thence for erection or completion of machines as required. The mere establishment of a store in itself involves a very large expenditure.

The present conditions under which the various parts of stock of a given type are made to a standard permits of interchange of parts, and all parts are at the present time manufactured at a rate which keeps pace with the men engaged in the erecting, and this is undoubtedly the most economical system to adopt under present conditions.

The abolition of the existing tool-room and instead thereof the establishment of a well-equipped room, furnished with modern tool-room machines, is no doubt desirable if all the conditions were favourable, and this is one of the questions that has been under consideration on several occasions in connection with the scheme of shop-reorganization that has been contemplated for some years past, but which has had to give way to more urgent and important work for financial reasons.

The system of cost-keeping, as already pointed out, efficiently meets the requirements of the New Zealand Railways for the reasons already given. The card system has, after investigation, been found unsuitable for our requirements. If the new work were entirely separated from repair, and the whole of the operations necessary were performed under the one roof, the card system of cost could no doubt be brought into operation. I have, however, no hesitation in saying that such a system would not be found to be more efficient or any more simple than the present system, and, as a matter of fact, the New Zealand Railway method of keeping shop accounts has been adopted by at least one of the Australasian States after full investigation. I do not consider the appointment of a Costs Clerk to each shop a matter of necessity from an economical or efficiency point of view. All the data that is necessary is fully provided for, and is readily available at the hands of the responsible officers who control the section in which the various workshops are situated.

Discipline: With regard to the movements of the staff at Addington, I disagree entirely with the conclusions of the Commissioners. The evidence of the Engineer and the various foremen was emphatic on the point that, taken as a whole, the amount of work done by the men was satisfactory. Similar testimony was also given by independent witnesses. It was further shown that the men, as workmen, compared favourably with day-workmen in America, although it was admitted that the American piece-workmen were quicker.

The Board's conclusion that centralisation of the control of the staff has taken all power and authority out of the hands of those directly in charge of the men, and so militated against the proper carrying-on of the work, has evidently been based on insufficient knowledge of the matter. Those directly in charge of the men have all the control that is essential for the maintenance of proper discipline, and I do not agree with the conclusion of the Board that a great improvement in staff would be effected if Workshops Managers were held personally responsible for the results obtained by the shops and given greater powers of control.

The system of staff control advocated by the Board has been tried, but was not satisfactory, for reasons that are set out clearly in the statement I placed before the Board on the 29th March. I then pointed out that the practice for many years was to allow officers in charge of districts, workshops, and large stations at which a number of men were employed, to engage on their own responsibility any men who were required to fill vacancies that occurred on their respective staffs; but that system did not work satisfactorily, for the reason that men who were considered unsuitable for employment in one locality not infrequently went to another, and were taken on without proper inquiry being made as to their qualifications and eligibility; in other words, there was absolutely no standard. The same difficulty was found to exist in connection with the punishment of men for offences committed against the regulations or for dereliction of duty. Some of the officers went to the extreme, and inflicted penalties which in many cases were not justifiable, and were, moreover, out of all proportion to the offence committed. Others, again, took an extremely lenient view, and passed over in the lightest manner gross breaches of the regulations which should have been met by severe punishment, and in respect to which dismissal would in some cases have been quite justifiable. A further disadvantage of the subject that militated severely against the men was the fact that promotions were more rapid in some districts than in others. This not infrequently resulted in a man who was not thoroughly efficient receiving promotion in one district, while a more efficient man in another district was kept back. The position became so acute that in 1889 it was decided to concentrate the staff arrangements at the Wellington Headquarters, and since 1896 the staff appointments and arrangements have been governed by the regulations under the Government Railways Classification Act. The object of the Act was to secure uniformity, and this can only be done by concentrating the staff-work and directing it from one central office, as has been the practice for the last thirteen years. An independent system of staff control by district officers, which proved unsatisfactory when the staff of the New Zealand Government Railways numbered less than 3,000 persons would, in my opinion, be an utter failure when applied to a staff which now numbers 13,000 men. The fact that, in respect to the Addington Workshops, the Locomotive Engineer, on whom devolves the responsibility of making recommendations as to the suitability of the men who are engaged on instruction from the Head Office, has recommended fully 75 per cent. of the tradesmen to be placed in the first grade is, in my opinion,

a complete answer to the question that has been raised as to whether the present method is conducive to the efficiency of the staff or otherwise, or insures the employment of the better class of tradesmen.

