1886.

NEW ZEALAND.

GOLDFIELDS, ROADS, WATER-RACES, AND OTHER WORKS IN CONNECTION WITH MINING

(REPORT ON).

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

Mr. H. A. Gordon, F.G.S., Inspecting Engineer, to the Hon. W. J. M. Larnach, C.M.G., Minister of Mines.

Sir,— Mines Department, Wellington, 4th May, 1886.

I have the honour to submit my annual report on works undertaken and executed under the control of the Mines Department, and also on the condition of mining generally on the various fields I have visited during the year ending the 31st March, 1886.

The works are classified under the heads of "Subsidized Roads and Tracks," "Drainage and Sludge-channels," "Aids to Prospecting," "Water-races," "Roads constructed wholly by the Department," and on mining generally.

SUBSIDIZED ROADS AND TRACKS.

Coromandel County, Auckland.

Widening Road from Emily Battery to Rocky Point.—This road was estimated to cost £291 when first undertaken; but the prospects of this part of the district did not warrant the county completing the work at present—other works were deemed more urgent; so that they got permission to transfer the balance of the subsidy to complete the road from Vaughan's claim to Matawai Battery, and road from Makarau towards Wairau. The cost of this work was £60, of which £40 have been paid.

Road up Manaia Valley.—This is a dray-road, and is estimated to cost about £1,500 when completed. Up to the present time there have been £375 expended, and the work is still in progress; but as the work has been so far executed more cheaply than originally contemplated, the whole of the subsidy authorized is not likely to be required. This road will open up a large tract of country, and it is believed will be the means of opening up a good goldfield.

Road, Makarau towards Waiau.—This is a dray-road, and was originally estimated to cost £300, but it has been found necessary to extend it in order to give facilities to the miners. This road will also open up the country at the back of Manaia and Tiki to Mercury Bay. The whole of the £300 have been expended, and the county has had permission to transfer portions of subsidies authorized for other roads in the district, which at the present time are of less importance, in order to complete it. The work is in progress, and will cost when finished about £600.

Road from Old Saw-mill towards Awakane.—This is the continuation of a dray-road that was constructed several years ago through Lynch's Paddock, and when finished will open up the back country where gold has been found. The work is now in progress, and will cost when completed about £600.

Thames County, Auckland.

Prospecting-track to open up Karangahake Goldfield.—This track has been in course of construction for nearly two years. When completed it will give access to the whole of the country between the Ohinemuri River and Te Aroha, which bears favourable indications of good auriferous and argentiferous reefs being found. This is a district that has lately been proved to contain rich silver lodes, which are likely to lead to a branch of mining that has heretofore been neglected in the colony owing to the mining community not being acquainted with the various descriptions of ores in which silver is found. The cost of this work up to the present time has been £784, and it will take about £597 to complete.

Track up Maungawheriwheri Creek.—This is a prospecting-track from the crushing-battery up Maungawheriwheri Creek, to enable the miners to get access into the back country. The work is in progress, and will cost when completed about £100.

Widening Road from Bridge over Hape Creek to Otanui Mines.—This work has been undertaken to enable a better means of communication to be made between the Thames and the Otanui mines. This road will be much shorter than by the Kaueranga Valley, and will be the

means of the miners in the Otanui district getting their supplies at a cheaper rate. Up to the present time £96 have been expended, and it will cost about £500 when completed.

Road from Thames Borough Boundary to Hematite Mine.—This is a dray-road from the Thames Borough boundary to the hematite deposit, which is intended to be utilized as flux for smelting silver ore in the furnace recently erected at the Thames. The cost of the work has been £400; of this amount, £233 6s. 8d. were contributed by the Government.

Road from Karangahake to Battery.—This is a dray-road to connect the mines with the crushing-battery at Waitewheta Creek. The total cost of the work was £300; of this amount £200 have been paid as subsidy.

Otanui Road to Mines.—A dray-road was constructed about two years ago from the crushing-battery at Maungawheriwheri Creek towards the Otanui mines. Further extension was required to connect the mines, and this has now been completed at a cost of £299 18s.; of this amount, £199 18s. 8d. have been paid as subsidy.

Roads to Ralph and Wick's Battery, Waitekauri.—These are shown as separate works in the list of subsidized roads and tracks, but they really mean the same road. This battery was formerly on the Owheroa side of the range, and now is removed to the Welcome Claim. The road that has been constructed is to enable the quartz to be taken to the battery, and also for conveying machinery. The total cost of the work was £469 1s.; of this amount a subsidy of £246 3s. 10d. have been paid.

Rocky Point to Tararu.—This is a dray-road within the Thames Borough boundary leading to Tararu. The former road was washed away in places by the action of the waves, and had to be re-formed and protected with a stone apron on the sea side. This has been completed at a cost of about £300; of this amount £200 was paid as subsidy.

Metalling Road, Kaueranga Valley to Otanui Creek.—The object of metalling this road was to enable crushing-machinery to be brought on the ground at Otanui. A considerable portion of the work has been done, and when completed it is estimated to cost £650; of this amount £443 6s. 8d. was authorized as a subsidy, of which £267 13s. have been paid.

Road, Tapu Battery to Mines.—Fresh discoveries of auriferous-quartz lodes have lately been discovered at Tapu, and a road is in course of construction to connect them with the crushing-battery. The cost of the work, when completed, is estimated at £160; of this amount £106 13s. 4d. was authorized as subsidy, of which £44 have been paid.

Ohinemuri County, Auckland.

Track up Tui Creek.—This is a locality where a galena lode rich in silver has been found. It lies between Karangahake and Te Aroha, which is a very broken and rugged country, and difficult of access without tracks. The estimated cost of the work is £300, of which £200 have been authorized as subsidy. The track is in course of construction, and subsidy up to the amount of £103 paid.

Prospecting-track, Whangamata.—This is a track to open up the country in the vicinity of Parakawai, where auriferous-quartz reefs have recently been discovered, but which cannot be worked until a track is made, as the whole of the country is broken and densely timbered. This work is estimated to cost £200, of which £166 13s. 4d. was authorized as subsidy.

Tauranga Road to Karangahake Bridge Site.—A horse-bridge has been constructed across the Ohinemuri River, near the junction of the Waitewhata Creek, to give access to the Karangahake Goldfield. A road forming an approach to this bridge from the Tauranga Road is now in course of construction. The work is estimated to cost £380; of this amount £243 6s. 8d. have been promised as subsidy.

Piako County, Auckland.

Road from Wairongomai to Ferguson's Battery.—Formerly this was a horse-track up the side of the Wairongomai Creek; but, in order to enable Mr. Ferguson to get his crushing-plant on the ground, it was found necessary to widen it into a dray-road, which cost £500; of this amount £333 6s. 8d. was paid as subsidy.

Tramway to Ferguson's Battery.—This tramway branches off the county tramway, which was constructed over two years ago from the mining claims to Messrs. Firth and Clarke's battery at Wairongomai Township. Mr. Ferguson has now constructed a battery on a comparatively new principle higher up Wairongomai Creek, in close proximity to the quartz-workings; and this tramway is now almost completed so as to give the various companies holding mining claims an opportunity of sending their quartz to either battery. Mr. Ferguson claims that his battery will save considerably more gold than the one at Wairongomai Township, and thereby enable quartz lodes to be worked that are at present unremunerative. When this tramway was first undertaken it was estimated by Mr. Ferguson to cost £1,500; of this amount a subsidy of £1,000 was authorized; but the work has cost a great deal more than was first anticipated; and, although considerably more than £1,500 have been expended, the tramway is not yet completed. The subsidy, however, of £1,000 have been paid.

Track to Claims on Buck's Reef.—This is a horse-track to a large quartz lode, which can be traced along the Te Aroha Range for nearly three miles, and gold of a payable character has been found in portions of it. The whole of the country here is very rough and precipitous, and also densely timbered; so that unless there are tracks constructed no really legitimate

work can be carried on. A track to open up the claims already taken up on this reef is estimated to cost £150; of this amount £100 have been authorized as subsidy.

Track from Fern Spur to Butler's Spur.—This is a horse-track along the face of the range The present track is so steep and in such a wretched condition that many portions of it are almost impassable. It is proposed to improve this track, and do away with the steep grades, at an estimated cost of £300; of this amount £200 has been authorized as subsidy.

HUTT COUNTY, WELLINGTON.

Track, Makara Valley to Terawhiti.—This is a horse-track from the road leading down Makara Valley, at Printer's Flat, to the Maori gardens at Terawhiti, a distance of about nine miles. A good passable track has been constructed, which now brings the Terawhiti mines within three hours' ride from Wellington. The estimated cost of the work was £300; of this amount £200 were authorized as subsidy, of which £106 13s. 4d. have been paid.

COLLINGWOOD ROAD BOARD, NELSON.

Bridge and Approaches over the Aorere River.—This is for a foot-bridge over the Aorere River at Salisbury's Crossing, which, together with approaches, is estimated to cost £220; of this amount £146 13s. 4d. have been authorized as subsidy.

MARLBOROUGH COUNTY, MARLBOROUGH.

Road, Deep Creek to Dead Horse Creek.—This is really widening the old horse-track into a dray-road from Deep Creek to the Caledonian Claim, to enable machinery to be brought on the ground. The cost of the work was estimated at £68; of this amount £45 6s. 8d. was authorized as subsidy.

BULLER COUNTY, NELSON.

Track, Northern Terraces to Oparara.—This is a horse-track to connect the Karamea settlement with Oparara diggings. Many of the settlers at certain seasons of the year, when they have not sufficient work on their farms, work on these diggings, some of whom make fair wages. The estimated cost of the track is £500; of this amount £333 6s. 8d. was authorized as subsidy, of which £250 have been paid. The road is still in course of construction.

Track, Lyell Creek Bluff to Victor Emmanuel Claim.—This is a track to enable supplies to be brought up to the miners who are working on the Victor Emmanuel line of reef, which is situated about four miles and a half up New Creek from its junction with the Buller River. The estimated cost of the work is £650; of this amount £433 6s. 8d. was authorized as subsidy, of which £200 have been paid.

Road to connect Alluvial Diggings with Charleston Road.—This is a dray-road from Westport–Charleston Road to Nine-Mile Beach, to enable the miners who are working there to get sawn timber and supplies brought to their claims. The cost of the work was £400; of this amount £266 13s. 4d. have been paid as subsidy.

Track, Four-Mile Creek towards Grey Valley.—This is a continuation of the horse-track up the Four-Mile Creek. This track has been extended for about a mile and a half, and is now up to the gorge in the Four-Mile Creek. The cost of the work has been £300; of this amount £200 have been paid as subsidy.

Road to connect Alluvial Diggings north of Deadman's Creek.—This is a road that had to be constructed, as the sea had made encroachment on the beach, and washed away the only road there was. The road is some distance back from the beach, and has cost to construct £278; of this amount £185 6s. 8d. have been paid as subsidy.

Road to Cape Foulwind.—This is a road through the Pahihi, between Westport and Addison's Flat, towards Cape Foulwind, in order to give facilities to the miners who are working on the several leads between the Westport–Charleston Road and the ocean beach. It is estimated to cost £450; of this amount £300 were authorized as subsidy, of which £200 have been paid.

Extension of Denniston Road.—This is a horse-track from the Township of Denniston to the Mount William Diggings. Gold has recently been found in this locality, and there is no means of communication. The estimated distance is six miles, and total cost £929; of this amount £300 have been authorized as subsidy.

Road, Ngakawhau to Mokihinui viâ Beaches.—This is a dray-road from the end of the railway to the Ngakawhau River, going towards Mokihinui. The cost of this work was £100; of this amount £66 13s. 4d. have been paid as subsidy.

Road to connect Ngakawhau Railway with Mokihinui Coal Company's Workings.—This is a dray-road from the ocean beach at the Mokihinui Township to the Mokihinui Coal Company's wharf up the Mokihinui River, and some clearing along the bluff near the Ngakawhau River, so as to allow a continuous line of dray-traffic from the Ngakawhau Railway-station. The total cost of the work was £443 10s.; of this amount £128 13s. 4d. was paid as subsidy by the Mines Department and £250 by the Crown Lands Department.

INANGAHUA COUNTY, NELSON.

Track, Reefton to Big River.—This is the continuation of the track from Reefton to Merrijigs. It is now almost completed to the Big River, where a number of quartz leases are taken up, and some of which are being worked. The distance of this road from Reefton is sixteen miles. It is

constructed 5ft. wide with easy grades, and trollies are now used upon it for conveying machinery from Reefton to the quartz mines in the Big River District. The estimated cost of the portion lately under construction was £1,792; of this amount £1,194 13s. 4d. was authorized as subsidy, of which £1,084 6s. 8d. have been paid.

Road, Owen Reefs to Uno Battery.—A subsidy of £200 was authorized to the county, on the principle of £2 for £1, to construct a road from the Westport–Nelson Road to the Owen Reefs, where recently auriferous quartz lodes of a payable character have been discovered; but, the county declining to proceed with the work, a survey of the road has been authorized, and plans will shortly be submitted, with estimate of the cost of construction.

Grey County, Westland and Nelson.

Track from Waipuna to Clarke's River.—This is a horse-track, metalled 3ft. wide, following up the Grey Valley from Mackay's station to the Clarke River, a distance of 5 miles 75 chains. By a continuation of this track at a future time it will open up the whole valley of the Grey River to the saddle of the Maruia. The cost of the work has been £1,200; of this amount £800 have been paid as subsidy.

Track, Cameron's to Cape Terrace.—This is a horse-track, metalled 3ft. wide, from the Cameron's track to Cape Terrace, a distance of 3 miles 58 chains, and now affords a direct line of communication between Cameron's and the Greenstone Road. The cost of this work was £700; of this amount £466 13s. 4d. have been paid as subsidy.

Track, Red Jack's to Nelson Creek.—This work is in course of construction, two miles of it being completed. It commences at Blackwater, and terminates at the Kangaroo Road, a short distance from Hatters' Terrace. The total distance is 5 miles 8 chains. The estimated cost of the work is £750; of this amount £500 was authorized as subsidy, of which £150 have been paid.

Road, Barrytown to Deadman's.—This is a road to give access to the terraces where miners are at work running parallel with the ocean beach, from about a mile to a mile and a half inland. The total distance of road to construct to Deadman's, which is the boundary between the Grey and Buller Counties, is seven miles. Of this distance, four miles have been completed. The total cost of work is estimated to be £2,240; of this amount £1,493 6s. 8d. was authorized as subsidy, of which £912 have been paid.

Track, Irishman's to Lake Brunner.—This is the continuation of the track from Marsden to Irishman's, to open up the country between Irishman's and Lake Brunner. Five miles of track are in course of construction, which is estimated to cost £900; of this amount £600 was authorized as subsidy, of which £150 have been paid.

Track, Limestone to Maori Creek.—This is the continuation of a track that was constructed several years ago by the county from the Greymouth–Marsden Road to the Limestone diggings. It is now proposed to continue this track on to Maori Creek, a distance of upwards of four miles. The estimated cost of work is £800; of this amount £533 6s. 8d. have been authorized as subsidy.

Westland County, Westland.

Track, Ross Borough Boundary to Mount Greenland.—This is a horse-track from the Ross Borough Boundary to the Cedar Creek Reefs, on the south-east side of Mount Greenland, a distance of about eight miles. This track is well laid out and constructed, costing when completed £1,280 15s., of which £853 16s. 8d. was paid as subsidy.

Track, Kanieri Lake to Humphrey's Gully.—A dray-road has recently been made by the county between Kanieri and the lake. A horse-track has also been constructed from the lake to the upper works of the Humphrey's Gully Gold-mining Company, at a cost of £279 2s., of which £186 1s. 4d. was paid as subsidy.

Track, Larrikins' to Loopline Dam.—This is a horse-track from Larrikins', up the Kapitea Valley, to the Loopline Road, near the Kapitea Dam No. 2. This road was urgently required in connection with the water supply, and will be of service in enabling miners to prospect this portion of the country. The total cost of works was £499 11s., of which £299 14s. was paid as subsidy.

Track, Okarito Forks to Teal Creek.—This is a proposed track from Okarito Forks to Teal Creek, to give the miners an opportunity of prospecting the various terraces which are believed to contain gold of a payable character. A survey has been made, and plans are in course of preparation. The estimated cost of the work is £600; of this amount £400 has been authorized as subsidy.

Lake County, Otago.

Road to Invincible Mine, Rees River.—This is a dray-road from the end of the road constructed by the Lands Department up the Rees Valley, to give access to the quartz workings up the Rees River. The total cost of the work is estimated to be £450; of this amount £200 was authorized as subsidy by the Mines Department, and £100 by the Lands Department.

Connection of Road, Arrowtown to Macetown.—This is for an approach from the Arrow River into Arrowtown. The road from Macetown comes down the bed of the Arrow River for about a mile above Arrowtown; after coming out of the gorge it crosses a wide shingle-bed of a creek, and rises very abruptly into the town. It is proposed to make a new approach, which is estimated to cost £225; of this amount £150 has been authorized as subsidy.

Track, Mount Criffel Diggings.—This is for improvements made in the original track, which

now enables provisions to be brought to Mount Criffel by pack-horses. These improvements have been so far completed to enable the track to be utilized. The cost of the work has been £150; of the amount £100 was authorized as subsidy, of which £33 11s. have been paid.

SOUTHLAND COUNTY, OTAGO.

Roads, Waikaia Bush, and Waikaia to Whitcombe.—These are one road, although the subsidy was applied for at different times. The road commences about seven miles up the valley from the Waikaia Township, and terminates near Piano Flat, at the north boundary of the Waikaia District. The cost of the work is estimated at £300; of this amount £200 was authorized as subsidy, of which £166 13s. 4d. have been paid.

Road, Waikaia to Switzers, and Waikaka to Township.—This is one road, and is now in course of construction, and will when completed give access to Round Hill, where mining is now being carried on. The cost of the work is estimated at £300; of this amount subsidy have been authorized up to the extent of £200.

TUAPEKA COUNTY, OTAGO.

Track from Roxburgh Road to Campbell's and Pomahaka Creeks.—This is to make a passable horse-track from the Roxburgh Road over the Old Man Range, to get provisions and supplies taken to the miners at work in Campbell's, Potter's, and the upper portion of the Waikaia River. The estimated cost of the work is £450; of this amount £300 were authorized as subsidy, of which £12 15s. have been paid.

Improving road from Waitahuna River.—This is for improving and forming the present road from the Waitahuna River towards Waipora, *via* Copper Mine. The estimated cost is £200; of this amount a subsidy of £133 6s. 8d. have been authorized.

Road to Quarry and Approaches to Waitahuna Bridge.—This is a road for the purpose of opening out a quarry to procure stones to build piers for the new bridge across the Waitahuna River that is in course of construction, and also in making approaches to the bridge. The cost of the work is estimated at £200; of this amount £133 6s. 8d. have been authorized as subsidy.

MANIOTOTO COUNTY, OTAGO.

Road, Shepherd's Hut to Vinegar Hill.—This is a road to give a better means of communication with Vinegar Hill, where a number of claims are at work carrying on hydraulic sluicing operations on an extensive scale. The estimated cost of the work is £100; of this amount £66 13s. 4d. have been authorized as subsidy.

WALLACE COUNTY, OTAGO.

Road, Round Hill to Colac Bay and Orepuki.—This is really a road which is urgently required. There are a number of miners employed at Round Hill, and the present track is almost impassable for horses. It is corduroyed for almost the whole of the distance, which is about four miles, and in places the grades are very steep. A new line of road has been laid off, and a portion of it is in course of construction. The estimated cost of this work is £525; of this amount £350 have been authorized as subsidy.

FIORD COUNTY—OTAGO.

Track, Dusky Sound.—A subsidy of £200, on the principle of £2 to £1, has been authorized to construct a track to open up the country in this locality, in order to enable the miners to have an opportunity of prospecting the country. Prospectors have been in this locality for several years, who state they have discovered copper and graphite, the latter of which is of excellent quality; but it is questionable if they have yet succeeded in finding any lodes of a payable character. This is a portion of the country which is very little known; and, unless tracks are made to open it out to enable men to get provisions, it may lie for many years before systematic prospecting is carried on, except some one is fortunate enough to accidentally strike a rich metalliferous lode.

Several other small tracks have been undertaken by the counties, which have been subsidized; the whole of these appear in the tables appended hereto.

SUBSIDIZED ROADS TO OPEN UP MINES OTHER THAN GOLD.

Road, Kanieri Coal-field, Westland.—A road is in course of construction in order to give facilities for the development of the coal-seams that are known to exist in the Kanieri district. It is estimated that an expenditure of £600 will be required for this purpose; of this amount £300 was authorized as subsidy, of which £53 5s. 4d. have been paid.

Track, Ohinemuri Coal-seam, Thames.—A coal-seam has been discovered about half a mile up a creek on the Paeroa side of the range from track leading from Waitekauri to Paeroa. This road is to assist the development of this coal-seam, and to enable the coal to be brought to market. The estimated cost is £300; of this amount £150 was authorized as subsidy, of which £60 have been paid.

Track, Richmond Hill to Copper Mine, Nelson.—This is a horse-track over Richmond Hill to the copper-mine at Copper Creek, which is a tributary of the Roding River, in the Nelson District. The estimated cost of the work is £469 13s.; of this amount £313 12s. was granted as a subsidy, of which £209 4s. has been paid.

SUBSIDIZED DRAINAGE-CHANNELS AND SLUDGE-CHANNELS.

Kumara Sludge-channel No. 2, Westland.—This is a channel constructed by the miners, with a subsidy of £2,500 from the Mines Department, to relieve the No. 1 Channel, that was wholly constructed by Government. A great deal of dissatisfaction some time ago existed among the miners who had claims opened out into this channel, inasmuch as its carrying-capacity was not sufficient to accommodate all parties. Permits were originally issued by the manager to thirty parties to use this channel; and, after the whole of them were in full work, it was found that not more than twenty-one of these could be accommodated; and in order to provide for the remainder it was decided to only allow each party three-hour shifts. This method of working is not an advantageous one, and is the means of a good payable claim becoming one of little value; hence the necessity for a second channel. The tailings-site available for No. 1 Channel is likewise getting fast filled up, which was also an inducement for the miners to construct another. About eleven parties that are now using the Government channel will, as soon as a connection is made and flushing-water conducted into the channel, use the one which is now nearly completed. Arrangements are now made for the completion of the whole of the works on a satisfactory basis, both to the miners and to the Government. From the warm feeling and kind expressions of the miners towards the Hon. the Minister of Mines on his recent visit to this district, I think that all dissatisfaction is at an end regarding the working of the race and sludge-channel.

Muddy Creek Sludge-channel, St. Bathan's, Otago.—This channel is one of the most gigantic works of the kind undertaken by private enterprise in the colony. It was commenced about twelve years ago; but the first company that undertook it failed. It was then purchased by the present proprietors, who have been steadily at work for the last four years and a half. It has cost up to the present time about £12,000, and it will yet take a considerable amount to construct it to the ground intended to be worked. It has had to be constructed through from 30ft. to 50ft. of tailings deposited in the bottom of the creek from the early workings; and great difficulties have been encountered in constructing it through a description of pug, which slides bodily from the side of the gully into the cutting, and has had from time to time to be sluiced away. When completed it will be about four miles in length. It is 12ft. wide in the bottom, which is paved with stones, and the sides are lined in places with stones and scrub. A subsidy of £1,000 was authorized for the completion of this work on the principle of £1 for £1, and £700 5s. 11d. have been paid.

St. Bathan's Sludge-channel, St. Bathan's, Otago.—This is a large tail-race or sludge-channel which has been undertaken by the miners to work the deep old quartz wash-lead below St. Bathan's Township. It will be about a mile and a quarter long when completed. At the present time there are 40 chains of the lower end completed, and 23 additional chains almost finished. This tail-race was commenced in 1882, and it has been in progress ever since. It is 10ft. wide in the bottom, paved with stones where the ground is not solid, and lined with stones and scrub on the sides; having a grade or fall of 1 in 100 up to a point where a large body of flushing-water has been brought in from Dunstan Creek, and from this point to the head it is constructed with a grade of 1 in 60. The principle upon which this tail-race is constructed shows the unity that exists among the miners. A company was formed from among those who had claims that would be enhanced in value by the construction of this work, and each person had a number of shares allotted to him in proportion to the benefit to be derived, or ground held that this tail-race would be the means of working. There are four men steadily engaged cutting this tail-race with water, by merely loosening the drift wash, throwing out the large stones, and sluicing away the fine material down the race. From the progress made it will yet take several years before the channel is completed. There has been £2,700 already expended on the work, out of which a subsidy of £217 3s. 9d. have been paid, and a further subsidy of £782 16s. 3d. authorized for the work.

Lawrence Drainage-channel, Otago.—This is an extension of the channel constructed about three years ago, and also a connection with the lower end of Gabriel's Gully, to prevent the tailings that are accumulating there from getting into the channel and silting it up. The estimated cost of this work is £750, of which £150 have been paid.

Ross Sludge- or Stormwater-channel, Westland.—This work is a reconstruction of the present channel, which is found to have insufficient carrying-capacity in time of heavy floods; and works are also required to prevent the tailings from accumulating on private land alongside the railway reserve. The urgency of these works was clearly demonstrated recently, during the heavy floods that occurred in March last, when about five chains of the upper portion of the channel was completely washed away, and the ground cut down for 30ft. below its level, filling the whole of the workings on Ross flat with water and *débris*. Before this took place, portions of the channel were torn up by the current, and in several places the water flowed over to such an extent that the houses on the side of Aylmer Street next the channel were flooded. This damage was caused to a great extent by the manner in which the channel is constructed. By having ties across the channel, the logs and roots got held fast and backed the water. The channel has been temporarily repaired so as to enable working on the flat to be resumed, at a cost of about £500, out of which a subsidy of £200 was paid; but these temporary repairs will be of no service in the event of another large flood taking place. The whole channel requires to be reconstructed, and the timber frames, if used, should be tied back into the bank, and not across the top as at present. The other portion of the work consists of temporary protective works to prevent the tailings and sludge from destroying private property. The total cost of these works is estimated at £1,500, which amount has been authorized.

Pipeclay Sludge-channel, Bannockburn, Otago.—This channel was first undertaken about seven years ago; but the first company that undertook its construction failed on account of the numerous difficulties to contend against. The present company has been steadily progressing with its construction for the last three years and a half; and, judging from the progress made during last year, it will yet take a considerable time before it is completed. It is about a mile and a half in length, 6ft. wide in the bottom, which is paved with stones, and about 3ft. high on the sides, which are also lined with stones. It is constructed with a grade of 1 in 18, and when completed will be the means of a large area of deep ground being worked. Some dissatisfaction among the miners interested in its construction was expressed when the present company altered the grade to 1 in 21; but this obstacle has been remedied by the company, and the grade made uniform. It may appear at first sight that the time engaged in the construction of this work has been unnecessarily long; but it should be borne in mind that before the tail-race could be made, tailings to a depth of 30ft. and 40ft. had to be sluiced away, as well as the tailings that are coming into the gully from the high terraces that are being worked; also, the nature of the sedimentary rock that had to be cut through in places to get a uniform grade was of such a character that it swelled, causing large slips to take place, and even lifted up the bottom of channel in one place, which had to be several times cut down after the paving had been laid. A subsidy of £698 19s. was authorized for the completion of the work, out of which £402 14s. 4d. have been paid.

Drainage-channel, Ophir, Otago.—This is the continuation of a drainage-channel that was constructed from the Manuherikia River several years ago, to drain the ground then being worked. This channel has been extended for a distance of over a mile further up the flat, and further extension is in course of construction in order to enable the ground to be prospected and worked. The whole of the ground in this locality is excessively wet, and cannot be worked unless by very expensive machinery, or tail-race; the latter is by far the best method of drainage. At the time of my visit in December last several claims were taken up, and were being worked in this flat; but with what success I was unable to ascertain. The principle on which this tail-race is constructed is defective in design, inasmuch that, after making an open ditch, a small culvert, built of rubble-stones, has been constructed in the bottom of it, and afterwards covered over. There are no man-holes left to get into this culvert; neither is the culvert sufficiently large to admit of any person getting in to repair it in the event of it breaking down or silting up. This work is estimated to cost when completed £1,500; of this amount £1,000 was authorized as subsidy, of which £610 13s. 6d. have been paid.

Long Gully Sludge-channel and Maerewhenua Water-supply, Otago.—A channel requires to be constructed to prevent the accumulation of sludge from the mining claims being deposited on Mr. McMaster's land. A subsidy of £100 has been authorized for this work on the principle of £2 for £1, and £1,500 towards a water-supply and tail-race for the district.

AIDS TO PROSPECTING.

Deep-level Tunnel, Reefton, Nelson.—This tunnel is now constructed for 2,100ft. The country through which this tunnel is constructed has now more the appearance of rock where auriferous-quartz lodes may be found. Up to the present this tunnel has been constructed on subsidy principle of £1 for £1; and £2,397 have been paid. There is still a balance of subsidy authorized of £1,081 to continue this work. It is considered that this subsidy will be sufficient to construct the tunnel sufficiently far enough to cut some of the present lines of reef that have been worked near the surface.

Deep-level Tunnel, Boatman's, Nelson.—This tunnel was first undertaken at the expense of six different companies holding ground in the locality, to prove the existence of deep levels or otherwise. Four of these companies have ceased to contribute towards the cost; so that latterly the cost of construction has been borne by the Homeward Bound and Specimen Hill Companies. The tunnel is now sufficiently advanced to cut the line of Welcome Reef, which appears from recent surveys to be going through the Homeward Bound Company's ground; but, taking the strike into account, it must be between 300ft. and 400ft. below the level of this tunnel. The length of tunnel completed is 2,120ft., and the cost of the work up to the present time is about £2,700; of this amount £300 was authorized as subsidy, of which £150 have been paid.

Manuka Flat, Lyell, Nelson.—This is a tunnel to prospect a large area of table-land near the Lyell which is believed to contain rich alluvial leads of gold. It is estimated that a tunnel will require to be driven for a considerable distance before the wash-drift is reached. A subsidy of £500 was authorized towards this work on the principle of £1 for every £1 10s. spent by the company.

Tokatea Gold-mining Company, Coromandel, Auckland.—This company, after working out their upper levels, constructed another adit-level with the anticipation of cutting the reef, as had been done in the upper levels. After constructing the lower adit for 2,888ft. the lode was not met with, and prospecting then had to be carried on to see if the reef had been totally cut out, or thrown on one side. A subsidy of £350 was authorized for this work on the principle of £1 for £1, and £42 6s. 6d. have been paid.

Tuapeka Prospecting Association, Otago.—This association, after prospecting in various parts of the district, sunk a shaft on Weatherstone's Flat for the purpose of prospecting for the deep lead of cement that was worked by the Weatherstone Company; but they have not been

successful in finding it. Subsidies have from time to time been authorized to the extent of £450 on the principle of £1 for £1, and £438 10s. have been paid.

Owharoa Deep-level Tunnel, Ohinemuri, Auckland.—This is a field where rich auriferous quartz has been worked, but the present workings only contain quartz of a low grade. It has been deemed desirable to put in a deep-level tunnel to prospect the deep levels, and £200 have been authorized as subsidy on the £1 for £1 principle for this purpose.

Cromwell Prospecting Association, Otago.—This association is prospecting the country in the Cromwell District; for which a subsidy of £250 was authorized on the £1 for £1 principle, of which £93 9s. have been paid.

Oterongia Prospecting Association, Auckland.—This association is formed of Europeans and Natives to prospect the land known as the King Country. A subsidy of £500 is authorized for this purpose on the £1 for £1 principle, and £25 6s. 8d. have been paid.

Red Hill Gold-mining Company, Collingwood, Nelson.—This company received a subsidy of £300 on the principle of £1 for £1 to drive a deep-level tunnel to prospect for auriferous quartz. The whole of the subsidy is paid, and the work is proceeding.

Waipori Deep Level Association, Otago.—This association has been prospecting the deep levels in Waipori Flat, a little above the township. The ground is very wet, requiring machinery to pump the water. One of Ashbury's patent steam-pumps was obtained to enable the association to proceed with the work. A subsidy of £300 was authorized on the principle of £2 for £1, and the whole of the subsidy paid.

Cardrona Prospecting Association, Otago.—This association is prospecting the Cardrona Valley for the lead that was lost some years ago. Gold has been traced and worked almost continuously for about nine miles down the Cardrona Valley; but as the gold got into the flat the ground became deeper and wet, which deterred the miners from following it. The association are prospecting some distance down the valley, at a point where it is narrow, and where the schist rocks can be seen on each side. Subsidies for this work have been authorized to the extent of £400 on the £1 for £1 principle, and £223 2s. 6d. have been paid.

Deep Levels, Naseby, Otago.—An association was formed at Naseby to prospect the deep ground up the Hogburn Creek, about forty chains above the township. A shaft was sunk to a depth of nearly 300ft. through the terrace or Maori bottom, where the old quartz drift-wash was got; but no gold was obtained of a payable character. A subsidy of £300 was given towards this work; and a further subsidy of £350 was authorized towards the continuation of prospecting from this shaft, but no steps have yet been taken to resume work.

Miscellaneous Aids to Prospecting.—Miscellaneous aids to prospecting have been authorized to the extent of £2,068 11s. 4d., of which amount £187 11s. 4d. have been paid.

ROADS UNDERTAKEN AND CONSTRUCTED WHOLLY BY GOVERNMENT FOR THE DEVELOPMENT OF THE MINES AND OPENING LANDS.

Track, Ahaura to Amuri, Nelson.—A continuation of a horse-track constructed about six years ago by the Lands Department. The portion lately completed is between Granite or Randall Creek and the Ahaura River, a distance of nearly seven miles. The track is constructed throughout this distance 6ft. formation and 4ft. metal, with good grades suitable for dray-traffic. The cost of construction of this portion of the road has been £2,504 19s. 7d. This road not only gives facilities to the miners who are working in the vicinity of Haupiri Lake, but likewise to settlers in the Haupiri district, where there is a large area of good agricultural land, but which will never be of much value until the whole road to Ahaura is widened into a dray-road in order to afford the settlers an opportunity of bringing their produce to market; which would cost about £5,000. This is also the main road between the Grey Valley and Canterbury, and has been used since the first of the goldfields on this part of the West Coast for travelling stock over from the East Coast.

Road, Brighton to Seventeen-mile Diggings, Nelson.—A survey has been made of this road, and seven miles of the end next the Seventeen-mile Diggings is in course of construction by the Grey County Council, with subsidy from the Government. Recently plans for the remaining portion have been handed over to the Buller County Council, who have undertaken the construction within their county.

Road, Cobden to Seventeen-mile Diggings, Nelson.—The road from Cobden to the Seven-mile Creek, going towards the Seventeen-mile Diggings. A horse-track was constructed from Coal Creek to the Seven-mile Creek about three years ago by the Lands Department; but it was found that no suitable gravel could be obtained on the line of road for metal, and that it would require to be brought from the ocean beach. This necessitated widening the track into a dray-road. The work is in course of construction under the supervision of the Public Works Department, and has cost up to the present time £1,154 3s. 4d. It is estimated to cost an additional £800 to complete the work, which sum has been authorized.

Track, Mokihinui to Karamea viâ Rough and Tumble, Nelson.—The construction of this road until recently was under the supervision of the Public Works Department; but now the plans have been handed over to the Buller County Council, who are supervising the works. Three sections on the north side of the Mokihinui River are completed, and other sections are in progress. The total value of the work completed and that authorized is £11,818 1s. 11d., of which £6,648 16s. 4d. have been paid. This road is urgently required to give access to the Karamea settlement, where a large area of good agricultural land exists suitable for the extension of settlement.

Track, Mokihinui Quartz Reefs to Specimen Creek, Nelson.—A horse-track, having 4-feet metalled roadway, constructed with grades suitable for dray-traffic, and forms a portion of the road between Mokihinui and the Lyell. The road was constructed under the supervision of the Buller County Council, who have expended on the work up to the present time £891 13s. 3d.

Road, Wilberforce Reefs, Canterbury.—A road on the Canterbury side of the range to open up the Wilberforce quartz reefs; for which £2,000 were authorized. Of this amount £1,718 7s. 7d. have been paid.

Road, Cedar Creek, Nelson.—A dray-road from the Hokitika–Ross Road to the quartz reefs at Cedar Creek. The road has been surveyed for the whole of the distance, and four miles of it is in course of construction. The contracts let amount to £2,414 16s. 3d., and the remaining four miles to complete the road is estimated to cost about £2,850. This work is being carried on under the supervision of the Westland County Council, which has authority to undertake work to the value of £3,000. Of this amount £442 14s. have been paid. The sections now under construction, with supervision and cost of survey, will absorb the whole of the money authorized; but the road will have to be carried on to Cedar Creek before the portion under construction can be utilized. A good horse-track would be sufficient from the end of present contracts to Cedar Creek, and when the prospects of the reefs warranted the extra expenditure it could be afterwards widened into a dray-road.

Tracks, Collingwood to Motueka and Karamea, Nelson.—These are tracks which are urgently required, this part of the country being destitute of roads and tracks, and yet, from its formation, it is likely to be rich in mineral resources. Surveys have been made, and a portion of the work is under construction. The amount expended up to the present time is £248 19s. 7d.

Road, Owen Valley Reefs, Nelson.—A survey for a dray-road is now being made from the Buller Valley to the Owen reefs; but until that is completed an estimate of the distance and cost cannot be given. The money expended up to the present time has been £47 7s. 6d.

Road, Waikaia Bush, Southland.—This is improving the present road through Waikaia Bush, which is about twelve miles in length. The work is being carried on under the supervision of the Southland County Council. The sum of £1,000 have been authorized for the work, of which £241 15s. 5d. have been expended.

Track, Aorere Valley to Karamea, Nelson.—This is a road which the Collingwood County Council has undertaken to supervise. There has been £1,000 authorized to be expended on the construction of a road; and of this amount £250 have been paid.

Opening up Mokau River, Taranaki.—This work consisted in snagging the Mokau River, for the purpose of enabling suitable barges to get up to convey to market the coal that has lately been discovered here. The work has been carried on under the supervision of the Public Works Department, and has cost up to the present time £440 16s. 9d.

Road to Criffel Diggings, Otago.—The Lake County Council has been authorized to undertake the construction of a road to Mount Criffel Diggings to the extent of £1,000; but none of this amount has yet been paid.

Track, Wangapeka to Karamea, Nelson.—A survey of a road from Wangapeka to Karamea is now being made by the Waimea County Council, which has undertaken the supervision of the work. The amount authorized is £1,500.

WATER-RACES.

Waimea Water-race, Westland.—This really forms portion of the Waimea–Kumara Water-race; but, as the Waimea portion was undertaken previous to the Kumara Goldfield being discovered, to work the ground in the vicinity of Fox's, Goldsborough, and Stafford, it may be of interest to show the result of the working of each water-race separately before taking the whole of the works under one head. On the upper portion of this Waimea Water-race there is upwards of one mile of fluming, having a maximum height of about 40ft. This portion has been constructed for nearly twelve years, and is beginning to show signs of decay, especially in the legs of the trestles, a number of which have been taken out and replaced with new ones, as also some of the stringers; but these renewals can be made from time to time without interfering with the working of the race, or without increasing to a great extent the cost of maintenance, as the men that have to be steadily employed in the ordinary course of maintenance can do a large portion of this work while attending to their other duties. There are also several other small flumes on the line of race which have been partially replaced; and the manager has been instructed to always have a supply of sawn and other timber on hand, so that in the event of any accident or breakage occurring it can be repaired without much delay. The superstructure of all the bridges and flumes will yet last for a considerable time so long as the understructure is kept in proper repair; and from what I have seen on going over this work on my recent visit, the manager is exercising due care to have all necessary repairs executed with strict economy. The following table will show the results of the working of this portion of the race during the past financial year:—

Month.	Sales of Water.	Amount of Cash received for Sales of Water.	Expenditure.	Amount of Outstanding Moneys at the End of each Month.	Number of Men employed.	Approximate Amount of Gold obtained.	Value of Gold.
1885.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	141 19 6	271 19 5	79 13 5	232 8 9	111	281	1,067 16 0
May	183 7 0	183 0 6	87 12 11	232 15 3	121	294	1,117 4 0
June	172 12 5	111 16 2	93 13 7	293 16 6	121	300	1,140 0 0
July	147 3 3	170 15 9	113 3 10	269 19 0	112	490	1,862 0 0
August	120 7 9	119 19 5	159 3 8	270 7 4	111	360	1,368 0 0
September	185 1 2	217 2 5	95 13 5	238 6 1	109	301	1,143 16 0
October	191 0 9	159 7 0	43 15 0	269 19 10	109	317	1,204 12 0
November	166 7 5	108 19 10	90 1 2	327 7 5	100	275	1,045 0 0
December	127 5 9	280 1 2	115 17 9	174 12 0	101	299	1,136 4 0
1886.							
January	35 15 9	0 7 0	131 13 0	210 0 9	93	53	201 8 0
February	140 8 8	97 5 4	60 15 10	253 4 1	93	244	927 4 0
March	179 6 7	30 0 10	60 14 6	409 9 10	104	306	1,162 16 0
Totals	1,790 16 0	1,750 14 10	1,131 18 1	..	1,285	3,520	13,376 0 0

Remarks.—Amount of money outstanding on the 31st March, 1885, £362 8s. 8d.; amount of money outstanding on the 31st March, 1886, £409 9s. 10d. Profit on Waimea Water-race, £618 16s. 9d. Average earnings of miners, after deducting cash paid for water, £2 1s. 9d. per week.