The reference of the Board to the fact that the actions of persons outside of the Railway service in interesting themselves on behalf of particular men or bodies of workshops men is not calculated to improve the discipline or smooth working of the shops is noted, but in my opinion the position has not been properly understood. The fact of an individual preferring a request or making a suggestion on a matter connected with railway-working does not influence the management one way or the other, and I am not aware that foremen or Workshops Managers have allowed themselves to be influenced in any way by outsiders. I have carefully perused the newspaper reports of the evidence on this head, and the conclusion I have come to is that what was intended to be conveyed was the fact of persons outside of the Department being permitted to walk through the shops, and while doing so to converse with the men, was not conducive to discipline. So far as my own evidence is concerned, I made the position perfectly clear, stating distinctly that any alterations that were made or concessions that were granted resulted from the fact that the requests were reasonable.

Turning now to the question of the amount that should be added by way of commission to cover fixed charges, I would point out that the present basis of 15 per cent. was decided upon by Royal Commission, which reported in 1876, and which was set up for the purpose of dealing exhaustively with the system of Railway accounts. In actual practice the commission has been found to be sufficient to meet the charges for which it was imposed, and, that being so, the natural result that would accrue from the raising of the commission charge would be an increase in the capital cost of the rolling-stock and appliances forming part of the Railway equipment, and on which sum the Department is expected to return 3 per cent. per annum.

In regard to this question of commission it is interesting to note that, while in New Zealand a charge of 15 per cent. is made in respect to the cost of both the labour and material, on the Midland Railway in England and the Canadian Pacific Railway the charges amount to 10 per cent. only, and are calculated on the cost of the labour only; the Great Northern Railway of England makes a charge of 20 per cent. on cost of labour only; the Grand Trunk Railway of Canada makes no charge; the Victorian Railways charge 20 per cent. on labour only; New South Wales 32½ per cent. on labour only; another Australian State 30 per cent. on labour only; Queensland, 12½ to 17½ per cent. on labour only. In addition to the charge of 15 per cent. which the New Zealand Government Railways make for commission, calculated on the total cost of labour and material, a charge of 4d. in the pound on the value of material is added to cover stores commission. This represents an impost of nearly 2 per cent. on the cost of the materials, and the workshops commission of 15 per cent. is calculated on this additional cost. It is not, I submit, necessary nor desirable for the Department which is manufacturing stock for its own purposes to make a profit out of the manufacturing account. The cost of the new machinery being charged to Capital Account, the Working Railways have to provide for the interest on the capital invested. The upkeep of the shops and the wear-an-tear of all machinery is provided for out of the working-expenses, and becomes a charge against the ordinary vote of the Department. Nothing is therefore to be gained by abnormally increasing the Manufacturing Account.

In arriving at the cost of the three "A" Class locomotives built at Addington in 1908, the Board has assumed 33⅓ per cent. on the cost of wages and material. I have already shown that the New Zealand Railway method of computing commission on wages and material stands alone, that the general practice elsewhere is to compute such charges on the labour only, and that the commission varies from 10 per cent. on the Midland and Canadian Pacific Railways to 32½ per cent. on the New South Wales. The basis assumed by the Board is therefore higher in a double sense than that of any other railway system, first in respect to rate, and secondly, by reason of the inclusion of the cost of material.