From this it will be seen that the sales of water have been £1,790 16s., whereas the previous year they amounted to £1,726 5s. 6d. The actual cash received for sales of water last year was £1,750 14s. 10d.; the amount received the previous year was £1,664 1s. 1d. So that the actual sales of water have increased £64 10s. 6d., and the actual cash received £86 13s. 9d. during last year. The expenditure on maintenance last year was £1,131 18s. 1d., and that of the previous year £1,352 3s. 5d.; thus showing a decrease in last year's expenditure of £220 5s. 4d., which must be considered satisfactory. The actual profit on last year's transactions was £618 16s. 9d., against £311 17s. 8d. the previous year; thus showing an increase of £306 19s. 1d. The value of free water given last year to the miners to assist them in opening out their claims was £20 3s. 4d.; and the moneys outstanding on 31st March for water were £409 9s. 10d. The average number of miners employed in working mining claims with water from this race has been 107; and the approximate amount of gold obtained 3,520oz., representing a value of £13,376. Deducting the cash received for water from the value of the gold obtained, the average earnings of the miners have been about £2 1s. 9d. per week. The total cost of construction of this portion of the water-race has been £118,575 15s. 2d., and profits derived from the working of the race £618 16s. 9d.; which gives direct interest at the rate of about ½ per cent. on the cost of construction.

Kumara Water-race, Westland.—The results of the working this portion of the Waimea-Kumara water-supply are given separately; but, strictly, the Kumara Water-race has to be taken in conjunction with the Kumara Sludge-channel, as that work was constructed to enable the water to be utilized from this race. The whole of the works in connection with the supply are in good repair, and the race is capable of carrying about a hundred sluice-heads of water. The tunnel from the Kapitea Creek has been partially enlarged, but a small portion of it still remains to be completed. A folding-gate has been constructed by the manager across the by-wash at the upper dam at Loopline Road, raising the surface of water in the dam 15in., which increases the carrying-capacity of the dam considerably; but, in the event of a heavy flood taking place, this gate should always be opened, as the embankment and outlet-box from the dam are not constructed to stand additional pressure. Indeed, during a recent flood the outlet-box showed signs of weakness, and had to be strengthened; so that great care and strict supervision must now be exercised to prevent any accident occurring. The following table will show the results of the working of this race during the year:—

Month.	Sales of Water.	Amount of Cash received for Sales of Water.	Expenditure.	Amount of Outstanding Moneys at the End of each Month.	Number of Men employed.	Approximate Amount of Gold obtained.	Value of Gold.
1885.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	655 16 0	1,518 2 11	94 8 11	1,710 10 8	233	740	2,812 19 0
May	796 6 9	204 18 4	99 14 0	2,020 17 1	235	999	3,796 4 0
June	893 5 3	1,011 16 3	102 18 1	2,183 8 2	235	1,050	3,990 0 0
July	745 19 7	862 3 4	101 11 0	2,067 4 4	238	1,062	4,035 0 0
August	773 19 10	975 11 9	122 18 7	1,865 12 5	239	1,080	4,104 0 0
September	943 13 5	906 6 3	141 10 6	1,603 17 7	239	1,072	4,073 12 0
October	953 15 6	1,013 2 0	122 18 5	1,843 13 1	240	1,375	5,225 0 0
November	997 7 8	276 5 6	123 3 5	2,564 15 3	240	1,220	4,636 0 0
December	697 13 5	2,317 16 10	144 17 2	939 6 1	235	1,300	4,940 0 0
1886.							
January	686 4 0	1 0 0	127 0 9	1,624 10 1	233	1,357	5,156 12 0
February	708 15 8	346 2 9	109 10 6	2,077 0 7	229	1,197	4,548 12 0
March	935 19 7	948 5 2	164 8 1	2,064 15 0	232	1,404	5,335 4 0
Totals	9,788 16 8	10,381 11 1	1,454 19 5	..	2,828	13,856	52,653 3 0

Remarks.—Amount of money outstanding on the 31st March, 1885, £2,572 17s. 7d.; amount of money outstanding on the 31st March, 1886, £2,064 15s. Profit on Kumara Water-race, £8,926 11s. 8d. Average earnings of miners, after deducting cash paid for water and channel fees, £3 5s. per week.

This shows the sales of water amounted to £9,788 16s. 8d. for last year, while the previous year they amounted to £9,696 8s. 2d. The actual cash received for water last year was £10,381 11s. 1d., while the previous year it was £9,311 16s. 4d.; thus showing an increase on the sales of water of £92 8s. 6d., and of actual cash received, £1,069 14s. 9d. The expenditure on maintenance has been £1,454 19s. 5d., against £1,656 0s. 1d. of the previous year; thus showing a decrease on last year's expenditure of £201 9s. 8d. The actual profits on last year's transactions were £8,926 11s. 8d., while the previous year they were £7,665 16s. 3d.; thus showing an increase of £1,260 15s. 5d. This result is very satisfactory when it is borne in mind that the price of water was reduced 10s. per head last year. The value of free water given to assist the miners during last year in opening out their claims was £221 3s. 2d.; and the outstanding moneys for sales of water on the 31st of March last were £2,064 15s. The average number of miners employed in working mining-claims with water from this race has been 236; and the approximate amount of gold obtained by them 13,856oz., representing a value of £52,653 3s. Deducting the cash received for water, the average earnings of the miners have been about £3 10s. 9d. per week. The total cost of construction of this portion of the Waimea–Kumara water-supply has been £37,400 2s. 11d., and the profits derived from the working of the race £8,926 11s. 8d.; which gives interest at the rate of about 23⅞ per cent. on the cost of construction.

Kumara Sludge-channel, Westland.—The stone paving of this work, which was at first objected to by the miners, is now found to work very well, and is infinitely cheaper than the wooden-block pavement. It has been found that one set of 14-inch stone blocks lasts without scarcely any repairs for twelve months. A source of expense now in maintaining the channel is the extension of the various branches. The tailings-site is getting filled up to that extent that the extensions have to be continually carried on at a rapid rate in various directions. The tailings opposite the end of the channel have entirely filled up the place where the Teremakau River originally flowed, and have forced the river against the opposite bank, and are gradually filling up the bed of the river for some distance below the bridge on the Greenstone Road. The miners have constructed another sludge-channel with the assistance by subsidy from Government, which when connected will relieve the present channel to a considerable extent, and enable the whole of the claims to be worked more advantageously, and also allow a greater scope for the deposit of tailings. The following table will show the result of the working of the channel during the past year:—

Month.	Channel Fees.	Amount of Cash received for Channel Fees.	Expenditure.	Amount of Outstanding Moneys at the End of each Month.	Number of Men using the Channel.
1885.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
April	148 7 1	313 12 11	425 3 5	214 9 2	161
May	198 16 9	29 5 8	438 6 2	384 0 2	160
June	213 2 0	299 12 6	400 4 3	297 12 10	167
July	167 11 5	205 4 3	551 10 2	259 16 11	168
August	167 2 1	176 8 5	569 19 3	250 10 7	165
September	212 1 2	236 4 1	524 7 4	227 8 1	166
October	229 5 0	224 3 6	630 10 6	231 8 4	170
November	208 7 11	46 14 0	696 9 9	393 2 3	152
December	137 14 3	530 15 4	525 3 4	5 6 11	154
1886.					
January	169 9 1	..	477 19 3	174 16 0	155
February	146 8 1	84 19 3	442 16 0	146 8 4	156
March	221 13 9	219 1 4	533 3 7	149 0 9	155
Totals	2,219 18 7	2,366 1 3	6,215 13 0	..	1,929

Remarks.—Amount of money outstanding on the 31st March, 1885, £379 15s.; amount of money outstanding on the 31st March, 1886, £149 0s. 9d. Loss on sludge-channel, £3,849 11s. 9d. Average number of miners using the channel during the year has been 161. But this work must be understood to be incorporated with the Kumara Water-race: the one work is essential to the other.

The value of channel fees for the past year has been £2,219 18s. 7d., while that of the previous year was £2,163 16s. 4d. The actual cash received for channel fees has been £2,366 1s. 3d., against £1,732 15s. 1d. for the previous year; thus showing an increase in channel fees of £55 2s. 3d., and of actual cash received £633 6s. 2d., over that of the previous year. The expenditure on maintenance has been £6,215 13s., while that of the previous year was £6,161 14s. 7d.; thus showing an increase of £53 18s. 5d. The actual loss on the working of the channel has been £3,849 11s. 9d., or, in other words, the cost of maintenance has been £2 12s. 2d. for every £1 received for channel fees. The average number of miners using the channel during the past year was 161. The outstanding moneys due for channel fees on the 31st March last were £149 0s. 9d., and value of the free use of channel given to parties during last year was £12 12s. 8d. The total cost of this work up to the present time has been £17,200 12s. 6d.

Waimea–Kumara Water-race and Sludge-channel, Westland.—To take the whole of the works conjointly, although each portion is shown separately, it is all one scheme and under one management, and therefore must be considered as one work. The following table will show the result of working:—

Month.	Sales of Water.	Amount of Cash received for Sales of Water.	Expenditure.	Amount of Outstanding Moneys at the End of each Month.	Number of Men employed	Approximate Amount of Gold obtained.	Value of Gold.
1885.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	946 2 7	2,103 15 3	599 5 9	2,157 8 7	344	1,021	3,880 15 0
May	1,178 10 6	417 4 6	625 13 1	2,637 12 6	356	1,293	4,913 8 0
June	1,278 19 8	1,423 4 11	596 15 11	2,774 17 6	356	1,350	5,130 0 0
July	1,060 14 3	1,238 3 4	766 5 0	2,596 19 3	350	1,552	5,897 0 0
August	1,061 9 8	1,271 19 7	852 1 6	2,386 10 4	350	1,440	5,472 0 0
September	1,340 15 9	1,359 12 9	761 11 3	2,069 11 9	348	1,373	5,217 8 0
October	1,374 1 3	1,396 12 6	797 3 11	2,345 2 3	349	1,692	6,429 12 0
November	1,372 3 0	431 19 4	909 14 4	3,285 4 11	340	1,495	5,681 0 0
December	962 13 5	3,128 13 4	785 18 3	1,119 5 0	336	1,599	6,076 4 0
1886.							
January	891 8 10	1 7 0	736 13 0	2,009 6 10	326	1,410	5,358 0 0
February	995 12 5	528 7 4	613 2 4	2,476 13 0	322	1,441	5,475 16 0
March	1,336 19 11	1,197 7 4	758 6 2	2,623 5 7	336	1,710	6,498 0 0
Totals	13,799 11 3	14,498 7 2	8,802 10 6	..	4,113	17,376	66,029 3 0

Remarks.—Average earnings of miners, after deducting cash received for water, £2 18s. per week. Profit on Waimea-Kumara Water-race and Sludge-channel, £5,695 16s. 8d.

From this it will be seen that the sales of water and channel fees during the year have amounted to £13,799 11s. 3d., while that of the previous year was £13,586 10s. The actual cash received was £14,498 7s. 2d., against £12,708 12s. 6d. of the previous year; thus showing an increase of sales of water and channel fees of £213 1s. 3d., and of actual cash received £1,789 14s. 8d. The expenditure on maintenance for past year has been £8,802 10s. 6d., while that of the previous year was £9,169 18s. 1d.; thus showing a decrease in the expenditure of £367 7s. 7d. The average number of miners employed working mining-claims by means of this work has been 343; and the approximate amount of gold obtained by them 17,376oz., representing a value of £66,029 3s. The total cost of construction being £173,176 10s. 7d., and the profits on the working of the race £5,695 16s. 8d., which gives direct interest at the rate of nearly 3⅓ per cent. on the cost of construction.

Nelson Creek Water-race, Nelson.—The auriferous terraces that this race commands are getting rapidly worked out. Several miners are turning their attention to the low flats adjoining the bed of Nelson Creek, and some have been successful in finding wash-drift of a payable character; but, as there is no fall to admit of ground-sluicing, some are proposing to work it on the same principle as the Gabriel Gully Sluicing Company at Tuapeka—namely, by lifting the whole of the ground by hydraulic pressure, and running it through sluice-boxes fixed on trestles on the surface, in order to acquire fall. The place where the gold has been found on this flat is well suited to work on this principle, as water can easily be obtained from the Nelson Creek, which is within twenty chains of the workings, and at an elevation of over 400ft., which will give sufficient head to work the ground on a wholesale principle. The great drawback to the working of the flat is that it is covered in places to a great depth with tailings from the terrace-workings; but if the gold is in the ground this will be overcome, although the expense of working will now be considerably greater than it would have been had it been worked in the first instance. The race is in fair repair, and if gold is found on the flat there will be no difficulty in keeping the bridges and flumes in repair for several years by replacing the decayed portions, which can mostly be done by the ordinary maintenance-men. The manager, Mr. Gow, has lately made a survey of an extension of this race from Wilson's Creek, which is within six miles of the head of the race, to River View. This extension would command the terraces on Irishman's, Black-sand, German Gully, and Sullivan Creeks, and the western side of the Ahaura River, where there is apparently a far larger area of auriferous drift than on the Nelson Creek side of the range. Several miners have been working in this locality for years, and have made good wages with the supply of water that is available; but whether there is sufficient payable auriferous ground to justify the extension of the Nelson Creek Water-race is a question that should in a measure be proved by prospecting the ground before the construction is undertaken. If this extension was undertaken the bridges and flumes on the present line of race between the Head works and Wilson's Creek would have to be replaced. This would not require to be done at once, but only from time to time, as the decayed portions had to be renewed. The survey is not sufficiently advanced to enable me to form an exact estimate of the cost; but, from the data supplied me by the manager, the extension will cost, including replacing the bridges and flumes, about £20,000. A survey is also being made from Lake Hochstetter to River View, and, from the appearance of the country, and distance that a race would have to be constructed, which is under seven miles, I am of opinion that a new race would be more cheaply constructed and of a more permanent character than the portions of the present race that would have to be utilized. The water could be brought on the ground at about 60ft. higher elevation without necessitating any high or long wooden flumes, which are the perishable portions of all water-races. As soon as this survey and plans are completed a correct estimate can be formed of the cost of both routes. The following table shows the result of the working of the race during last year:—

Month.	Receipts.	Expenditure.	Number of Men employed.	Approximate Amount of Gold obtained.	Value of Gold.
1885.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	92 13 4	60 13 4	57	190	726 15 0
May	79 0 0	62 3 4	56	179	684 13 6
June	74 18 4	71 16 8	54	143	546 19 6
July	11 19 2	188 13 2	60	40	153 0 0
August	75 8 4	120 7 8	65	207	791 15 6
September	85 1 8	99 8 8	67	232	887 8 0
October	90 0 10	95 10 8	65	240	918 0 0
November	172 1 8	90 19 8	68	266	1,017 9 0
December	89 15 0	90 17 8	68	221	845 6 6
1886.					
January	105 15 10	88 4 2	72	250	956 5 0
February	102 5 10	57 8 8	65	200	765 0 0
March	94 14 2	78 9 8	71	190	726 15 0
Totals	1,073 14 2	1,104 13 4	768	2,358	9,019 7 0

Remarks.—Average earnings of miners, after deducting sales of water, £2 7s. 9d. per week. Apparent loss on Nelson Creek Water-race, £30 19s. 2d.

The receipts from sales of water amount to £1,073 14s. 2d., while those of the previous year amounted to £990 6s. 8d. This shows an increase of £83 7s. 6d.; but this is more than compensated by the increase of expenditure. The cost of maintenance has been £1,104 13s. 4d., against that of £811 10s. 5d. during the previous year; which is an increase of £193 2s. 11d. This is due to large slips which took place in July last. The average number of miners employed working mining-claims by means of this water-supply has been sixty-four, and the approximate amount of gold obtained by them has been 2,358oz., representing a value of £9,019 7s. Deducting the sales of water from the value of the gold obtained, the average earnings of the miners have been about £2 7s. 9d. per week. The value of free water given to assist the miners in opening out their claims and in prospecting has been £488. The total cost of construction of this work has been £90,151 19s. 1d., and the loss in working during the past year £30 19s. 2d.

Argyle Water-race, Charleston, Nelson.—This water-race is now in good repair, the whole of it having been recently reconstructed; but it will have to be extended to Back Lead before any increase in the returns can be expected. The ground that the race at present commands is almost worked out. Tenders will shortly be called for the construction of the extension, which, when completed, will enable a large area of auriferous ground to be worked between Ballarat Gully and the Nile River. The following table shows the result of the working of the race during the past year:—

Month.	Receipts.	Expenditure.	Average Number of Men employed.	Approximate Amount of Gold obtained.	Value of Gold.
1885.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	30 7 4	33 19 1	..	..	..
May	28 5 0	36 9 10	..	..	..
June	30 15 4	28 3 4	..	..	..
July	39 7 2	31 19 5	..	..	..
August	40 5 9	26 3 4	..	..	..
September	36 1 10	42 12 7	..	..	..
October	38 4 9	33 10 6	..	..	..
November	37 2 11	30 1 8	..	..	..
December	30 17 8	40 7 1	..	..	..
1886.					
January	36 15 3	32 15 10	..	..	..
February	39 17 4	26 10 0	..	..	..
March	47 2 4	29 5 0	21	464	1,774 16 0
Totals	435 2 8	391 17 8	21	464	1,774 16 0

Remarks.—The average number of days worked during the year has been eighty-five per man, or at the rate of £4 10s. per man per week during the time they were at work. Profit on Argyle Water-race, £43 5s.

The receipts have been £435 2s. 8d., while those of the previous year were £476 13s. 6d.; thus showing a decrease of £41 10s. 10d. The expenditure for past year has been £391 17s. 8d., against £419 19s. 7d. of the previous year; being a decrease of £28 1s. 11d. The amount of free water given to the miners during the past year has been £4 2s. 6d. The total cost of this work up to the present time has been £14,192 17s. 11d., and the profits drawn last year from the working of the race £43 5s.; which gives interest on capital invested at a little over a quarter per cent.

Mikonui Water-race, Ross, Westland.—This work is in course of construction. About three miles of the lower portion is completed, which is still leased to the Mount d'Or Gold-mining Company at a rental of £100 per annum. The work in progress during the year has been confined to the construction of the long tunnel. About 50 chains of the lower end of this tunnel is completed; but a portion of this will have to be retimbered again before water is admitted. The ground, being of a swelling nature when exposed to the atmosphere, breaks the timber soon after it is first put in position. A contract for 35 chains of the upper end of tunnel was taken,

and 22 chains of this is constructed. The ground through which the tunnel is constructed at the upper end is very hard, and stands remarkably well. Indeed, it is so hard that the contractor failed to carry out his contract; so that at the present time no work is being done. There is still about 68 chains of the centre of this tunnel to construct.

Mount Ida Water-race, Otago.—This water-race is managed by a trust; but the Government have had to find money for extensions, and for making up deficiencies in the cost of maintenance when the expenditure exceeds the receipts. The race has lately been extended to Spec and Home Gullies, which will enable a large area of auriferous ground to be worked, and will increase the revenue considerably. This work has hitherto produced the most unfavourable results of any water-race constructed by Government as far as direct revenue is concerned; for not only has the expenditure for maintenance exceeded the receipts from sales of water, but the total value of gold obtained by means of this work would not pay for the cost of construction. Seeing that the extensions to Spec and Home Gullies are completed, it is to be hoped the trust will manage to establish a fund from the profits to carry on any further new works that may be required. The receipts from sales of water during last year were £893 6s. 5d., while those of the previous year were £1,221 14s. 10d.; thus showing a decrease of £328 8s. 5d. The expenditure during the past year has been £1,338 2s. 5d., against £1,596 0s. 10d. of the previous year; or a decrease of £257 18s. 5d. The total cost of constructing this work was £65,766 3s. 8d., and the loss on working during the year has been £444 16s. The average number of men employed in working mining-claims by means of this work during the past year was 130; and the approximate amount of gold obtained by them has been 3,392oz., representing a value of £12,723. Deducting the money paid for water from gold obtained, the average earnings of the miners have been about £1 14s. per week.

In dealing with the revenue arising from these water-races, I have confined myself to the direct profits as a commercial venture; but the Government derives a great direct benefit by carrying on these undertakings, in addition to the direct profits of working. The value of the duty on gold obtained by the means of these works ought to be taken into account. Therefore, on that basis, the profits accruing from the working last year would amount to the following percentage of the capital invested in their construction: Waimea Water-race, £970 16s. 9d., or ½ per cent.; Kumara Water-race and Sludge-channel, £6,462 11s. 11d., or 11¾ per cent.; Waimea–Kumara Water-race and Sludge-channel, £7,433 8s., or 4¼ per cent.; Nelson Creek Water-race, £204 16s. 10d., or ¼ per cent.; Argyle Water-race, £89 13s., or ⅝ per cent.; Mount Ida Water-race, total loss of £5 8s.: total of whole works, £7,722 10s. 6d., or 2¾ per cent. This shows that the Kumara portion of the Waimea–Kumara water-supply has paid 11¾ per cent. last year on the expenditure on construction; while, taking the whole of the supply and works connected with it, which have cost £173,076 10s. 7d., it has paid about 4¼ per cent. on the large capital invested. It will be seen from this, had it not been for the extension to Kumara Goldfield, the expenditure on the Waimea portion would have given a poor return on the cost of construction.

The following table will show the collateral advantages derived by the working of these water-races:—

Name of Water-race.	Receipts.	Expenditure.	Profits or Loss on Working.	Average No. of Men employed.	Approximate Amount of Gold obtained.	Value of Gold obtained.	Value of Duty received on Gold obtained.	Total Profits or Losses and Value of Duty.	Total Cost of Construction.
Waimea–Kumara and Sludge-channel.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.	£ s.	£ s. d.	£ s. d.
Seven years ending Mch. 31, 1885	45,839 3 0	33,741 6 3	12,097 16 9	466	123,485	472,330 2 6	..	..	173,076 10 7
Year ending 31st March, 1886	14,498 7 2	8,802 10 6	5,695 16 8	343	17,376	66,029 3 0	..	..	..
Total	60,337 10 2	42,543 16 9	17,793 13 5	451	140,861	538,359 5 6	14,086 2	31,879 15 5	173,076 10 7[1]
Nelson Creek.									
Seven years ending Mch. 31, 1885	12,646 0 7	8,429 2 4	4,216 18 3	59	23,983	91,734 19 6	..	..	89,833 19 7
Year ending 31st March, 1886	1,073 14 2	1,104 13 4	*30 19 2	64	2,358	9,019 7 0	..	..	317 19 6
Total	13,719 14 9	9,533 15 8	4,185 19 1	60	26,341	100,754 6 6	2,634 2	6,820 1 1	90,151 19 1[2]
Argyle.									
Seven years ending Mch. 31, 1885	3,093 16 2	2,826 13 3	267 2 11	16	5,014	19,178 11 0	..	..	12,743 16 9
Year ending 31st March, 1886	435 2 8	391 17 8	43 5 0	21	464	1,774 16 0	..	..	1,449 1 2
Total	3,528 18 10	3,218 10 11	310 7 11	17	5,478	20,953 7 0	547 16	858 3 11	14,192 17 11[3]
Mount Ida.									
Seven years ending Dec. 31, 1884	10,821 14 8	13,217 11 5	*2,395 16 9	81	14,319	54,770 0 0	..	..	65,066 3 8
Year ending 31st Dec., 1885	893 6 5	1,338 2 5	*444 16 0	130	3,392	12,723 0 0	..	..	700 0 0
Total	11,715 1 1	14,555 13 10	*2,840 12 9	87	17,711	67,493 0 0	1,771 2	*1,069 10 9	65,766 3 8[4]
Grand totals ..	89,301 4 10	69,851 17 2	19,449 7 8	615	190,391	727,559 19 0	19,039 2	38,488 9 8	343,187 11 3[5]

Average percentage on capital invested during eight years.—[1] $2\frac{3}{10}$ per cent. [2] Nearly 1 per cent. [3] ¾ per cent. [4] Direct loss of £1,069 10s. 9d. [5] $1\frac{4}{10}$ per cent., besides which the consumption of dutiable goods by the men employed in connection with those works should be taken into account. * Loss is shown.

It will be seen from this table that the total cost of these works has been £343,187 11s. 3d.; the total receipts, £89,301 4s. 10d.; and total expenditure on maintenance, £69,851 17s. 2d.: leaving a profit of £19,449 7s. 8d. during the eight years that they have been in operation; the Mount Ida Race showing a direct loss of £2,840 12s. 9d.

MINING GENERALLY.

Otago.

Tuapeka.—Mining in this district is chiefly confined to alluvial workings, the chief centre of attraction being the Blue Spur, at the upper end of Gabriel's Gully, on a range between this and Munroe's Gully, known as the cement workings. This locality was a busy place twenty-four years ago: gold was found in every little gully and watercourse falling into each of those large gullies. Of late years the gold-working has been confined to the beds of the once rich Gabriel's and Munroe's Gullies, and to crushing the cement from the terraces. For a long time this cement was broken up with picks and hammers and sluiced away in the ordinary manner; but as time wore on this method was found too slow a process to make the ground pay reasonable wages for working. The richest of the ground was worked out first, and when that was done steps were then taken to work the poor-grade cement on a more wholesale manner. It was found that by breaking it up with hammers a great deal of the gold was carried in unbroken pieces away with the water in the sluice-boxes; and this led to the substitution of crushing-batteries. After the adoption of these batteries it was found that the poor-grade dirt paid the shareholders far better for working than the original method, and a good many of the claims gave for a number of years handsome returns to the shareholders; but as time passed on and the richer ground got worked, even this method is now found too slow a process to make poor cement pay, and steps are now being taken to introduce a new class of machinery to reduce the stuff more economically. During my recent visit to this locality many of the miners were greatly in favour of adopting stone-breakers to pulverize the cement; but these will be a failure, as they do not reduce the cement fine enough for sluicing. The general system that has hitherto been adopted in working that class of material has been to blast the cement with dynamite, fill it into trucks, which are hauled up an inclined tramway, and emptied into large hoppers at the stamping-battery, where two men are employed in each hopper to break the large lumps fine enough to put through the stamps. This method requires two men for every ten head of stamps; and the quantity of material crushed in this manner is about 150 tons in sixteen hours. The large amount of labour required to work the claims on this principle is found to be too great to make them remunerative. There are large hills of auriferous cement yet in this district that would be worked if a cheaper method of reduction was used; and there is no doubt that if improved machinery for crushing this class of material were introduced, it would open up a large field for the introduction of capital. Mining must be carried on in a systematic manner to make it a commercial venture that will pay good interest on capital invested. The days are gone by for miners to acquire a competency in a few years, working with the tub and cradle, or even the more advanced method of a small sluice-box. Before concluding my report I intend to give a description of machinery recently adopted in America for the reduction of ores; and this class of machinery is especially adapted for crushing the auriferous cement found in this locality. This class of machinery is not only much cheaper than stamps in the first instance, but the cost of wear and tear is infinitely less, and will reduce a far larger quantity of material with the same amount of power required to work it. In order to give a general idea of the principle on which the cement companies at present work their claims, a description of the principal companies may not be out of place.

The Extended Company.—This company has been continuing mining operations for twenty-three years, and during eleven years of this period they have used a stamping-battery consisting of twenty heads of stamps to reduce the cement sufficiently fine to allow the crushed material to be washed in a sluice-box. Recently their stamping-battery was burned down, and they did not consider it advantageous to erect another, as the cement was getting too poor to manipulate by this method. They are now breaking the cement with water coming from a hydraulic nozzle under 400ft. of head. Their workings being considerably under the surface of Gabriel's Gully, they use water to lift the sluiced material, on the principle known here as "Perry's." A large paddock is excavated out of the bed-rock, and into this paddock the whole of the material is sluiced from the face. An upright or slightly-inclined pipe, 15in. in diameter and 47ft. long, is placed from the bottom of this paddock to a flume, which extends for about two chains, and empties into another small tank, where a second inclined pipe of same diameter is placed, having a vertical height of 37ft.; thence the whole of the water and the sluiced material goes into a large flume, and is carried away as in an ordinary sluice-box, having ripples and false bottoms, to save the gold, the tailings being deposited in the bed of Gabriel's Gully. By these two lifts the whole of the water and tailings are raised a vertical height of 84ft. To accomplish this about twenty sluice-heads of water are required, having a head from 350ft. to 400ft. Five sluice-heads are employed in breaking the cement and sluicing it into the lower paddock. Then seven and a half sluice-heads are employed to raise the water and tailings to the first flume, 47ft. in height, and another seven and a half heads are employed to raise it from the second tank or paddock up to the main sluice-box, 37ft. in height. This system of working was only commenced at the time of my visit, so that very little was known respecting it; but with the large quantity of water that

had to be used the company could only work about four hours per day, owing to the supply of water being insufficient, it having to be stored up for twenty hours in dams to enable them to get twenty heads for the four hours' work. From what I observed of this system of working I am convinced it will not be successful, as the cement is too hard to break, even with the pressure of water they have, and unless this description of stuff is finely broken up a large percentage of the gold will be carried away in lumps of cement among the tailings.

Otago Company.—This company has been at work for twenty-three years, and during that period have had a stamping-battery at work for eleven years. The cement is blasted with dynamite, and broken with hammers and picks to such an extent that it can be lifted into trucks, which are hauled up an incline with winding-gear attached to the turbine water-wheel which drives the battery. At the top of the incline the trucks run into a "kick-up," and are emptied into hoppers, each hopper feeding ten heads of stamps. Two men are employed in each hopper to break the cement sufficiently small for the stamps to operate on. Instead of using the ordinary punched grating that is employed in quartz-crushing batteries, there are vertical bars of round iron three-eighths of an inch in diameter, placed five-eighths of an inch apart, which is found by experience in crushing this class of material to be sufficiently close together. By this method they crush about 150 tons of cement in sixteen hours, or with two shifts of men per day. After the material gets through the grating it falls on inclined tables similar to those used for saving gold in quartz-crushing batteries. Then it goes away in a line of sluice-boxes or flumes, which have false bottoms, and the tailings are deposited in the bed of Gabriel's Gully. About as many workmen are employed at the stamping-battery as there are in the face. This company's cement averages from five to six grains of gold per ton, which is stated to be something like a fair average of the whole hill.

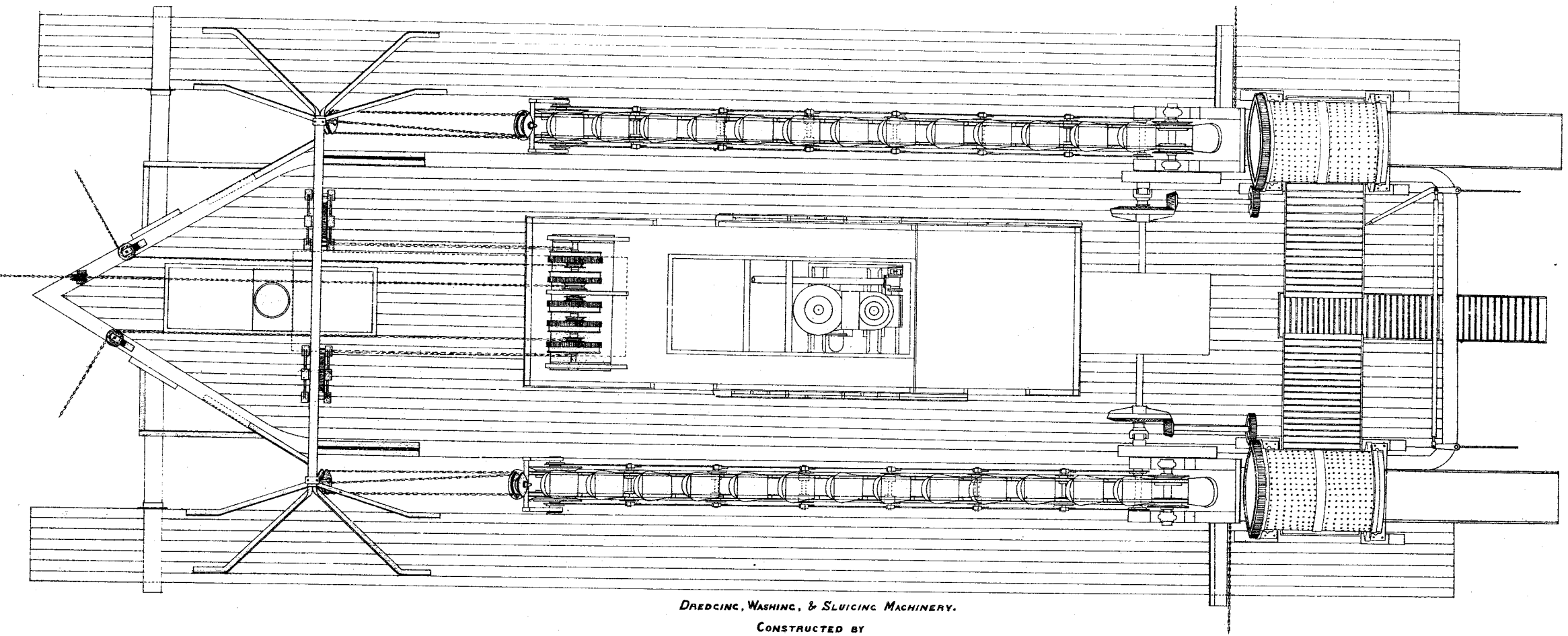
The Nelson Company.—This company has twenty heads of stamps; but they are now idle, as they find that by the present mode of working it will not pay for labour, wear and tear of machinery, with interest on capital; and are waiting to see if some new system of crushing can be devised to get through a much larger quantity, and reduce the labour employed in working the machinery.

The Perseverance Company.—This company has ten heads of stamps, but they have not been working for some time. They are sluicing the cement in the ordinary manner, employing men to break it up in the face before running it away.

Morrison and Company.—This company has a crushing-battery of fifteen heads of stamps; but, like the Perseverance Company, they have stopped the battery, and are now sluicing the cement in the ordinary manner.

The whole of these companies are at work on the Gabriel Gully side of the range. On the Munroe's side there are two crushing-batteries at work, each having ten heads of stamps; but only one of the companies is able to make it pay, the ground being better in one lease than in the other. At Weatherstone's the same class of cement is found, and one company has a crushing-battery; but this is now idle, as they experience the same difficulty in making their ground pay as the companies do at the Blue Spur.

Waipori.—This is an old diggings, but there are still about eighty Europeans and a similar number of Chinese engaged in mining, principally hydraulic sluicing; and some of the claims are still paying good wages. Among these are O'Brien Brothers' and Boulton and party's claims, which are situated on the north side of the Waipori River, about half a mile above the junction with Lamerlaw Creek. These claims are in a narrow gut of deep ground, having schistose rock on each side. This gut is from 100ft. to 200ft. wide at the top, and about 30ft. at the bottom, having a vertical height of from 60ft. to 90ft., the bottom of the gut being about 45ft. below the present bed of the Waipori River. The whole of the wash-drift in this gut is full of water-worn pebbles, principally quartz, and indicates that at some remote period it had been the bed of a large stream. The wash-drift is found in layers with gold distributed through it for the whole of the depth, and it is intermixed with a large quantity of the oxides of iron and manganese. The richest portion of the wash-drift is found within 25ft. of the bottom of the gut. To look at the surroundings, it is evidently the old bed of the Lammerlaw Creek, which at one time had been a deep gorge. The wash-drift on the top portion of this gut for about 40ft. deep has been sluiced away, and the bottom of the gut is now being worked by an inclined horse-tramway, which is used to haul up the wash-dirt to the surface, where it is washed in sluice-boxes, the water in the wash-drift being drained by Californian pumps driven by small overshot water-wheels. This gut is about thirty chains in length, and several claims have been at work here for the last seventeen years. O'Brien Brothers and Boulton and party have yet a number of years' work in their claims. In this district there is a good deal of cinnabar mixed with the wash-dirt. Some of it is as large as peas, but as a rule it is in small grains, having been broken up by boulders with the action of water. To form an estimate of the primitive mode of working that is still adopted in this district, the total quantity of stuff removed during the last seventeen years would not exceed 750,000 cubic yards. If the average time be estimated at twelve years, and the number of men employed about thirty, and to allow them to work for nine months out of every year, the quantity of stuff removed would amount to nearly nine cubic yards per man per day; but when it is taken into consideration that two-thirds of this amount of material was sluiced off with water, and that a sluice-head of water is capable of removing about five cubic yards per hour, it leaves the quantity of work done by manual labour to be very small; but even with



DREDGING, WASHING, & SLUICING MACHINERY.

CONSTRUCTED BY

MESSRS KINCAID McQUEEN & Co

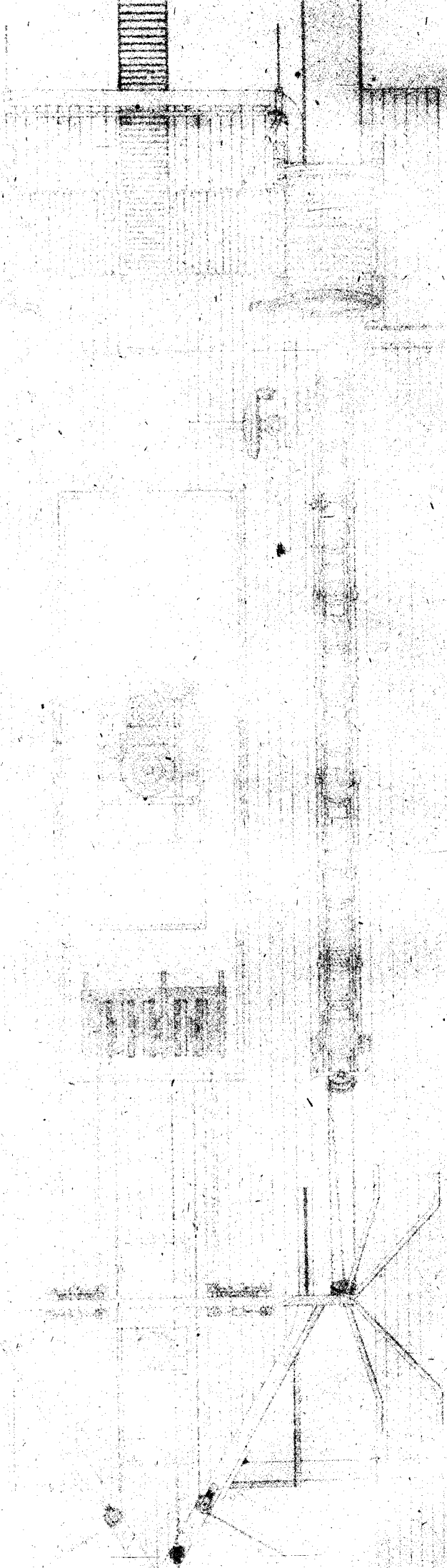
VULCAN FOUNDRY

DUNEDIN. FOR THE DUNEDIN GOLD DREDGING Co. CLUTHA RIVER, ALEXANDRA.

SCALE OF FEET

0 2 4 6 8 10 12 14 16 18 20

Photolithographed at the General Survey Office, Wellington N.Z. February, 1886.



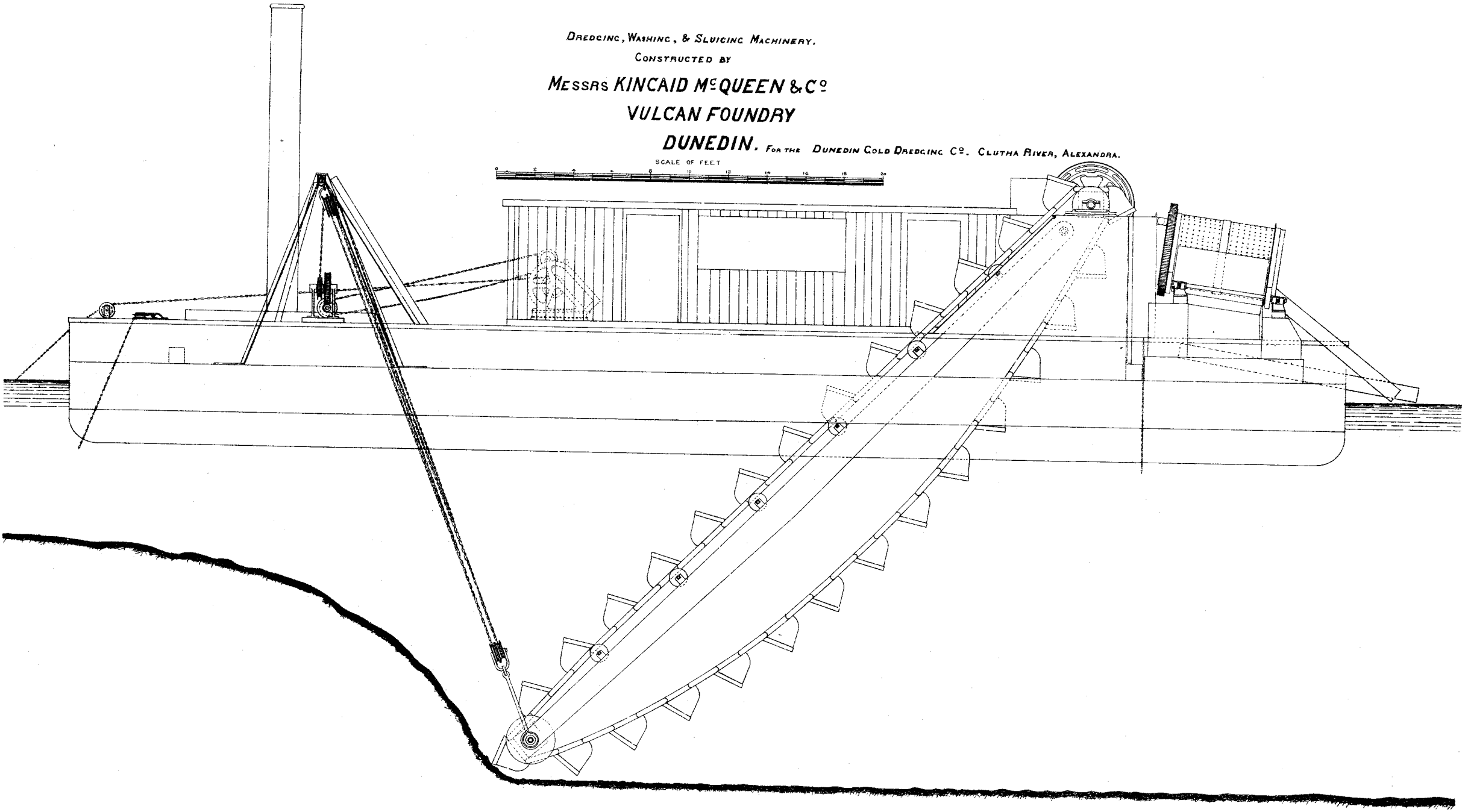
DREDGING, WASHING, & SLUICING MACHINERY.