This latter factor represents approximately a charge of £10 per ton on a locomotive, as, even assuming the Board's basis for the purposes of calculation, and dealing with it on the same lines as other railways, by excluding material, the cost per engine ("A" Class) is approximately £90 8s. per ton, or, in round figures, £10 per ton less than the amount estimated by the Board. The cost of the same locomotive, estimated by the Railway Department's method, is £86 10s. 11d. per ton, so that the inclusion of the material on a 15-per-cent. commission basis, as has been done by the Railway Department in all its calculations, represents a loading of £4 per ton on the locomotive. The rate per ton on the basis of calculation ruling on other railways would have been £82 10s. 11d. Throughout the whole of the Board's calculations the highest rate of commission has been charged, and on the aggregate amount of wages and material, thus showing the cost of locomotives built in the Railway workshops in the worst possible light. The Board has apparently assumed, in making its calculations and deductions, that the firms with which the comparisons have been made have charged up to 33⅓ per cent. as manufacturers' cost in respect to both wages and material. There is, however, no data to support the supposition that such an amount is calculated in the prices for contract locomotives. In respect to these the commission is an unknown quantity, and it is therefore impossible to make an accurate comparison. It has also been shown by direct evidence that Messrs. Price Bros., as the result of their experience, consider that they have taken the contract for the "A" Class locomotives at much too low a rate, and, as a matter of fact, it is known that the Department could not to-day place a contract for a similar class of locomotive at the same rate. Furthermore, there is the fact that the Railway Department has materially assisted the contractors by doing certain portions of the intricate work in the Railway workshops.

With respect to the comparison of the Class "Q" Baldwin locomotive with Class "A," it is only necessary to point out that the "Q" was built in a large American workshop which has

specialised in the matter of manufacturing locomotives, and is devoted to that purpose. They were obtained six years ago—before the Addington "A" compounds were built—and from a country in which labour-conditions are better from a manufacturer's point of view than New Zealand, and from the largest railway locomotive manufacturing shops in the world, specially equipped with all the latest appliances for the rapid manufacture of locomotives. The "Q" engine, moreover, is a "simple" engine, while the "A" is a "compound," and the "Q" does not compare with the New-Zealand-manufactured locomotive either in class of workmanship or the material used therein. A comparison of the Class "Q" locomotive with the "A" is therefore valueless for the purpose for which it has been introduced.

Dealing next with the Class "B" locomotives, again the Board's figures have been obtained by including labour as well as material on the assumption of the 33⅓-per-cent. basis for the purposes of making a comparison with the Sharp-Stewart engines. The latter were obtained in the year 1900. The Addington locomotives were built subsequent to 1903. Here, again, the labour-conditions have militated against New Zealand from the point of view of the manufacturer of the locomotives. The firm of Sharp-Stewart, being largely engaged in locomotive-manufacturing work, have a further advantage in the matter of equipment of their shops. The same remarks apply to the comparison instituted between the nine "U" locomotives built at Addington and the six "UA" locomotives built by Sharp-Stewart and the ten "Uc" locomotives built by the same firm in 1901, and the ten "UB" locomotives obtained from the Baldwin Company. In every single instance in which the Board has made comparisons it has entirely failed to appreciate the widely divergent conditions that exist in respect to labour and facilities in New Zealand, and the conditions existing in countries such as the United Kingdom and the United States of America. It has, moreover, assumed, without having any evidence to support the fact, that the charges for the locomotives include a 33⅓-per-cent. commission based on both labour and material. It was, however, recognised that, in so far as imported locomotives were concerned, the labour-conditions and the fact that the locomotive-manufacturers specialised in that particular work, enable contracts to be let abroad at a cheaper rate than the engines could be manufactured in the Railway workshops.

With respect to the comparison of the ten locomotives built at Addington and those built at Hillside and by Price Bros., it must be borne in mind that all the experimental work in connection with this class of engine was undertaken at Addington, a considerable proportion of the work being done under stress of circumstances and at overtime rates. Hillside had the benefit of the patterns made at Addington, and, as the work was done under ordinary circumstances, the engines were built at a cheaper rate per ton than the Addington lot, and, taking the figures as a basis, the Hillside locomotives were built at a much lower rate per ton than the contract for locomotives of the same class let to Messrs. Price Bros. In nearly every case in which the building of a new type of locomotive has been undertaken in the Dominion, the experimental work has been done at Addington, and this has naturally increased the cost of production at that shop to some considerable extent.