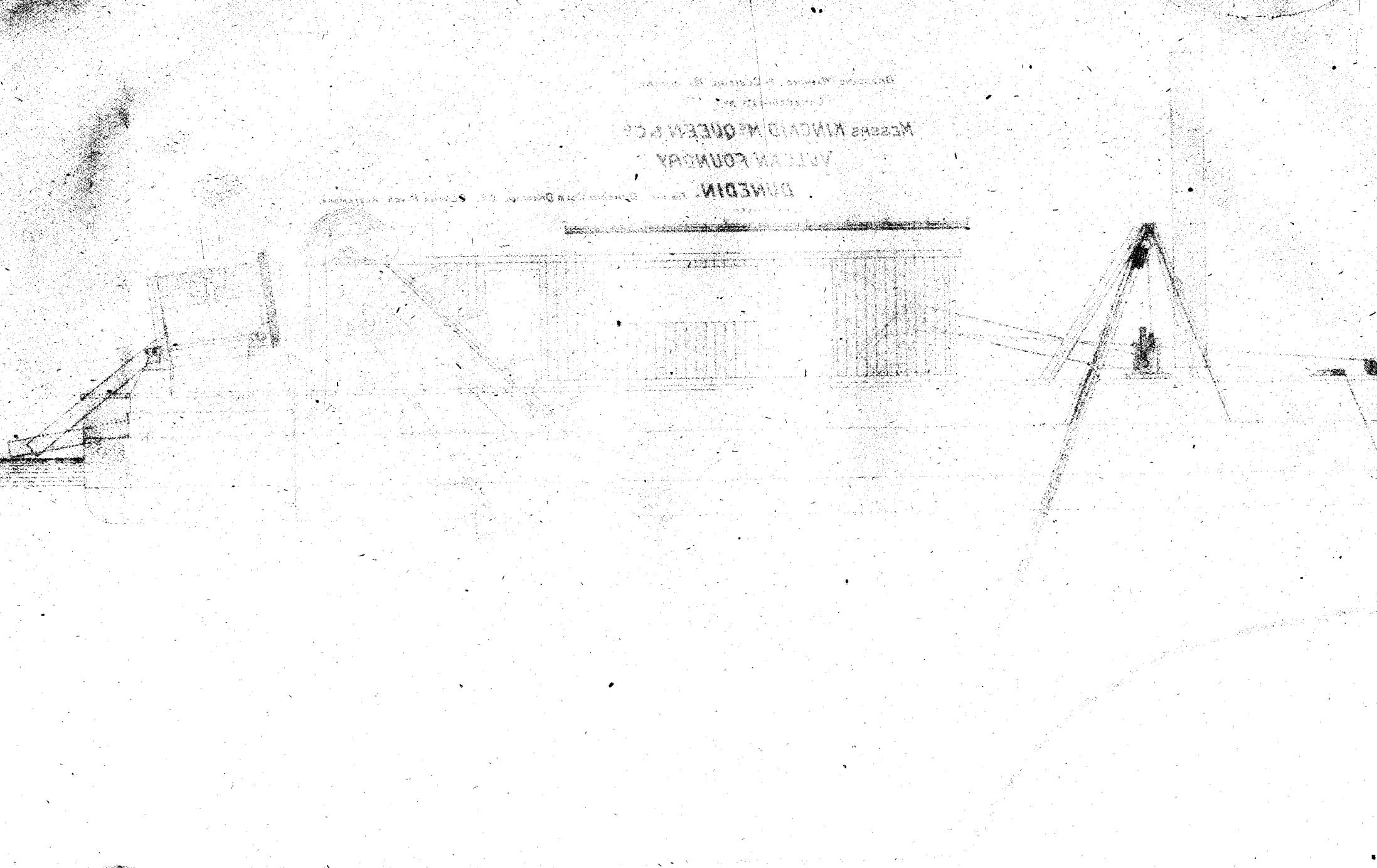
CONSTRUCTED BY

MESSRS KINCAID McQUEEN & Co

VULCAN FOUNDRY

DUNEDIN. FOR THE DUNEDIN GOLD DREDGING Co. CLUTHA RIVER, ALEXANDRA.





this primitive mode of working, men are still earning good wages. O'Brien Brothers for the last year made about £274 per man, being a trifle over 5 guineas per week, and Boulton and party stated that the portion of their claim they had yet to work would give from £6 to £8 per week per man.

Roxburgh.—This is what was known in the early days as the Teviot goldfield, the working being confined to the beaches of the Clutha River and its banks, and low terraces along the valley. The mining population here is now limited; but there are yet a good many still engaged on the north bank of the river, and several dredges at work dredging the bed of the river. These dredges are all worked by current-paddle-wheels worked by the force of the stream, and some of them are paying very well. There are three parties of miners working the deep ground on the side of the river—viz., Waite and party, Hutton and party, and Woodhouse and party. Each of these parties employs from seven to eight men. The ground they are working being below the level of the river, there is a considerable amount of water to contend with, and they have erected overshot water-wheels, each wheel working two large Californian pumps. They strip paddock after paddock, leaving a drainage tail-race to the well where the Californian pumps are placed; and as soon as the bottom of one paddock is taken up the excavation of the next paddock is thrown into the one that has been previously opened; and so on they continue to work the ground—which is paying them fair wages. Other parties are sluicing on the banks of the river, all of which are satisfied with their claims.

Campbell's.—This field is situated at a very high elevation on the opposite side of the Old Man Range from the Clutha River. The men can only work for about eight months in the year. A great many miners, in the early days, that were working on this field, lost their lives in the snow in attempting to cross the Old Man Range to the Clutha Valley. The Government erected snow-poles over the range to enable them to find their way, but these are now nearly destroyed; still, the heaps of stones that were placed round them can in many places yet be seen. Campbell's Gully contained rich deposits when it was first opened, and still supports a limited mining population. Notwithstanding the severity of the winter, some of the miners reside here during the winter months. They have to lay in a stock of provisions, as no supplies can be brought during winter. This gully or creek is one of the tributaries of the Waikaia River, where rich claims are now being worked by Chinamen. I was informed on good authority that from one paddock the Chinamen stripped recently they got 600oz. of gold. An attempt has recently been made by the county to construct a dray-track from the Clutha Valley to Waikaia Bush; but the money at their disposal, which they obtained from the Government, was not sufficient to make it passable. The top of the range being a soft peat-bog, a trench has been cut out of this bog for the drays to get through; but the melting snow converts it into a watercourse. It may be passable during two or three months in midsummer, in dry weather.

Alexandra.—Dredging the Molyneux River.—A short distance above Alexandra there is a large double-action steam-dredge at work, which has now been employed in dredging the bed of the river for about four years. It was constructed by Messrs. Kincaid and McQueen, of Dunedin, and is well adapted for excavating auriferous drift from the beds of rivers. Indeed, this dredge is the most complete one in the colony, although far from being perfect, that has yet been employed in gold-mining; and, from what I could learn, has been successful in obtaining gold to pay the proprietors for the outlay. Not only is the dredged material lifted, but the whole of it is washed on board. Great credit is due to the manufactures of the dredge, for the ingenious manner in which everything is placed so as to economize labour. There are three men on each shift, and the dredge is kept continually at work day and night, stopping only on Sundays and when it is absolutely necessary to do repairs. After lifting the wash-dirt out of the river, and emptying it into a hopper, the dredged material goes through a revolving screen and is washed on board, the large stones passing behind the dredge in one place, and the fine tailings in another. The following is a description of the dredge: The dredge is 66ft. long, built of iron, having two pontoons, one at each side, extending the whole length of the hull and about 2ft. 6in. clear from the side, so that the total width of the hull and pontoons is 26ft. On the deck of the dredge framing is erected to carry the dredging-shaft, hoppers, and washing-apparatus. There are two sets of buckets and dredging-ladders, one on each side, and which work between the hull and pontoons, and each set can be worked separately or together, as required. The buckets are capable of lifting 150 tons of stuff per hour, dredging to a depth of 25ft. below the level of the water. The dredged material falls into a shoot which carries it into a revolving cylinder, 4ft. in diameter and 6ft. long, made of boiler-plate, and perforated with holes one inch in diameter. This revolving cylinder has a dip or inclination towards the stern of the dredge of 1½in. to the foot. On the inside of this cylinder short pieces of angle-iron are riveted here and there all round the cylinder, to prevent the stones getting away before they are properly washed. All the fine stuff passes through the perforated holes in the cylinder, and falls on to an inclined screen and thence into ripple-boxes, where the gold is collected, and the tailings are carried away clear of the stern of the dredge. The large stones and coarse gravel that come through the end of the revolving cylinder pass into a shoot at the stern of the dredge, and are deposited in the river. The water for washing purposes is lifted by a centrifugal pump, and is so conveyed that jets are made to play on the screens, thereby washing the stones and coarse gravel, and carrying the gold into the ripple-boxes. The ripples in these boxes are made of bar-

iron, laid on the flat across the box, and placed about three-eighths of an inch apart, having under them, on the bottom of the boxes, cocoanut-matting. The water coming down these inclined tables forms ripples in each of the interstices, and there the gold is deposited. The first set of inclined tables are set across the dredge at an inclination from the outside towards the centre, where the tables from each of the revolving screens join on to another inclined table, which carries the sluiced material into the river at the stern of the dredge. The whole of the dredging-machinery is worked by a vertical inverted compound steam-engine, having cylinders of 12in. and 22in. diameter respectively, and 18in. stroke, working under a pressure of 60lb. to the square inch. A powerful double-cylinder steam-winch lifts and lowers the dredging-ladders, as well as works the mooring-chains, of which there are five in number—viz., three at the bow and two at the stern. Each chain has its own drum, which can be connected or thrown out of gear as desired. These are all under the control of one man. A plan of this dredge is annexed, so that a clearer knowledge can be obtained of the principle on which it is worked.

Cromwell.—The principal workings here are in the vicinity of Smith's and Pipeclay Gullies, Bannockburn. These gullies were very rich in alluvial deposits when first opened, and some portions of them have been worked over a second and third time. After the beds were partially worked, the terraces on each side were operated on by hydraulic sluicing, the tailings from which have been deposited in the gullies, which has raised the level of their beds to such an extent that at the present time a large quantity of ground known to be payable for working is locked up for want of fall.

Carrick Range.—Star of the East Company.—This company has been at work for several years, having found on and near the surface several rich leaders or lodes of quartz. They have recently been driving a low-level tunnel with the view of striking the reef at a greater depth than has hitherto been worked. This tunnel is constructed for about 900ft., and cut a leader of quartz containing a little gold; but there was not sufficient known respecting it at the time of my visit to tell whether it would be payable for working or not. There is a crushing plant on the claim; so that, if anything is found, they have the means at hand to properly test and work the ground.

Royal Oak Association.—This is merely a prospecting association, formed for the purpose of prospecting the ground that was formerly held by the Royal Oak Company, and which contained near the surface rich auriferous quartz. This association has driven in from the face of the range at the head of Smith's Gully for a distance of 1,100ft., and has cut several small quartz leaders, none of which contained gold. They have recently discovered an auriferous-quartz leader on the surface, and were engaged in prospecting it at the time of my visit.

New Cromwell Company, Bendigo.—This company is engaged in sinking a shaft for the purpose of working the same reef that produced a large quantity of gold a few years ago. At the time of my visit this shaft was sunk to a depth of 187ft. It has two winding compartments, each 5ft. by 3ft. 2in.; and one pumping- and ladder-shaft, 5ft. square. They were also engaged in the erection of winding and air-compressing machinery. The company contemplates sinking the new shaft to a depth of 600ft. The reef has been partially worked from the surface down to a depth of 430ft.; but the lode that is supposed to be stoped out is in many places only partially so. Indeed, on the principle hitherto adopted for working this mine, only rich quartz would pay for working. The average width of the reef is about 2ft. 6in.; occasionally it widens out to 4ft., and in some instances narrows down to 6in. wide. The bearing of the reef is 95°. It has an underlie or dip to the north, while the strike of the reef is westerly. The reef here can be traced in a westerly direction for a long distance, but on the easterly end it is apparently cut off by a slip from the main range; but probably it may yet be found here in the deep levels. This company has a battery of twenty heads of stamps, which is driven by one of Whitelaw's turbines. The ordinary quicksilver ripple- and blanket-tables are attached to the stamping-battery. This battery is idle at present, and it will take a considerable time before the shaft is down and the company is ready to stope out quartz from the deep levels; but the manager informed me that it is the intention of the company to crush a deal of the stone now lying on the surface, which was thrown away during the early workings as being too poor to pay. Judging from the formation of the quartz lode this company is likely to find a good payable lode at the deep level.

Skipper's and Shotover and Lake Wakatipu.—This district includes the watershed of the Shotover River and the head of Lake Wakatipu, which has contributed largely to the quantity of gold obtained in the colony. In the early days rich finds were got in the beds of the Shotover River, Skipper's, and Moke Creeks. Latterly the auriferous-quartz reefs are getting developed, which still enables it to maintain its prestige as a rich field.

Phœnix Quartz-mining Company.—This company's mine is situated on the north side of the right branch of Skipper's Creek, about six miles above the junction of this creek and the Shotover River. This property belongs to Messrs. Bullen Brothers, of Marlborough. They purchased this mine some years ago from the original proprietor, and have been working it ever since, sometimes getting a fair return, but generally, up to about twelve months ago, the work done was principally of a prospecting nature. However, the prospectors had every confidence that they would ultimately be recouped for the steady drain on their resources. They kept on vigorously prospecting the ground; but it was not until about two years ago that the

mine began to show signs of being a paying venture. On the upper levels rich patches of gold were occasionally obtained; but the lodes were very broken and irregular, and the large expenditure involved in working a quartz-mine in a rough, broken country the same as where this is situated, together with its elevation, and the difficulty of getting machinery on the ground with no roads but pack-tracks, and even those had extremely steep grades, the quartz had to be extraordinarily rich to pay the expense incurred both in working the lodes and in crushing it. During the time the present proprietors have had this mine they must have expended many thousands of pounds on machinery and in carrying on the workings. They were working at the time of my visit on two lines of reef, and were making provision to work two additional lodes known to exist in their ground. The lodes that they were working are termed the main and middle reefs. The main lode averages about 15ft. wide, and is worked down to the water-level. The length of the streak or shot of gold in this lode varies from 50ft. to 100ft. The gold does not run uniformly through the whole width of the lode, but only in runs or streaks, generally near the foot- and hanging-walls. The stone, to a certain extent, that is taken from this lode is picked, and varies from one to six ounces of gold per ton of stone. The middle lode averages about 6ft. wide. The run of gold has been worked for about 300ft. in length along the lode, and still continues in a westward direction. The average return, taking the whole of the lode, is about 1oz. 8dwt. of gold per ton. It has a dip or underlie of about 1 in 1, and an apparent strike in a westerly direction. There is a sufficient quantity of payable stone in these two lodes opened out to keep the crushing-battery fully employed during the next two years. The lode that they are at present opening up is the Promised Land Lode, which is the next one north from the middle lode, and averages about 4ft. in width, with runs or streaks of gold about 200ft. in length. The whole width of the lode averages about 16dwt. per ton. The remaining lode is termed the Northern Lode, on which a deal of work has been done. This lode is about 2ft. in width, carrying rich quartz, averaging from 1oz. to 3oz. to the ton, and carries the run or shot of gold for about 300ft. in length. The whole of these lodes continue, and can be seen in a gully about one mile distant in an easterly direction from the place of operations, and they are again seen about three miles distant in a westerly direction on the eastern slope of Mount Aurum. The formation of the quartz reefs in this locality, as well as those at the head of Lake Wakatipu, are well defined, and do not occur in bunches or blocks nearly so much as they are found on the West Coast. The foot- and hanging-walls of the reef can be traced for a long distance; but the space between them is in many places filled with mullock. The quartz is not continuous, but occurs here and there at intervals along the line of lode. In all quartz lodes the gold runs in shots or streaks, and extends only for a certain distance along them, but, generally, by following the line of the foot- and hanging-walls auriferous quartz will again be found, although the value of the shot or run of gold may be entirely different from the one formerly worked. The four lodes in this company's ground run almost parallel with each other on a general east-by-north direction, the main or southern lode being 100ft. south from the middle lode, and the other lodes being about 30ft. apart from each other. The ground is well opened out, and the mine in every place promises to pay the owners handsomely for the large amount of money they have from time to time expended. Mr. F. Evans, the manager, assured me that he is confident of obtaining gold to the amount of at least £100,000 from the lodes that are at present opened up; and, judging from the appearance of the stone, with the large amount of gold that can be seen, I should not consider the estimate the manager has formed of the value of the quartz to be too high. An engine-shaft has been sunk on the main lode in one of the main drives, where winding- and pumping-machinery is about to be erected. The winding-engine and pumps will be driven by compressed air. The manager contemplates trying an experiment of making an air-receiver in the rock; but I am afraid the veins and fissures, although very minute, will prevent it being a success. This company experience great difficulty in getting water to work their crushing-battery at the place where it is erected; and in order to remedy this they are at present making arrangements to drive their battery by electricity. At the time of my visit in November last they had two of Pelton's hurdy-gurdy water-wheels erected in the left branch of Skipper's Creek, which will be worked by a head of water equal to 186ft., having two $\frac{7}{16}$in. jets playing on each wheel. The quantity of water they contemplate using is six and a half sluice-heads, which, at 186ft. in height, is equal with these water-wheels to over 100 horse-power. The pipes leading the water down to the hurdy-gurdy wheels are 22in. in diameter at the intake end, and tapering down to a much less diameter at the bottom. This large amount of motive power is to be employed to drive two Brush dynamos, each of which is calculated to be capable of transmitting thirty-six horse-power. These dynamos are situated about two miles from the crushing-battery, and the current is to be transmitted by a No. 8 B.W.G. copper wire from the dynamo to a Victorian motor, which is placed in the same building as the crushing-battery; and from this motor the stamps are driven. The crushing-battery at the time of my visit consisted of twenty head of stamps, 7cwt. each, having 8in. drop, and making about eighty blows per minute. These were driven by a Leffel turbine, 16in. in diameter, working under a head of water equal to 51ft. Provision was being made to erect another ten heads of stamps as soon as the electric machinery is completed. Messrs. Fletcher and Co., of Dunedin, electric engineers, are erecting the machinery, and have guaranteed the company its success. It being the first crushing-battery that ever has been attempted to be driven by electricity, great

interest is taken by the mining community in the erecting of the machinery. Should it prove a success it will open up a new means of utilizing the mountain-streams and rivers for motive power. The weakest point I observed in this was the wire that is taken between the dynamo and the Victorian motor: it did not appear to me to be sufficiently large enough to carry the current for the distance that the dynamos were situated from the crushing-battery; but I have recently learned that the electric appliance is now working very satisfactorily. The manager of this mine uses nothing at the present time but blankets for saving the gold coming from the crushing-battery. No attempt is made to save the pyrites beyond what adheres to the blankets; but the manager informed me that he has been conducting experiments for saving gold by a new process which so far have been very successful—viz., by using hydraulic troughs on something of the same principle as classifiers and pyramidal boxes for saving tin, but with this difference: that he intends to employ chemical action to convert the gold into a trichloride, and collect it in that state. This company is not sparing any expense where they consider any improvement can be made in crushing-machinery or gold-saving appliances. They are at present erecting a stone-breaking machine to pulverize the quartz as it is taken from the mine, previous to depositing it in the paddock near the battery. This will enable the crushing-battery to get through a much larger quantity of stuff. The pulverized quartz is taken from the paddock where it is deposited after going through the stone-breaker, into self-feeding hoppers, which act automatically and feed the stamps. As I have stated previously, it is only recently that this mine has shown signs of paying; but from February, 1884, to November, 1885, 6,400oz. of gold have been taken from the mine, while the total product is about 15,500oz. At the time of my visit there were seventy-eight men employed. The mine and crushing-battery being situated at a high elevation, it is only during the summer months that crushing can be carried on. There are several other quartz-leases taken up in this neighbourhood, but none of them have been so extensively worked as the Phœnix Company's mine; but now, when the quartz lodes have been fully proved to be rich in the precious metal, there is little doubt but what prospecting will be carried on with far more vigour than has been the case in recent years.