I do not concur in the Board's views respecting the difference in cost of the locomotives built in the Railway Workshops at Addington and those manufactured elsewhere, and, as I have already pointed out, in my opinion the loading of the locomotives built in the Railway workshops with a heavy percentage on the cost of material and labour is not justifiable. The effect of the Board's methods is plainly seen in their comparison between the cost of the "WF" locomotives manufactured by Price Bros. and by the Railway Department. Messrs. Price Bros.' rate per ton works out at £86 19s. 8d.; the Railway figures give a rate of £77 15s. 7d. per ton at Hillside, and at Addington, where the experimental work was done, £89 6s. 5d. The Board, by fixing a higher rate of commission than charged under any other railway system referred to above, in a double sense increases the cost at Hillside by nearly £13 per ton, and at Addington by £14 per ton. The same methods have been adopted in respect to other comparisons; and the fact that wages in England and America are very much lower than the rates ruling in New Zealand has been ignored. Instead of the rate per ton for "WF" locomotives of Messrs. Price Bros. being lower than those built in the Railway workshops, they are actually £9 per ton higher than at Hillside and £2 per ton lower than at Addington.

With respect to the "A" locomotives, the question of the rate at which Messrs. Price Bros. are paid being remunerative or otherwise can, I think, easily be determined by comparing the price per ton of the Class "A" compound with that of Class "WF." The contract for the latter was let in 1905, at a tonnage-rate of £86 19s. 8d.; the "A"s were let in 1906 and 1909, at a rate which works out at £73 16s. 4d. per ton. In the meantime the Arbitration Court had increased the wages of the tradesmen, thus raising the expenses of the firm. As the contract rates for the "WF"s were regarded as a reasonable rate, it is apparent that the firm's statement that they are losing money on the "A"s is correct. The Board has followed the same method of arriving at the cost of castings as it has at the cost of locomotives, and by increasing the commission arrived at the rates stated. Notwithstanding this, the fact remains that the Department can supply to its own shops castings at the rate of £12 10s. per ton, and this rate is less than the rate at which outside firms tendered to supply the Government's requirements. At Christchurch the rate for castings up to 7 lb. in weight was £16 per ton; over 7 lb. and up to 100 lb., £14 per ton; castings over 100 lb., £13 10s. per ton; special castings, £16 per ton. The Railway Department's rates are £15 per ton for castings under 7 lb., and £12 10s. per ton for castings over 7 lb., the average all-round rate being £12 10s. per ton.

With respect to the manufacture of points and crossings, the only point at issue is the amount that should be charged as commission. The Board considers 33⅓ per cent., while the Department is of opinion that 15 per cent. is sufficient to add to work that is being carried on for its own purposes.

I do not concur in the Board's opinion that the available data points to an increase rather than a decrease in the cost of the smith and forging work at Addington. Reliable data is available, and shows that the cost has not advanced.

Output.: With regard to the output, I would merely remark that a shop which has admittedly from the outset been established for the purpose of undertaking repairs to railway rolling-stock cannot be expected to compete in the matter of manufacturing-work with shops that are specially equipped and established to undertake such work, and it has all along been recognised by the Department that, as a result of the undertaking of the two classes of work in the one establishment, the new work must from time to time give way to repair-work to meet the exigencies of the service, and the transfer of men from one job to another under such conditions becomes a matter of imperative necessity. The Board apparently relies on Return No. 1, which sets out in detail the statement of new work and repairs executed at Hillside for the years 1908–9 to show that the output at Addington is not satisfactory. In this connection, however, I would point out that it is not practicable to determine this question on the mere figures included in the return without some personal knowledge of the class of work that has been put in hand and the progress of the work up to the end of each financial period. The amount of repair-work varies in volume both in regard to light and heavy repairs, and it is quite possible, and not infrequently happens, that heavy works undertaken towards the close of one year, and well advanced but not completed, are not shown in the returns for that particular year, but in those for the following year. Although the time taken to complete the job after the close of the financial years may not exceed a few weeks, still the fact that the job has to be carried into next year swells the output of that year to the detriment of the preceding year.

I quite concur with the Board that with certain changes in the matter of the equipment of the shops—which, however, as I have already stated, resolve themselves into a matter of expenditure—an increased output could be obtained. I, however, doubt very much whether the increased output thus obtained would be commensurate with the expense involved in securing it.