Gallant Tipperary Reef.—This quartz reef has been worked for about twenty years. Companies from time to time have been formed to work it—indeed, it may be said that the same company—the Gallant Tipperary—that is now at work took the ground up in the first instance; but, having expended all their capital, the company changed its name three times, and was re-formed with fresh capital. Nothing was obtained from this reef until about three years ago, when it was let on tribute, the company receiving 15 per cent. on the gross yields of gold. The tributors' time being up, and the mine promising to pay, the company are again working it, and are constructing a deep-level adit to work the stone advantageously, which will, when completed, give from 200ft. to 300ft. of backs. They have struck the reef in the deep level, which shows a little gold in the stone. The thickness of the reef varies from 2ft. to 4ft. This company has a crushing-battery of twelve heads of stamps, which is driven by a turbine water-wheel, the water being brought across the Shotover River in malleable-iron pipes hung on a wire rope. They use quicksilver and blanket-tables for saving their gold.

Aspinall's Reef.—This is a reef that was discovered about sixteen years ago, up Hardy's Gully, about half a mile higher up the range than the road from Maori Point to the sand-hills, by A. Olson, one of the original prospectors of the first quartz reef that was discovered in the Skipper's district. He sluiced the surface, and obtained about 60oz. of free gold by this process. Afterwards a company was formed to work the reef. This new company stoped out about 14 tons of stone, and sent it to a crushing-battery at Skipper's Creek, from which they obtained 48oz. of gold, after which they sunk a shaft on the lode; but, finding the quartz wedge out, they abandoned it. J. Aspinall took this ground up about four years ago, and has been prospecting it off and on ever since. Mr. Aspinall has driven 200ft. along the line of lode, and sunk several winzes, and has recently struck gold-bearing leaders about 18in. wide, which, from the appearance of the stone that is obtained from them, will average about 1oz. of gold per ton.

Macetown Reefs.—Premier Company.—This company are working a quartz reef up the right branch of Macetown Creek, about four miles above the junction with Arrow River. They constructed a tunnel from the face of the hill, at about 120ft. above the level of the creek, for 380ft. in length, when they struck a quartz reef containing payable gold. After striking this reef they drove 220ft. along the lode, and sunk a winze 60ft., from which they are now working. The lode is about 3ft. in thickness, and dips about 4ft. vertical to 1ft. horizontal, having a westerly strike, its course being about 290°, or west by north. The lode is being stoped out from the winze that is sunk in the main tunnel; and in the bottom-level the company is driving westerly along the lode on a dip inclination, conveying the quartz along from the passes on this level to the bottom of the winze in Cornish wheelbarrows, where the quartz is capsized and again shovelled into a small truck or bucket, to be hauled up to the main level, the winding being done by a small portable steam-engine placed at the mouth of the tunnel. The stone, by this means, which averages about 16dwt. per ton, pays the company to work. It may not be out of place here to remark that the reason many of our quartz-mines do not pay for working is the extraordinary manner in which they are opened out and worked; which, I understand, is due in a great measure to the shareholders, who refuse to sanction any expenditure to open up the mines properly before commencing to stope the quartz out.

Therefore a great many makeshifts are resorted to, which are in some cases the means of preventing a systematic plan of operations being afterwards carried on. The Premier Company is an instance of this. If the ground they are now working pays, it would leave a large margin of profit if worked in a systematic manner. The mine is so situated that a tunnel could be constructed on the level with the creek, when all the quartz above that level could be stoped out and run in trucks from the passes into the paddock, instead of being handled about four times. The cost of the additional men employed, and the cost of coals for working a winding-engine, &c., as at present, would soon amount to the cost of putting in a low tunnel; and, when once in, the advantage on the system of working would make quartz pay that cannot be taken out by the present method. The quartz lode in this mine is very hard. The manager informed me that it takes four hours to drill a hole 2ft. 6in. deep. This being the case, compressed-air rock-drills could be used with great advantage, especially where the lode is not of a great thickness. This company has lately purchased a crushing-battery from the Maryborough Quartz-mining Company, which consists of ten heads of stamps, 7cwt. each, and one Berdan. These are driven by an overshot water-wheel, 30ft. in diameter. At the present time they use quicksilver ripple-tables and blankets; but they propose doing away with the use of quicksilver, and adopting blankets entirely. The number of men employed by the company is sixteen. The quantity of quartz crushed from this mine during the year ending April last was 1,596 tons, which yielded 698oz. of gold; while the total yield from the mine has been 2,921oz.

Lady Fair Company.—This company is working on the opposite side of the creek from the Premier Company, and at a higher elevation. They have a tunnel driven for about 610ft.: 360ft. of this is on the line of reef. The only work being done at the present time is prospecting, on which two men are engaged. They formerly worked the reef on the surface and stoped the stone out for about 100ft.; but nothing has yet been got of any importance in the level they are working on at present.

Tipperary Company.—This company's mine is the best in this district. They have recently sunk an underlie-shaft, following the dip of the lode, in the main level going in from the creek, to a depth of 312ft., and commenced to open out levels from the bottom of this shaft in easterly and westerly directions. The underlie-shaft is 6ft. by 3ft. 6in., having partition for winding of 3ft. 6in. square, the other portion being used as a ladder-shaft for the men to get up and down to their work. The quartz is hauled up this shaft in a small truck or box capable of holding 7cwt. of stone. This box has wheels like a truck, and it is kept in position by rails fixed in the shaft. When the box is wound up to the top of the shaft another truck is run underneath it, and the quartz in the box is emptied into this truck from a trap-door which there is at the bottom of the box. The winding in this underlie-shaft is done by a water-balance erected outside the mine. This water-balance is a tank mounted on wheels, which runs on an inclined tramway the same length as the depth of the shaft where the winding takes place. When this tank is at the top of the incline it is filled with water, and the weight of the tank when filled is sufficient to bring about 7cwt. of stone in the box up the winding-shaft. When the tank arrives at the bottom of the incline there is an iron knob projecting which opens a valve in the tank, and allows the water to be discharged. The weight of the empty box in the winding-shaft is sufficient to haul up the empty tank to the top of the incline, to be again refilled with water, so as to bring up the next loaded box. The winding-rope, $\frac{5}{8}$in. in diameter, made of best plough-steel, is carried on pulleys in the main drive to the incline-shaft, where there is brake-gear erected so as to regulate the speed of winding. One man works the brake-gear; and also, by levers attached to telegraph wire, the same man can shut off and on the water to fill the tank or water-balance when it is at the top of the incline. This winding appliance is very simple, and every credit is due to the manager (Mr. Resta) for the manner in which the mining operations are carried on. But, although this mode of winding is simple, it is too slow a process, and only suitable for winding for a small party of men. In conducting larger mining operations it is only mere waste of money in constructing what may be termed a makeshift. This company has been at work for about eight years, and during that period the mining-manager informed me that nearly 15cwt. of gold had been taken out. Since then I have learned that the actual amount was 184,000oz. There are three distinct runs or shots of gold in this mine, all on the same line of reef. The eastern shot is about 130ft. in length, the middle one 77ft., and the length of the western one has not yet been determined. It has been worked for 80ft., and still continues. The general direction of the reef is about 10° south of west, the strike being westerly, and the dip or underlie being northerly about 1 in 12. The width of the lode varies considerably: in some places it is only about 2ft. wide, while in others—as, for instance, at the bottom of the underlie-shaft—the reef is 15ft. wide. The average yield of gold from the quartz hitherto crushed from this mine is about 1oz. per ton. This company has a crushing-battery consisting of ten heads of revolving stamps, 7cwt. each, one Berdan, and one Buddle, which is driven by a Whitlaw turbine water-wheel 3ft. in diameter. They use quicksilver in the stamp-boxes and have ordinary riffle-tables covered with copper plates. Afterwards the tailings go over 16ft. of blanket-tables. The blankets are washed out every hour into tubs, and the blanketings ground up in the Berdan, and thence go through an amalgamating Buddle. There is a large quantity of pyrites in this mine; but no effort has yet been made to save it beyond what is collected on the blanket-tables; and even some of the stuff that has gone through the Berdan and is put aside as waste product

still contains a deal of gold. The crushing-battery is situated about one mile from the mine, and it costs 2s. 6d. per ton to cart the quartz this distance. The number of men employed on this company's works is thirty-two, exclusive of men getting mining timber, &c.

This district, until about eighteen months ago, was very heavily handicapped, as no dray or wagon could be brought within about twelve miles of the mines. All mining-timber, tools, machinery, and provisions had to be packed by horses over the top of a high range, which was not accessible during the winter months. However, this is now mended, and things can be carted to the mines. Mining-timber that formerly cost 10s. per prop can be now delivered for 3s. Laths are now got at £3 7s. per 100 for 5-feet lengths, and sawn timber 17s. 6d. per 100ft. superficial.

Head of Lake Wakatipu.—Invincible Company.—This company's mine is situated on the face of the range on the east side of Rees River, about fifteen miles up the river from the head of Lake Wakatipu. The main reef that the company have been working averages about 12ft. wide. This has been stoped out to a depth of 60ft. below the surface, and 250ft. in length. A branch-lode has recently been discovered going away from the main reef at an angle of about 45°, and at the time of my visit a commencement was made to get a few tons from this reef to test its value. There is a peculiarity about the main lode in this company's mine which does not occur in any other quartz-lode in the colony, that being the extremely loose nature of the quartz compels the stopes to be close-lathed overhead, and in many places face-boards have to be used, which necessitates a large amount of mining-timber. The whole of the lode is highly impregnated with iron pyrites, which is found to contain from nine to ten ounces of gold per ton, and until recently no attempts have been made to save it. The company are engaged in driving a lower level, which will, when it strikes the reef, give about 180ft. of backs. They have also discovered a quartz lode containing gold at about 1,000ft. under the present workings, so that the future of this mine at the present time looks very promising. The company have a crushing-machine consisting of ten heads of stamps, driven by an overshot water-wheel; and they were, at the time of my visit, erecting seven Berdans. Heretofore the stamping-battery was only used, and the gold collected on blanket-tables, the pyrites being allowed to run away among the tailings. The manager, to ascertain whether the pyrites were as rich in gold as that shown by analyses made by Professor Black, collected 11½ tons of pyrites and ground it in a Berdan, and got 108oz. of retorted gold. This led to the erection of more Berdans, in order to treat the quartz more fully before allowing the tailings to run to waste. They likewise entered into a contract with a Pyrites Company that has been formed, to give the latter company all the tailings as they come from the battery, and to receive from the Pyrites Company 15 per cent. of the gross yield of gold that they obtained from the pyrites. This Pyrites Company have erected two classifiers, three pyramidal boxes, and two jiggers to save the pyrites, and were making a commencement to work them at the time of my visit; but the jiggers did not act so well as was anticipated. The company are, however, erecting a rotating convex table 24ft. in diameter, which they anticipate will save any residue of pyrites that gets away from the jiggers. The whole of the machinery used is similar to that employed in the dressing-works. The jiggers are driven by a Little Giant turbine water-wheel 10in. in diameter. The Invincible Company have sixteen men employed underground, and eight men on the surface. Since November, 1882, the date of commencing operations, to the 22nd July, 1885, they have crushed 7,224 tons of quartz, 11½ tons of pyrites, and obtained therefrom 3,800oz. 14dwt. of gold. Besides paying for the machinery out of the proceeds from the mine, this company have paid £2,975 in dividends, and carried £508 to the reserve fund. The average yield of gold per ton has been about 10dwt. 12gr. The returns from this company during the year ending the 31st March last show that 2,602 tons of stone were crushed, which yielded about 1,131oz. of gold, besides 109oz. got from tailings, making the yield for the year 1,240oz. The total quantity of stone crushed from the mine to this date was 8,730 tons, yielding 4,448oz. of gold.

A little further up the range, and extending up the Rees River Valley from the Invincible Company's mine, another quartz lode has been discovered, which promises to be of a highly-payable nature; but as there is not much work yet done it would be premature to say whether it will continue to give such high expectations when properly prospected.

The direction of these quartz reefs corresponds with the reefs at Skipper's, and they are apparently in the same belt of country; but the formation of the lodes is entirely different.

Before concluding with quartz-workings in the Lake District, the whole of the mines may only yet be said to be in their infancy. The great drawback to contend with by want of roads has prevented men with means from embarking capital in mining operations. Hence men with little or no means have been working the ground for a mere livelihood, with the expectations of finding some very rich deposits to enable them to open up the ground in a systematic manner or to sell shares at a high price. The great want is men with capital to go into mining as a commercial venture, not merely holding shares, waiting until some rich patch is struck to raise their value, so that they can be disposed of at a profit, but to open up the mines systematically, employ improved machinery, so that dividends accruing from the working may be a source of income to be depended on.

Lake District.—Skipper's.—J. Aspinall's Claim.—This claim is situated on the point at the junction of Skipper's Creek and the Shotover River. Mr. Aspinall was the first man who took up a mining-lease in this locality. He has been working on this point—principally

on the ground that he now holds—for the last eighteen years. In the early days this ground was held in quarter-acre and 100-feet claims, and Mr. Aspinall bought one claim after another, until now he holds the whole of the auriferous ground on Skipper's Point. The area of ground worked here is about ten acres, and from that area about sixty thousand pounds' worth of gold have been obtained. Of this amount Mr. Aspinall has taken out about £30,000. He is one of the most enterprising miners in the colony. Indeed, it may be said that there are only two individual miners in Otago who have made mining a profession, and conducted their operations on an extensive and systematic manner; and these are John Aspinall, of Skipper's, and John Ewing, of St. Bathan's; both of whom have been paid for their enterprise. Mr. Aspinall has the most improved hydraulic appliances for working his claim. Malleable-iron pipes, nozzles, and grating are all manufactured by himself on the ground. Indeed, his workshop and tools, although he lays no claim to be a mechanic, would not disgrace some engineering establishments, although on a smaller scale. The ground that Mr. Aspinall is at present working is from 140ft. to 190ft. in depth; and from 100ft. to 150ft. of this is loose shingle, which contains scarcely the colour of gold, the wash-drift being within 40ft. of the rock. To get away this large amount of top-stuff fifteen sluice-heads of water are required. This is conveyed in two sets of pipes, one having a head of 300ft. and the other 60ft. A plentiful supply of water is not to be had unless at an enormous expense. The present supply is got from small creeks and reservoirs, which only allow about four months' water in the year. The cost of the hydraulic plant, with tail-races and reservoirs, may be set down at about from £1,600 to £2,000. The yield of gold, although less than was obtained in early years, is still very satisfactory. With the improved appliances for getting through a large quantity of stuff, the ground still pays remarkably well for working.

A considerable population in still engaged in alluvial mining on the Upper Shotover and terraces, some of whom are doing very well. On Monk's Terrace, opposite the sandhills, N. M. Innes has been working for about twenty years, and has still got very rich ground, which is easily worked, being only about 30ft. in depth; but the supply of water is limited, there being not above six months' water in the year. J. McLeod has been at work in this district since it was first opened, and is still making fair wages; but this is due to the system of hydraulic sluicing, which makes water do the work which in former years was done by manual labour. At Stony Creek Terrace W. L. Davis has taken up a mining-lease of fifteen acres, and has been engaged during the last twelve months in constructing a water-race; instead of fluming the gullies on the line of race the water is conveyed in a siphon made of malleable-iron pipes, which are all manufactured on the ground. Mr. Davis discovered very rich ground on Yates's Terrace while constructing his water-race, which he is now working, as well as continuing the construction of the other works in connection with the water-supply for the ground originally intended to be worked.

Mount Criffel.—This is a field where one of the most recent discoveries of deposits of auriferous wash-drifts has been made. Very little was known of its existence as a gold-field until about twelve months ago, although the prospectors discovered gold in this locality about eighteen months previous; but the ground being at a high elevation, or about 4,000ft. above sea-level, where there is no water available for washing the dirt but in the spring months of the year, when the snow melts, and mining operations can only be carried on about six months of the year, owing to the large amount of frost and snow during the winter months, it requires to be rich ground to pay for working. The prospectors of this field were Messrs. Wilson, Halliday, and Beatie; and before they could be certain whether the ground was of a payable character or not, they had to stack the wash-dirt in the summer months, and wait until the next spring before water could be got to wash it. The first season's washing gave them about 300oz. of gold; but last season they were not successful in getting the snow-water to wash the dirt that they had stacked the year previous, owing to not having taken the precaution of covering the wash-dirt with sods. The frost got a complete hold of the loosely-stacked material, freezing it in one solid mass; and before it was thawed sufficiently to wash, the snow-water was gone. They are, however, constructing a water-race from the Luggate Creek, which they expected to have completed before the winter set in. There were at the time of my visit about sixty miners on this field, most of whom were making good wages; but the great drawback is the want of water. The mode adopted for washing the dirt by the most of the miners is this: The wash-dirt is hauled to Luggate Creek, where there is a good supply, or to a small gully on the top of the range where dams are constructed capable of holding about one sluice-head of water for two hours. At the latter place four parties of miners use this water at the same time, each party picking it up after the other has used it; so that by the time it reaches the fourth party it is in a very muddy state. However, with this mode of working the miners are enabled to earn fair wages. Some of the parties had no hesitation in showing me their earnings. One party, Moylan and Hawthorne, are doing extremely well: they have four men employed, and after paying all expenses from the proceeds, they have each over £20 per week to themselves. The wash-drift where a large portion of the gold is obtained from is an old deposit of quartz drift-wash, having all the pebbles greatly rounded, indicating that at some remote period it had been brought there by a stream of water. In some of the claims large trees of petrified wood are lying amongst the wash-drift near the schist rock. Judging from the fracture of those petrified trees, they must have been Manuka at one time. The depth of ground

varies considerably, being from 4ft. to 55ft. deep, having different layers, containing gold from the roots of the grass downwards; but the richest portion of the wash-dirt is about 4ft. thick next the bottom. Craig and party, who have one of the claims in the deep ground, were taking levels at the time of my visit with the view of bringing in a second water-supply from the Luggate Creek; but I have not learnt the result—whether a sufficient quantity of water could be got at the level required to work the ground. On the opposite side of the Luggate Creek from Mount Criffel, and about a mile and a half nearer the Clutha River, further discoveries of alluvial deposits have been made, and thirty miners are engaged at work. This place is termed the Mid Run, and is about 1,200ft. lower than Mount Criffel, which will enable the claims to be worked during the whole of the year. There are likewise about twenty miners engaged in prospecting on the Luggate Flat; but at the time of my visit only one shaft had been bottomed, from which 13dwt. of gold was obtained.

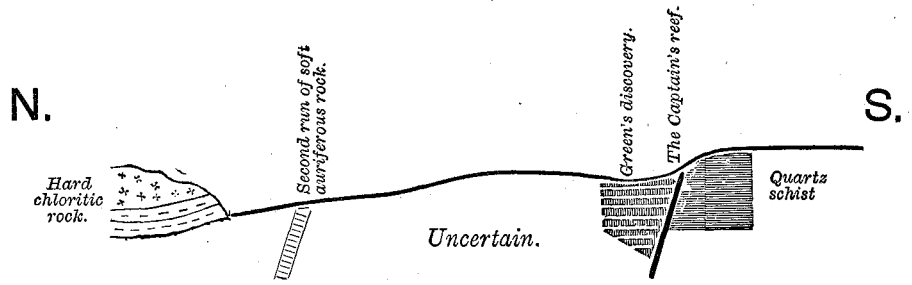
Black's.—There is only a very limited mining population here, no new finds having been got for many years. The old ground is getting pretty well worked out; but some of the miners who have been on this field since it was opened are confident that there is a lead of gold in the deep ground which hitherto has not been able to be worked owing to the large amount of water there is to contend with. In order to enable the deep ground to be tested a tail-race is in course of construction from the Manuherikia River to near the old workings, about a mile higher up the Manuherikia than the Township of Ophir. This tail-race is now so far constructed that some parties have commenced to work the ground adjoining the side of the tail-race; but very little is yet known whether the ground is payable or not.