With respect to the Board's remarks regarding the amount of knowledge of the cost of manufacturing possessed by some of the members of the staff under whose immediate direction the work is being carried on, and the apparent small importance attached to the possession by them of such knowledge, I have to state that, so far as the Department is concerned, its arrangements provide for full particulars of all costs being available at the end of each four-weekly period for the use and information of Workshops Managers and foremen; and, although it may be true that some of the foremen were not able to give the Board right offhand definite information respecting the cost of operating the shops immediately under their control, it is, I think, altogether erroneous to suppose that these men did not make any investigations on the subject, as, generally speaking, it has been found that the foremen take a very intelligent interest in the question of shop-operations, not only as regards the establishments with which they are closely connected, but also in those of kindred establishments, and they vie with each other in their endeavour to insure efficiency and economy. The amount of knowledge possessed by the foreman as to the cost of manufacturing depends to a considerable extent on the time that he has been in the position. Foremen are appointed on the recommendation of the head of the branch and the local officer controlling the district in which the men are working. They are invariably men who have risen from the ranks of operatives, first to the position of leading hand, and next to that of foremen. Some of the foremen at present located at Addington have been there but a short time, and I have noticed that one of these officers, in giving evidence before the Commission, failed to take into consideration certain factors which affected the cost of working the particular branch that he controls, but, notwithstanding this, the man in question is an efficient officer, who has done and is doing good work for the Department; and there is no doubt whatever that, with the better opportunities that are afforded him in his present position, and the data provided for perusal, the advantages to be derived from an accurate knowledge of all that pertains to his shop will become more apparent, and he will daily recognise the necessity that exists for keeping himself in close touch with the question.

With regard to the suggestion that officers appointed to supervise manufacturing-work should have had experience beyond the shops of New Zealand Government Railways, I would point out that, as practically the bulk of the men have been trained in the railway shops in the Dominion, the adoption of the suggestion of the Board would mean the importation of men from abroad, or, in the alternative, the sending to other countries, at regular intervals, for training in workshops practices, some of the men connected with the Railway workshops of this Dominion. The probabilities are that, with practical experience gained abroad, improvements in the system of conducting manufacturing-work might be effected; but here, again, the question arises as to whether the advantages to be gained would be commensurate with the expense involved, having regard to the comparatively small amount of manufacturing-work that is undertaken in the country or that is likely to be put in hand during the next few years. In this connection I may mention that a year or two ago the Department selected two of the Senior Workshops Managers and sent them to Australia to examine into the method of work and inspect the machinery installed in the leading workshops in the Australian States. On their return to this Dominion the officers reported on what they had seen, and made recommendations respecting the purchase and installation of certain machines, which were duly ordered and installed. Other officers have from time to time, both before and since, had extended leave, during which they have visited the Australasian State Railways. The Board's recommendation that Worshops Managers should be given two years' active work in an English manufacturing shop is one which, in my opinion, is impracticable on account of the expense that would be involved. The matter is, however, largely one of policy; but I do not consider that the results would be commensurate with the expense involved.

With regard to inventions of workmen, I have to state that for many years past it has been well known in the service that the claims of any member who invented and brought under notice any invention of practical utility would receive favourable consideration, and the appliance would be treated on its merits, and, as a matter of fact, the Department has from time to time received many proposals for so-called improvements in various appliances. As a general rule, however, the suggested improvements are crude and impracticable and it is not infrequently found that they take a form that has been tried and discarded in the United Kingdom, the Continent, or American many years ago. A considerable amount of time is taken up in inquiring into the *bona fides* of the suggestions and utility of the appliances; and, although an occasional practical suggestion is made, it rarely happens that a tool of any value is invented. Notices to all the workmen are posted in every workshop, inviting them to bring before the Department any improvements that they consider practicable in regard to the method of working. Appliances have been submitted in several instances, and have proved of practical utility, and bonuses have been granted to the inventors.

Regarding the final conclusions of the Board that the work at Addington is not done as expeditiously and economically as it might be, I have to say that, in my opinion, the finding of the Board in this respect is not in accordance with the weight of the evidence, the whole trend of which was that, having regard to the purposes for which the shops were erected, the appliances with which they are equipped, and the prevailing conditions, the output is satisfactory. A careful perusal of the Board's report shows that from first to last it has looked at the matter as from the point of manufacturing of new stock, whereas, as I have indicated at the outset, the manufacturing of new stock, although it has of later years assumed considerable proportions, is altogether of a subsidiary character when compared with the repair-work. This view of the matter is strengthened by the Board's statement that the plant and appliances are suitable for the carrying-on of repair-work, but that considerable additions are required before they can be classed as efficient for manufacturing purposes. The system is condemned as faulty because of the association of repair-work with new work, the method of dealing with and carrying on the manufacture of new work, the system of cost-keeping, and the tool system.

Dealing first with the question of the association of repair with new work, I would point out that, having regard to the conditions that prevailed at the time the Railway workshops were established, and the fact that new work was originally only undertaken with a view to keeping the operatives engaged to carry on repair-work fully employed during those periods of the year when repair-work was slack, it would be impracticable to separate the repair from the new work. I fully appreciate the desirability of separating repair from new work, and, where the circumstances are such as to justify the expenditure, to have separate shops for each class of work. This is the method upon which all modern manufacturing and repair businesses are conducted. Each class of work is specialised, and by keeping the operatives employed thereon constantly at a particular work, the output is increased. So far, however, as the requirements of the New Zealand Railways are concerned, I am strongly of opinion that neither the existing nor the prospective business is sufficient to warrant my recommending the Government to set aside the large amount of capital that would be involved to provide for the establishment of a fully equipped up-to-date manufacturing shop, with its separate staff, and the annual recurring liability for finding the money necessary to keep the shop fully employed and pay the wages of the operatives. The minimum amount required for this, on the basis of existing expenditure out of capital on new stock, would be £250,000 per annum. I have already pointed out that the method of dealing with and carrying on the manufacture of the work is governed by the existing conditions, and, as far as can be seen, very little improvement can be made in the method without incurring a very heavy expenditure to provide for the complete reorganization of the shops and their equipment.

The system of cost-keeping is one that insures accurate results, and enables the necessary data to be furnished promptly and regularly, and is, moreover, eminently suitable for the existing conditions.

Improvements in connection with the tool system has been engaging my attention, but have had to be deferred on account of the expenditure involved.

I quite agree with the Board's opinion in regard to the existing system of classification, and I have for some time past been very strongly of opinion that the feeling that is permeating the members of the Railway staff, that because a man is No. 1 on the list he should slip quietly and unobtrusively into the higher grade irrespective of his qualifications or fitness for the position, and to the detriment of the better-qualified man who may be lower on the list, is not calculated to make for higher efficiency or to advance the interests of the service; and I consider the time has arrived when it should be definitely laid down that promotion from the low to the higher grades of the service will depend entirely on the general efficiency and good conduct of the members, and not on the numerical position of the member on the Classification list.

With regard to the statement that undesirable security of tenure of office is given to inefficient units, I need only point out that any member who is reported as being inefficient is promptly dealt with, and if his conduct merits it his services are dispensed with.

With regard to the statement that the cost of production and output at Addington is, generally speaking, greater than at private and other Government workshops, I have already fully reported on this aspect of the matter in dealing with the cost of locomotives. It is not, therefore, necessary to reiterate what I have previously stated on this head; but there is, of course, no doubt that as a larger proportion of the new work is done at Addington than at any other shop, and the work is admittedly carried out under conditions that are detrimental to the economical manufacture of new stock, the results of working at Addington must be less satisfactory than at any shops where better conditions prevail. I do not concur with the Board's conclusions, based on the prices quoted by Messrs. Price Bros., of the Thames, for the manufacture of "A" compound