W. Green's Reef.—This is a new discovery made at Ophir, or what is known as Black's Diggings, where gold has been found in a description of thinly-laminated decomposed schist rock, hitherto deemed stuff where gold was not likely to be found. This reef is situated about thirty chains from the Township of Ophir, at the head of Specimen Gully, where a deal of prospecting was carried on some years ago to find what was termed the Captain's Reef. Small leaders and lodes of quartz containing gold have been found in the locality, and many of the miners in the district always believed that a payable quartz reef would be discovered here. Mr. Green, in prospecting, by chance washed a dishful of this decomposed-schist lode, which is very friable, and was astonished to find gold thickly distributed in the quartz-grit that the schist contained after being puddled. This lode is enclosed by a well-defined foot-wall, and is apparently from 20ft. to 30ft. in width; but the hanging wall is not very clearly defined. However, at a little distance from this lode, on the side adjoining the place where the hanging wall ought to be, is a description of hard chlorite schist. The lode itself is formed in very thin laminations horizontally, having seams running in almost every direction, from horizontal to vertical. These seams are very minute; yet when the schist is broken down they are found to be composed of quartz-grit, and contain free gold as well as small quartz specimens having gold richly disseminated through them, the vertical seams being generally the richest. The bearing of this lode is similar to the generality of quartz reefs in Otago, being nearly east and west, having an underlie to the north. Several holes and trenches have been made along the line of lode for a distance of about eight chains, and gold obtained in nearly all of them. Indeed, there is one shaft about 30ft. in depth, which was sunk several years ago in prospecting for a quartz reef; but the schist being of such a soft, friable nature no one expected to find gold in it, and consequently it never was tested. Mr. Green is taking out the lode in a face, and was, previous to my visit, washing it in an ordinary small cradle, such as was used in the early days of the goldfields, and with this appliance he was able to wash out 1oz. of gold per day. He was constructing a long-tom to wash the stuff; but neither a cradle nor long-tom is a suitable appliance for this class of material. It requires too much puddling to get the whole of the free gold, and when sufficiently puddled the quartz-grit requires to be crushed. The character of the gold obtained is of a very spongy nature where found in conjunction with quartz; but where found in the soft schist it is very fine. Judging from the honeycombed and spongy nature of the gold, the matrix originally containing it, which was probably iron pyrites, has been decomposed and left the gold in a free state. Since this discovery was made several parties have been prospecting for similar lodes in the district, but, so far, have not proved successful in finding any containing gold. Similar decomposed schist occurs in quartz lodes. The quartz is suddenly cut out, and mullocky schist takes its place between the same walls where the quartz occurs. This change takes place in the quartz reefs at Skipper's; but there the schist is much more compact. G. H. F. Ulrich, F.G.S., Professor of Mineralogy at the Otago University, Dunedin, reports to the Hon. the Minister of Mines on this discovery as follows:—

"This is at present exposed and prospected for a distance of 8 to 9 chains, and in one place for a width of near 30ft., running at a strike of E. 10° N., W. 10° S., between two gullies, across the intervening ridge, which is about 60ft. in height. Near the top of this ridge, on the eastern side, are several old shafts sunk by former prospectors, and it is here where Mr. Green first found richly-auriferous quartz specimens, discovered the auriferous character of the stuff presently to be described, and has, so far, carried on most work. The stuff composing the deposit consists of a thinly-laminated, decomposed, soft and friable metamorphic schist—probably originally chloritic mica-schist—showing nearly horizontal bedding, and being more or less abundantly traversed in all directions, from horizontal to vertical, by broken quartz-veins, ranging from a thin thread up to an inch in size. A soft, white mineral occurring frequently in irregular small patches and veinlets

proved on examination to be silicate of magnesia. The colour of the decomposed schist when freshly broken is dark-greyish blue, but fades quickly, on exposure to the atmosphere, to bluish white, interspersed with brown ferruginous spots. According to Mr. Green's trial-washings—some executed in my presence—the gold is distributed through the stuff in hackly, spongy crystalline particles, from the size of a bean down to a state so fine and light as to be hardly recognizable by the naked eye and scarcely retainable in the tin-dish. Besides this, it occurs in the quartz-veins, especially those with a steep or vertical dip, some of which have furnished specimens of great richness, consisting, in cases, of more gold than quartz. A few which Mr. Green showed me would, if the quartz were broken out, yield small nuggets from several pennyweights up to perhaps nearly an ounce in weight. Owing to the irregular distribution of these auriferous-quartz veins, it is not possible to form any estimate as to the gold-contents of the stuff in the average, but so much can with certainty be foretold that, should the ground, on further exploration in strike and depth, prove as rich throughout as at the place about the old shafts, Mr. Green will be handsomely rewarded.

"Regarding the geological character of the deposit, and what it represents in a mining point of view, I was enabled to make the following observations: An open cutting between the old shaft shows that the soft stuff is sharply cut off on the south side by a hard quartz-vein, a few inches in thickness, dipping N. 10° W. rather unevenly, at angles varying from 60° to 70°. Beyond this quartz-vein, which is called the 'Captain's Reef,' and for the prospecting of which the old shafts have been sunk, follows thinly-laminated micaceous quartz-schist, showing nearly horizontal bedding. The quartz-vein has mostly been removed off the quartz-schist; but at one place a patch is left, showing a finely-polished surface, with deep striations normal to the line of strike—a so-called slickenside—whilst the ends of the laminations of the soft stuff are slightly turned upwards on the quartz-vein. Whether towards the north a similar wall exists has not been proved as yet, and nothing can be seen on the smooth surface for a distance of about two chains, where Mr. Green has prospected with fair results of fine gold from the gully upwards to near the top of the ridge, a second run of soft decomposed rock striking parallel to the first, but showing a lighter colour and more abundant, and larger ferruginous patches. Adjoining this farther northward follows chloritic mica-schist, which, though soft in the gully through action of the water and richly impregnated with pyrites, becomes soon hard up the ridge, exhibiting there massive rocky outcrops. The following sketch cross-section will serve for illustration of the several features mentioned:—



"From these features, considered in connection, clear evidence is afforded by the slickenside and the adjoining quartz-schist that in the line of the Captain's Reef *a fault* has taken place, with the result of a downthrow of the soft auriferous rock from probably a very high level; whilst in case of a second wall being found to the northward beyond the second run of soft auriferous rock—for which there is some probability—the whole of the intervening mass would constitute a huge mullock reef, such as exist on a smaller scale at Skipper's Creek and many places in Victoria. The alteration of the rock and its impregnation with gold, within the two lines of fissures, or at any rate off the faulting fissure running along the Captain's Reef, is in my opinion mainly due to the meteoric waters once circulating in this fissure, an hypothesis for which the fact speaks somewhat in favour of the richest specimens and best prospects of loose gold having been obtained by Mr. Green close along the Captain's Reef, which itself has so far not proved gold-bearing. Judging from similar occurrences in Victoria, a great part of the fine gold is doubtless derived from decomposed auriferous pyrites, an ore which may likely occur as a rich impregnation of the rock in depth below permanent water-level. There can hardly be a doubt that the fault, and with it the deposit—though whether it be of the same richly auriferous character is uncertain—extend farther westward in strike than at present opened. Several chains westward, on the western side of another gully, Mr. Green obtained, from greenish rotten rock, fair prospects of fine gold, of a similar character as occurring in the soft rock of his workings. Prospecting farther westward would, however, be connected with difficulties, as the line of strike of the fault runs across a drift-terrace into the flat, and extends through the Township of Ophir. Towards the east the chance of the extension of the deposit, at least of some width, seems unfavourable, as the ridges in that direction show in the line of strike of the fault massive outcrops of hard metamorphic rock rather close together.

"Regarding the extraction of the gold from the mullock, the softness and friability of the latter permit its quick conversion into thin mud by the action of water, and therefore the use of a puddling-machine, with a plentiful supply of clear water, and the crushing of the quartz portion remaining in the machine by means of a Chilian mill, would, in my opinion, be the most advisable process to adopt.

"Since Mr. Green's discovery several places, showing similar decomposed rock, have been tried on the ridges in different parts of the district, but apparently without success in finding payable

gold, the geological conditions of Green's mine being evidently wanting. Only one of these trial-places, called McLeod's workings, deserves, I think, some further exploration, as the run of rotten rock seems to strike nearly in the same direction as that of Green's, and prospects of fine hackly gold are said to be obtainable from it by tin-dish trials. Considering the great scarcity of quartz reefs in the district, in connection with the fact that there are a number of surface-workings and dry alluvial gullies—high above the boundary-line of the Manuherikia Lake-drift—which have yielded payable gold from gravel very poor in quartz, it is highly probable that such gold was derived from mullock-deposits similar to that at Green's, and the district therefore certainly deserves more extended and systematic prospecting."

With regard to the method of working this deposit, I quite agree with Professor Ulrich that a puddling-machine would be the best method of first dealing with the material, and afterwards crushing the residue in either a Chilian mill or Wheeler's pans. The schist, being extremely friable, would be carried off by the action of puddling, leaving only the small quartz-grit to be finally dealt with.

Rough Ridge.—Otago Central Company.—This company has been in operation for several years, but has not yet been successful in finding a large body of auriferous quartz of a payable character. The Rough Ridge abounds in quartz leaders containing gold, in some of which rich specimens are found. Several gold-bearing reefs have been from time to time found in the locality and partially worked; but they do not run so regularly as in other parts of the colony. The reef that is being worked by the Otago Central Company averages from about 8in. to 10in. thick. In some places it runs out to about an inch in thickness, and in other places it widens out to 2ft. There is a little gold to be seen in the stone; but the quantity to be obtained, unless very rich, will not pay for working. This company is working from a tunnel driven in from the side of the range. At the end of this tunnel a stream of falling water can be heard, which indicates that they are close on some watercourse, or, probably, a large reef. However, they have stopped operations at the end of the tunnel at present, and are stoping out a leader of quartz, which I have before described, with the view of having it crushed at an adjoining battery.

Tinker's.—This is situated about eight miles from Black's, or Ophir, at the foot of the Dunstan Range, where some very rich alluvial deposits have been found. The Blue Duck Company here, three years ago, washed out 2,400oz. gold with eight men in seven months and a half. This company have been steadily paying good dividends, and, although the ground is not so rich as it formerly was, it still pays the shareholders very well. Adjoining this company's ground the Matakinui Company have a mining lease which they work by hydraulic sluicing. They completed their water-race about nine months ago, and have now got their ground opened up, which promises to pay well. Their water-supply is taken from the Matakinui Creek, and is brought across Spottis Creek in a siphon made of malleable-iron pipes, 14 gauge, 15in. in diameter, and 1,518ft. in length, having 60ft. of head at the intake end. The tailings from this company's workings go down into Spottis Creek, thence down a new tail-race that has recently been constructed through the ground purchased by the Government a short time ago from Messrs. Laidlaw and Crawford.

The following table will show the principal companies at work in this field, the number of men employed, and the amount of water used by each company:—

Name of Person or Company.	Number of Men employed.	Number of Sluice-heads of Water used in working the Ground.	Head of Water or Pressure used, in Feet.
Blue Duck Company	8	14	130
Matakinui Company	8	6	180
Undaunted Company	8	12	250
Reid's Company	6	5	180
Sims and party	6	4	..
	36	41	..

Altogether there may be from eighty to a hundred miners employed at Tinker's; but the companies mentioned carry on the principal works. Since the purchase of Laidlaw and Crawford's property by Government, the miners have constructed about three miles of a new tailing-channel, and cut a ditch a hundred chains in length to divert the course of Spottis Creek.

St. Bathan's.—This is a district which has contributed its steady quota of gold ever since it was opened in 1863. During the last year about 4,000oz. of gold were obtained from this field, which includes Cambrian's. There are about a hundred miners steadily employed here, all engaged in hydraulic sluicing. One of the most enterprising miners of the colony lives in this locality—Mr. John Ewing, who carries on several large undertakings, and is generally successful in anything he undertakes. About three years ago he purchased a claim at Vinegar Hill for £1,100, and put a hydraulic plant on the ground costing about £2,000. He has spent in wages, since the purchase of the ground, £6,000, and paid £1,600 for water. In all, this claim has cost him £10,700, out of which he has only yet received gold worth about £7,000; but from the remainder of the ground that is still unworked he anticipates to be well paid for the

investment. The ground is not rich; but the systematic method of working enables him to put a large quantity of stuff away, and thereby make very poor ground pay. The miners here combine together to construct large tail-races in order to get sufficient fall to work their ground. There are large deposits of quartz-drift in the neighbourhood of St. Bathan's which contain a little gold all through it, and some of the layers are very rich. This drift is of an old formation. At the time it was deposited it must have been in horizontal beds; but now it is found lying at all angles from vertical to horizontal, but always corresponding with the angle of the Silurian rocks which it lies against, showing that after it had been deposited the whole country had, by some freak of nature, been tilted up. The quartz-gravel is all rounded, as though at one time it had been greatly washed and tossed about with water. In some places there are beds of leaves 5ft. in thickness, and so perfectly are they preserved that the leaves of the *Weinmannia racemosa*, which is common to all parts of New Zealand, can be easily distinguished. There is no regular run or lead of this quartz-drift, but it is found here and there all over the district. The difficulty is to understand where it had originally come from, as none of the present mountains in the vicinity outside a certain limit contain this formation. It appears to follow round the valley from the foot of the Dunstan Range at the Devonshire Lead, near Tinker's, going through Cambrian, Vinegar Hill, St. Bathan's; thence following round the foot of the mountains to Naseby; and again it is found on Mount Burster, about 4,000ft. above sea-level, where rich deposits of gold have been obtained; thence through the valley of the Maerewhenua. It is to work these deposits that the sludge-channels at St. Bathan's and Muddy Creek are being constructed.

Mount Ida.—This is a field that in former years was known as the Hogburn Diggings. Some of the gullies were very rich in auriferous deposits; but after these were worked out in the ordinary claims mining was chiefly, and is now, confined to the terraces, which contain auriferous wash, although generally of a poor quality. Recently the Mount Ida Water-race, which was constructed by the Government some eight years ago, has been extended to Spec and Home Gullies and the adjoining terraces, which are taken up in mining-claims and promise to give fair returns. There is a large area of ground in the Mount Ida district which this water-race commands that has never been prospected, and which may yet be found to be profitable for working.

SOUTHLAND.

Waiau River.—Gold has recently been discovered on the sea-beach at the mouth of the Waiau River, and some very rich patches have been found. It was discovered in August last by Arthur Young, a resident at Orepuki; and up to the 29th November, the date of my visit, nine men had obtained gold worth about £1,000. One man—Mr. Devonshire, a hotelkeeper at Orepuki—got from a patch of ground not more than 25ft. square £250 worth of the precious metal, besides a quantity of platinum, which he did not consider of sufficient value to save. The Waiau River when it first comes to the sea-beach is divided into two branches, one branch going westerly and the other branch easterly. These branches run parallel with the ocean-beach, having a bank of shingle between them and the ocean. The eastern branch follows the side of the terrace for nearly three miles. About twelve months ago the river cut through this bank of shingle, and left about forty chains of its old bed, which now forms a shallow lagoon, rising and falling with the ebb and flow of the tide. It was on the land-side of this lagoon gold was first discovered, and where the gold-workings are now situated. Several miners have from time to time found gold in the wash-drift up the Waiau River, but never in sufficient quantities to pay for working; but the gold now found on the beaches is of the same quality, and totally different from that obtained on the beaches at Orepuki, which is only seven miles distant. The gold found at Orepuki being worth £3 16s. per ounce, while that found on the Waiau Beach is only worth £3 8s. per ounce. This proves that the gold must have come from the interior, and has been washed down the Waiau River; and will probably lead to further discoveries being made. The wash-dirt is about a foot in thickness, and has from 2ft. to 5ft. of shingle on top of it; but, as the workings are only as yet confined to the edge of the lagoon, gold may be traced into the terraces. There is a large quantity of ruby sand in the wash-dirt, resembling that found on the ocean-beach between the mouth of the Rakaia River and the mouth of Lake Ellesmere, in Canterbury. The gold is of a fine scaly character, and shows that it has been ground up to a great extent by boulders travelling in the bed of the river. There were at the time of my visit twenty-five miners on the ground, all of whom had claims that were paying them good wages; but, unless gold is found in the terraces or traced further up the river, the whole of the present known extent of ground that can be easily worked is already taken up. The mode of washing the dirt is with small quicksilver-cradles lined with copper plates, so that a man can only wash a very limited quantity of stuff per day. At ebb-tides gold can be taken up with a shovel from the bottom of the lagoon; but, there being no means of draining, the only way of testing it properly would be by dredging. I feel confident that dredges will yet be employed on this river on the same principle as those at work on the Clutha; but this will take time, as further prospecting will require to be done.

Orepuki.—There are still a number of miners engaged at work in this locality, and the ground is paying those who have water very good wages. All mining operations here are confined to hydraulic sluicing.

Merivale.—Gold has recently been discovered here by Messrs. Fraser and McGregor; but up to the time of my visit on the 30th of November last nothing of any importance had been found. I prospected in several places, and found colours of gold, and was shown small samples, but nothing of a payable character. The place where the prospectors are working is situated about two miles and a half south of Merivale Station, on the end of the Longwood Range. The gold is of a coarse, spongy nature, resembling quartz-gold, and evidently has not travelled far. Mr. Richardson, who has a share in the prospecting-claim, showed me everything that was to be seen, and stated that there were about seventy miners altogether on the field, but they were scattered here and there over a large area of ground covered with heavy bush, without any tracks, some of the parties being six miles further south than the prospectors. One man came to the prospectors' claim while I was there, and stated that gold had been got in a quartz reef a few miles further along the range, and that the reef was pegged out for a long distance; but the time at my disposal would not admit of visiting the locality. There were several quartz leaders which had been cut at different places on the range near the prospectors' claim; but the quartz appeared of a very barren nature. From the appearance of the country and the character of the gold I saw, I think this is a place well worthy of prospecting, and a place where gold is likely to be obtained, both in alluvial drifts and in quartz. A few pounds would be well spent here in cutting lines through the bush to allow prospecting to be carried on. I have to thank Mr. Hirst, M.H.R., who kindly accompanied me both to this field and the Waiau, and gave me a deal of useful information respecting the nature of the country about Longwood, with which he is well acquainted.

West Coast, Westland.

Humphrey's Gully Company.—This company's working is situated at Humphrey's Gully, near the Arahura River, about thirteen miles from Hokitika. The company holds mining-leases comprising an area of about two hundred acres, which is intended to be worked by hydraulic sluicing. In order to conduct mining operations on an extensive scale, this company has constructed the largest water-race in the colony; but now finds it will have to be extended to the different tributaries of the Arahura River, and probably to the river itself, before a sufficient supply of water is obtained. The present supply is taken from Granite Creek; but this is only capable of giving about eighteen sluice-heads for sixteen hours per day. The works in connection with this water-supply are as follows:—

Headworks.—A dam has been constructed in Granite Creek by an earthwork embankment, being about 3 chains long on the top and 35ft. deep, having a puddle-trench in the centre 14ft. wide at the bottom and 6ft. at the top, while the total width of the embankment on the top is 12ft. It has a slope of 1 in 3 on the breast or inner side, which is covered with broken metal, and the outside or back slope is 1 in 2. An outlet-tunnel is constructed on one end of the embankment through solid rock, with a sluice-gate fixed at the intake end, the frame for which is set in concrete. The sluice-gate is constructed with planks 6in. in thickness, and covered with boiler-plate on the side next the face of tunnel, and slides on the face of iron rails, which are bedded into the concrete. The main sluice-gate is 5ft. high and 4ft. wide, and has a relief-gate in the centre 18in. by 12in. Both of these gates are lifted with geared pinions and screws. When the main sluice-gate was first constructed it was found that one man could not raise it with the gearing, and this led to the relief-gate being constructed in order to lessen the pressure on the main gate, which is equal to about twenty tons when the dam is full. The dam is capable of holding 5,300,000 cubic feet of water, or about thirty sluice-heads for two days.

Water-race.—The water is carried from the dam in an open conduit for 40 chains, where there is a flume constructed 59 chains in length, having a maximum height of 45ft. This flume is 5ft. 4in. wide and 4ft. deep, having a fall of 33ft. per mile. At the lower end of this flume there is an open conduit and several short tunnels, 6ft. wide at the bottom and 5ft. deep, constructed on a grade of 1 in 660. The water is then taken through a high range by a tunnel 60 chains in length, which took three years to construct, owing to blue reef, or what is termed pug, having been met with, which time after time filled up the tunnel for 6 chains in length, causing deviations to be made from the straight line to try and cut through better ground. This tunnel, which under ordinary circumstances ought to have been constructed for at most £6,000, cost about £11,000. The total length of this water-race is between six and seven miles; but the company is now constructing an extension above the headworks for four miles further, which their engineer estimates will give at least ten additional sluice-heads of water in dry weather. Of this distance, 2 miles 60 chains are already completed, and the remaining distance in course of construction; but, judging from the area of the watershed of the creeks that will be brought in when this extension is completed, there will not be a permanent supply to fill the race, which is capable of carrying a hundred sluice-heads of water. This, however, can be obtained by still further extension of about four miles to the Arahura River.