locomotives, that the manufacture of locomotives can be undertaken in the Dominion at a cost of 5½ per cent. in excess of that of the imported engine. It has been stated with authority that Messrs. Price Bros. will lose considerably on the "A" compounds, and I am personally convinced that at the present moment it would be quite impossible to place an order for similar locomotives, either in New Zealand, the United Kingdom, or America for the same amount per engine as is being paid to Price Bros. I have already pointed out that for the ten "WF" locomotives the contract price was £86 19s. 8d. per ton. Immediately after building those machines Messrs. Price Bros. built two similar locomotives for the Public Works Department, the price for which (exclusive of the Westinghouse brake) was £3,000 per engine, giving an average rate of £88 5s. per ton. Regarding the cost of manufacturing locomotives at Addington, I again repeat, notwithstanding the opinion of the Board to the contrary, that the price is not £100 per ton, and I do not consider that the Board's estimate as to the amount of commission that should be charged is a proper one. It is far in excess of that charged by any other railway system, and is, moreover, calculated on the total cost of labour and material, in contradistinction to the practice adopted elsewhere of computing the commission on wages-charge only. The commission, which represents shops' charges, is a fluctuating amount, and varies according to the industry carried out and the class of establishment. I am aware that it is the practice in some establishments to add a percentage on both material and wages, but the majority of firms, in estimating the cost of producing an article, add a percentage to the amount expended on labour only. The proper percentage for shop charges on labour can only be determined by practical experience. In the New South Wales workshops, for instance, although I have shown that the percentage added on the cost of labour is 32½ per cent., the fluctuation is from 25 to 32½ per cent. In Queensland it is from 12½ to 17½ per cent. It is, however, admitted by the New South Wales Railway authorities that their workshops' charges are fixed on a high scale. Our practical experience is that the present rate of commission is sufficient to cover the legitimate charges, and, if based on the actual cost of the wages, and irrespective of the material, it represents approximately a charge of 24 per cent.

The Department's experience in connection with the manufacture of locomotives is that it is better to make a thoroughly good engine in the first instance than to turn out an inferior article, for the reason that the better the class of workmanship and material used in the manufacture of the locomotive the less the subsequent cost of repairs.

With regard to the Board's suggestion as to the course that should be followed in the event of the Department itself deciding to continue the manufacture of locomotives, I desire to say that, in my opinion, the requirements of the Department in the matter of new locomotives are not of such volume as to justify me in urging the Government to set aside the money necessary to establish and equip a manufacturing-shop. It is not, nor has it been, contended that the whole of the appliances installed in the Addington Workshops are of the most recent pattern and up to date in every respect; but many of the machines, although of the older type, are still capable of doing good and efficient work and of meeting all the requirements of the Department; and in the circumstances I do not consider I should be justified in recommending a large expenditure in money in buying machines to replace them. The latter course would likewise commit the Department to a very considerable expenditure for shop-extension, and I am strongly of opinion that the policy that has been adopted of making the best of the appliances that are available under the existing circumstances, and devoting money that must be otherwise spent in the provision of machinery and extension of workshops to provide rolling-stock for meeting the more urgent requirements of the Department, and enabling the business of the Dominion to be carried on efficiently and to the interests of the public is the wisest and best one.

If it is desired to establish a manufacturing workshop, and the Government is prepared to find the large sum of money to meet the capital expenditure that would be involved annually in keeping the establishment going, the requirements of the Board could be met by converting the Hillside Workshops into a manufacturing workshop, equipping that shop with suitable appliances, and making the Addington and Invercargill Workshops repair establishments. Having due regard to the prospective requirements of the Department, I am, however, strongly of opinion that the establishment of a manufacturing-shop would, at the present time, be unwarranted and unjustifiable, and that the requirements of the Railways in the matter of locomotives can be amply provided for by letting additional contracts to private firms within the Dominion and carrying out such new work at Hillside, Addington, and Petone as is required to keep the men, who must necessarily be employed for repairs, fully engaged. While I hold these views, I at the same time fully appreciate the desirability of improving the equipment of the various workshops from time to time as circumstances warrant and funds are available, and it has been my practice during the last fifteen years to keep myself in touch with the most up-to-date appliances and methods, and, by judicious expenditure of the funds placed at my disposal by the Government for the purpose, to make such additions and improvements to the workshops machinery from time to time as the circumstances permitted.

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General Manager.

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