Workings.—The ground is worked from two faces, in one of which there are two 6-inch nozzles, and in the other one 6-inch nozzle, under a head of 220ft.; but the supply-pipe for these nozzles is at the present time far too small to give the effective force of water from the nozzles on the face, the supply-pipe being only 15in. in diameter at the top. This is so fixed that a large quantity of air is drawn into the pipe, which destroys the solidity of the force. The company's engineer, Mr. McArthur, informed me that he was getting a larger pipe in place of the present one, which will, no doubt, give a far greater effective force to the

water, and therefore will do much more work. The tail-race from the face where the two nozzles are at work is 3ft. wide in the bottom and about 2ft. deep, while the other tail-race is only 2ft. wide; both of which are paved, partly with wooden blocks 8in. thick, and partly with old iron rails and hematite-iron blocks. The wooden blocks last about three months; but there are very few stones in the wash-dirt, and these are of a very soft nature. Both tail-races have grizzles at the sides, covered with coir matting, for saving the fine gold. The faces of the workings are about 300ft. high, and have a little gold distributed all through the dirt. With a large supply of water, and taking the quantity of gold that is being obtained at present, the ground ought to be made to pay handsome dividends; but still, it is very questionable if ever it will pay a large percentage on the capital of the company, which is £150,000, of which £77,000 is declared paid up, leaving the actual capital of the present company £73,000. But the present company was re-formed after the works were in course of construction, the previous company having paid up £10,125; so that it may be said that the real capital is £83,125, of which £64,695 is paid up, leaving an available capital for the extension of works of £18,430. The present company commenced mining operations in June, 1885, and since that date have obtained gold to the value of £3,318, while the expenditure on wages on the mine, including the cost of opening out and constructing tail-races, has been £3,221 5s. 7d.; which shows a very satisfactory result, considering the limited supply of water that they at present have. The gold obtained by the old company was 62oz. 10dwt., representing a value of £240 1s. 5d.; thus making the total value of gold obtained from the mine £3,558 1s. 5d. This company has been now steadily sluicing for about six months; and the total quantity of gold obtained from the ground, including getting the claim in order, is about 935oz. The last washing-up gave about 300oz. There are sixteen men employed, working in two shifts of eight hours each.

Rangitoto Silver-mine.—This mine is situated at the side of Mine Creek, about 1,700ft. above sea-level, on the Mount Rangitoto Range, about eighteen miles by the road from Ross. The ore was first discovered in the side and bottom of this creek, where it is said very rich silver specimens were found; but the outcrop of the lode as now seen on the side of the creek does not contain a large percentage of silver. It is from 3in. to 6in. in thickness of solid iron-pyrites, containing gold, silver, galena, and zinc-blende, with a large proportion of arsenic and sulphur. The principal tunnels were full of water, slips having come down from the face and closed the mouths, so that I could not see the principal workings; but, from a quantity of ore that was stacked in a paddock, and from information I received from Mr. James Bevan, who accompanied me, the lode widened out to about 3ft. in thickness. The stone or ore in the paddock corresponded with this, as it was in large solid blocks, some of which were 15in. by 20in.; but here the iron-pyrites was mixed up with quartz. There has been a great deal of work done in this mine, and a number of tunnels constructed; but there seems to have been no systematic mode adopted for either working the mine or treating the ore after it was taken out. The lode or vein of iron-pyrites is dipping on an angle of about from 20° to 25°, having hard metamorphic clay-slate on top and bottom. In some places, where the lode is exposed in one of the tunnels, the pyrites is decomposed, and it appears as a vein of red oxide of iron mixed with soft quartz. It is about eight years since any work was done at this mine. The ore as it was then treated proved not payable for working; the principle adopted for treating the ore being similar to that for extracting gold from quartz. A crushing-battery of three heads of stamps is still on the ground, an amalgamating-barrel and two small buddles; but it appears that very little gold or silver could be got by this process. The company subsequently erected an open roasting-pan, made of wrought iron, about 16ft. long and 8ft. wide, to calcine the ore before crushing. The remains of this pan are still standing. I examined the tailings lying around the battery, and was surprised to find them full of quicksilver; and on washing some in an old fry-pan in a short time I collected about 20lb. of quicksilver and from 6dwt. to 8dwt. of gold and silver; so that, judging from the appearance of the treated material, the company could never have taken a great deal of gold and silver from the ore: whatever there was still remains in the tailings. The machinery and process of treatment adopted was totally unsuitable for this class of ore. The ore would require to be crushed dry by rolls or stamps, the former being preferable, and the crushed material calcined in a reverberatory furnace with a small quantity of common salt, until all the sulphur and arsenic were dispelled and the ore chlorinized; afterwards ground up in pans and amalgamated with quicksilver. This I consider the cheapest and most profitable mode of treatment. From what I have seen of the ore, and the thickness of lode as represented to me by Mr. Bevan, I think it is of a payable character for working. Mr. McLymont, assistant to Professor Black, accompanied me to this mine, and made several chemical tests of the ore, which showed to have about two parts of gold to one of silver, with traces of galena and zinc-blende. About 20 chains higher up Mine Creek there is a quartz reef from 12ft. to 16ft. wide cropping out, but it appears to be of a barren character. It is full of mica; but very little iron-pyrites is discernible. Mr. Bevan took me over the top of the mountain to see another mine, which is known as Linemann's Lease, and was represented as having given 2oz. of gold per ton; but on getting there we were greatly disappointed: there had scarcely any work been done, and the only thing that could be seen was a small vein of iron-pyrites about three-quarters of an inch in thickness. This is a portion of the country that is well worthy of prospecting, and a locality where gold, silver, tin, zinc, and copper may be found. The Silurian rocks adjoin the granite at Mine Creek, in the Rangitoto Silver-mining

Company's ground, on the side next to the Mikonui River; and the granite is again found on the south side of the Waitaha River.

Ross.—This district still continues to support a limited mining population. A few miners are working up Donnelly's Creek and around Ross; but the principal workings are confined to the Ross United, Prince of Wales, and Mont d'Or Gold-mining Companies. The great excitement about the discovery of the Cedar Creek reefs has entirely subsided. There are now only four men, employed in driving a deep-level tunnel to try and cut the reef at a lower level. These reefs were first discovered in the bed of Cedar Creek, where rich specimens were found; but the whole of the stone in the creek has been taken out as deep as it was possible to work it for water. Several tunnels have been driven, and the reef cut; but no stone of a payable nature was discovered beyond that in the creek, which may be accounted for in the following manner: The reef is running in an easterly and westerly direction, having a strike easterly of about 1 in 3. The tunnels, being driven on the east side of the creek, only cut the top of the reef, and left it dipping under-foot. In order to show me the reef and the likelihood of it paying, the men sunk a hole in the bottom of the first tunnel, and took out several specimens containing gold; none of which were rich, but they showed that there were good indications of a payable reef being found in the locality. There has really very little prospecting been done here to warrant the great excitement that prevailed at the time the reef was discovered. A low-level tunnel is now being constructed that will test whether the lode continues to go down carrying gold. This low-level tunnel is now driven for 150ft. at a level of about 200ft. below where the reef was discovered in the creek, and will require to be constructed for about twelve chains in length before it cuts the line where the reef is supposed to run; but, even when it is constructed for this distance, it is questionable whether it will be sufficiently low to cut the reef if the strike is going on the same inclination as found on the top. However, this can be determined by a proper survey. The country through which this tunnel is being constructed is very solid, having the strata all dipping uniformly in the same direction, which shows, apparently, that it is not a slip from the main range. The reef is about 2ft. in width on the surface, and should it continue to go down there is every probability of a good, permanent, payable lode being found.

Ross United Gold-mining Company.—This company holds an area of two hundred acres of Ross Flat, comprising almost the whole of the old workings. In the early days rich deposits of gold were found in this ground on different bottoms, and the gold-bearing layers driven out, leaving the ground standing on timber and the stones that were taken out of the wash-dirt. These different gold-bearing layers were in many instances difficult to follow, owing to the bottom on which they were formed. In some instances the bottom resembled the wash-dirt; and when a poor patch occurred in these layers it was considered that the bottom had not been followed: therefore, in many instances the gold-bearing layer was left sometimes under-foot and sometimes over-head the ground that was blocked out. Although the ground above water-level was then supposed to be worked out, it has since been proved that sufficient gold has been left to work the whole of the old workings in a face. Since the stoppage of the drainage-engine in 1872 private parties have been working in this old ground by carrying an inclined tramway down to water-level, and hauling the whole of the dirt up to the surface by reversible overshot water-wheels, and putting the whole of it through a sluice-box. The large quantity of water in the deep levels prevented any work being carried on here without the aid of heavy pumping-machinery to drain the ground. About five years ago a large company was formed to work the deep levels, and a lease of a hundred acres was given them on consideration of their erecting heavy machinery to drain the water. The first company expended all their capital without getting any gold. The company was then re-formed under the title of the Ross United Gold-mining Company, with a nominal capital of £150,000. Of this amount £103,500 is declared paid up, leaving the actual capital £46,500, of which £44,148 15s. is paid up. The actual expenditure in working the mine has been £37,370, and the value of gold obtained £10,108 7s. This company has bought out the whole of the private claims on Ross Flat; so that now they hold the whole of the ground where the rich leads of gold have hitherto been found, comprising an area of about two hundred acres. In order to drain as much of the ground as possible they cut a tail-race from the sea-beach, which is about 90ft. below the level of the original surface of ground on the flat. After completing this tail-race they commenced sinking a shaft on the terrace in order to avoid what was then considered the wet ground; their object being, when the shaft was down sufficiently deep, to drive out into the flat, and work the deep levels. It was found when the deep ground was worked formerly that there was scarcely any water below 160ft., and therefore they anticipated to be able to work the solid ground without tapping the water in the old workings; but in sinking the first shaft they met with pug they were unable to cope with, and had finally to abandon it and sink another at the bottom of the terrace on the flat, which is now down to a depth of about 340ft. In sinking this shaft they went through seven different gold-bearing layers, but none of these proved profitable to open out on. The company abandoned this deep workings for a time, and turned their attention to the upper levels above the level of their tail-race, and have erected elevators for lifting the tailings to a height of 60ft., and then by an inclined tramway to a further height of 120ft. The inclined tramway runs under a shoot where the elevator's buckets empty, and the door on this shoot is worked by hydraulic gear, which raises and shuts it when the truck is full. They are now working the whole flat on a

face by hydraulic sluicing, allowing the muddy water to pass into the underground tail-race, taking the tailings and stones up to the surface by elevators and tramway. In adopting this system a large paddock has to be made before there is room for a sufficient length of sluice-boxes to be placed in the bottom, and room to stack the stones; therefore it will take a long time yet before the full benefit of this system is obtained, as the large stones have now to be broken up and sent up to the surface, whereas they can be stacked in the bottom when the paddock is sufficiently large. This will likewise enable the elevators to lift more of the fine tailings, and consequently the ground can be washed more rapidly. The quantity of stuff washed in the paddock is limited to the amount of tailings and stones that the elevators and trucks on the inclined tramway can take up. According to data supplied me by the manager, the greatest quantity of stuff lifted by the elevators and trucks is about 19 cubic feet per minute. This shows that, although the buckets of the elevators have a capacity of 5 cubic feet, in the ordinary course of working they do not lift more than about 3 cubic feet each. This may occur through large quantities of stones being lifted, which takes up more space in the buckets than fine tailings, which set close together. The way I arrived at the quantity of material lifted was from the following data supplied by Mr. Wylie, the manager. He informed me that the greatest quantity of stuff yet lifted was 163 trucks, each holding 30 cubic feet, in four hours and a quarter. When the trucks are at the top of the incline they run into kick-ups, and are emptied on to an iron grating made of iron rails. The fine stuff falls into a sluice-box, and is carried away by a stream of water to Donnelly's Creek, and the stones fall into trucks, which are run out and emptied over a tip-head. Annexed is a sketch-plan of the elevators and tramway, showing the general arrangement. This mode of working has not so far been remunerative to the shareholders; and this appears to have induced them again to open out in the deep shaft, to try and find the bottom that Mr. Cassius was working on previous to the stoppage of the drainage-engine in 1872. They therefore opened out at 315ft., and constructed several tunnels in different directions into the flat, and one towards Cassius' old workings; but were not successful in finding any gold of a payable nature on this level. They constructed a pump above the tunnel, and afterwards sunk a monkey-shaft near the end of one of the tunnels furthest out in the flat, and struck good payable gold in the monkey-shaft at a depth of about 10ft. below the level of the tunnel. The wash-dirt here is about 5ft. 6in. in thickness, and from the prospects ought to pay handsomely for working. From this monkey-shaft, which is about 6ft. 6in. by 4ft., 2oz. 8dwt. of gold was obtained, which is equal to about 9dwt. per cubic yard. This ground cannot be worked, however, until another chamber and main tunnel is constructed at a deeper level; and it is questionable whether the present pumping-appliances will be able to keep down the water when the ground gets opened out. From my previous knowledge of the ground, the layer that has now been struck is entirely different from that worked by Cassius, the Morning Star, and the Excelsior Companies; and, from what I know of the levels, it is a little deeper. The wash is blue, mixed with a number of flat and angular slate stones, whereas the layer worked by the other companies was brown wash, mixed with a large quantity of soft sandstone floating reef, greatly rounded. The appearance of this layer exactly corresponds with a gold-bearing layer that was found in the Morning Star Company's shaft about 2ft. under the brown wash, and about 285ft. below the level of the surface. Taking the dip of the ground in the direction of where the gold has now been found would also correspond with this level. The present pumping-appliances are two hydraulic engines, 18in. cylinders with 9ft. stroke. These are working under a head of 314ft. of water, and are placed in a chamber in the shaft on a level with the tail-race. Each of these engines works two columns of pumps 15in. in diameter. One of them works one column 125ft., and another 71ft. The other engine works one column 207ft., and another 73ft., working seven strokes per minute with about 6-feet stroke; or, in other words, the engines are nearly working up to their full power. I would here point out the great necessity of better provision being made before blocking out the deep workings is commenced, and also before continuing any tunnel further in the direction of Cassius' old workings. The water in the old workings stands 200ft. above the tunnel from the Ross United Company's shaft, and there is no ladder-way or any way for the workmen to get away in the event of breaking into the old workings. If such an event happened at the present time the whole of the men underground would be drowned. The present shaft is divided into three compartments, one for the pumps, and two for winding; and the pumping-shaft is so full of pipes that it would simply be useless to attempt to put ladders there; another shaft or compartment is required for ladders alone. The Regulation of Mines Act ought to be strictly enforced here in compelling flank-bores to be kept well ahead of any drive going towards the old workings. This is all the more requisite, as there has been no correct survey of the old workings kept, and the company is entirely in the dark where they extend to. They do not know the exact level they were on, neither the dip nor inclination of the layers worked. Except these provisions are strictly enforced, there will be a catastrophe as great as that which occurred at Creswick Creek some years ago.

Prince of Wales Company.—This company's property now belongs to the Ross United Gold-mining Company, which consists of a mining-lease of sixty acres, elevating machinery, with head- and tail-race. The ground, previous to the formation of the Prince of Wales Company, was held in small claims, which paid the shareholders good wages for working. These claims were all purchased, and a company formed to work them on a more extensive

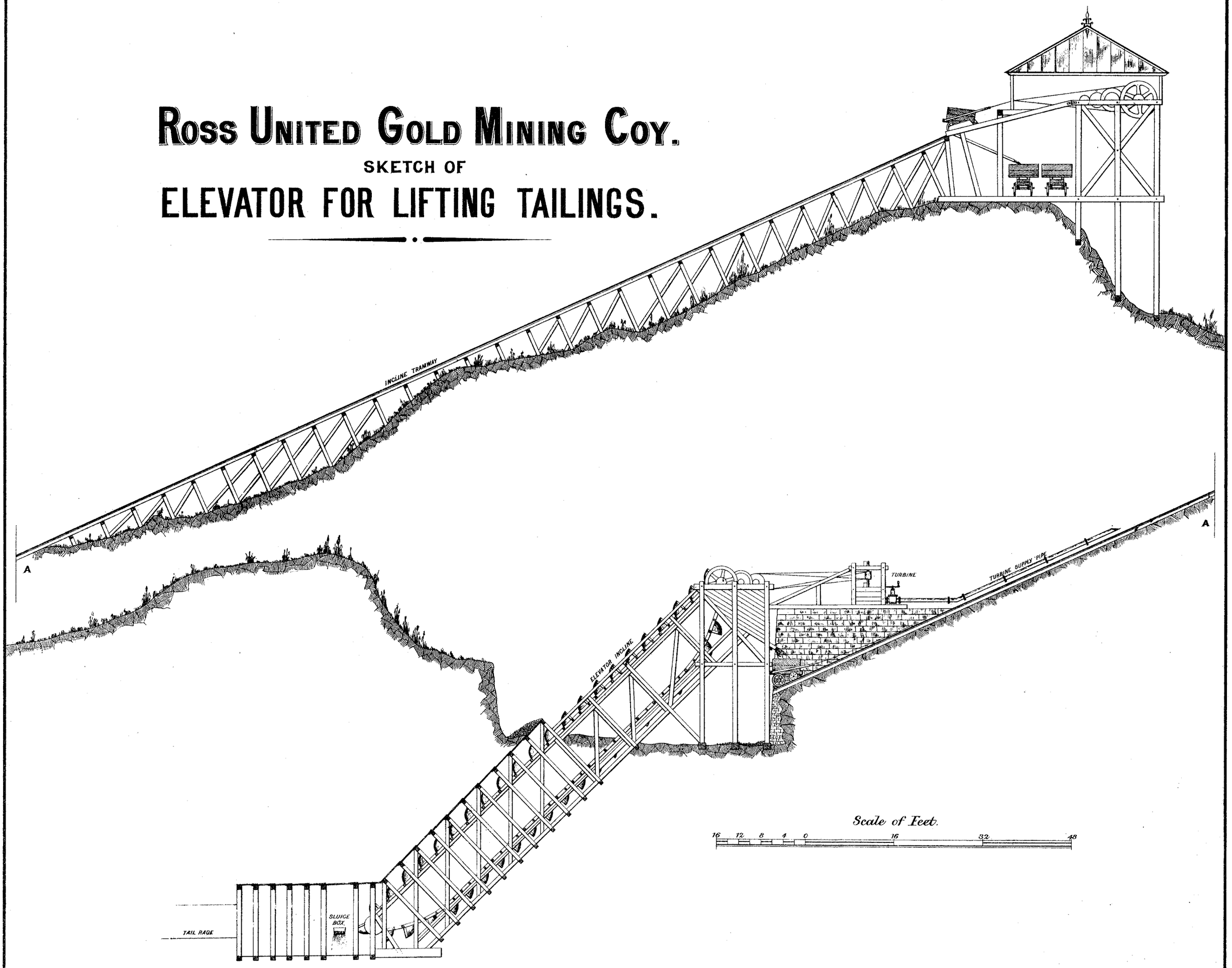
scale. A tail-race was constructed from the ocean beach for 33 chains in length, having a fall of 3in. to the chain. This enabled the tail-race to drain the ground 40ft. under the level of the surface at the workings. This tail-race is used in carrying away the water from the hydraulic-sluicing operations which are carried on at this level. The whole of the tailings from the sluice-box pass into a well about 6ft. deeper than the tail-race, and from this well the tailings are lifted to a height of 77ft. with elevators, tipped on to a screen which separates the stones from the fine material and enables them to be run away in trucks, while the fine stuff falls into a sluice-box and is carried away with water on to the flat. The elevating-machinery is driven by a turbine water-wheel constructed on the Whitlaw principle, placed under a head of water 37ft. 6in. in height; but it is only in wet weather that sluicing operations can be carried on, as the quantity of water available is not nearly sufficient to work the machinery in fine weather. But an ample supply can be obtained by extending the head-race to the Mikonui River, which is estimated to cost about £4,000. The want of a good water-supply seems to be the mistake that a great many companies make, causing their property to become almost worthless, whereas otherwise it may be very valuable. This occurs through depending on men who do not sufficiently understand the principle of measuring flowing or running water, nor the force and power it has in driving machinery.

Southern Fields.—Between Ross and Jackson's Bay, a distance of nearly two hundred miles, there are a few people here and there working on the ocean-beach, river- and creek-beds. A few parties of miners, principally Chinese, are working the terrace alongside Duffer's Creek, and, from what I could hear, are making a fair living. At Waiteroa, where good patches of gold were found some years ago, there is only one man at work. At Lake Mapourika there are from twenty to twenty-five miners at work, some sluicing and some tunnelling. The gold here is of a coarser nature than that found in the river-beds. The wash-dirt is from 3ft. to 5ft. in thickness, and is full of large stones and boulders, something resembling the wash at Kumara. This place was first opened about thirteen years ago, and has since supported a small mining population. The Five-Mile Beach, which was one of the richest beaches on the West Coast, and supported a large population for a number of years, is now a thing of the past, and only four or five men are at work. These, they inform me, only make very small wages except when they get a chance of surfacing on the ocean-beach after rough weather, which sometimes gives them a few ounces of gold very easily. A little gold is got on the beaches between this and Gillespie's Bluff; but the few miners that are here have some cattle, and only work at mining when surfacing can be obtained. At Gillespie's Beach there are eleven miners at work, all the workings being confined to beach-leads. This is a beach that would support a limited mining population for some years if a supply of water were on the ground. A water-race was brought in here about fifteen years ago capable of carrying from ten to twelve sluice-heads of water. The ditch is still in good order; but the fluming, that had to be brought from the terrace across a swamp for 27 chains to the beach-workings, has long since fallen down and has never been replaced. The general system of working here is to lift the water with a common spear-pump into a trough at the head of the washing-box; and by this means the miners are able to wash the richest of the black-sand layers. There are some payable layers under water-level which cannot be worked advantageously without the aid of pumping-machinery. Gold has been got on the ocean-beach near the mouth of every river coming out of the main range between the Mikonui River and Jackson's Bay; but as yet no heavy finds have been discovered inland. Whatever payable auriferous ground has been worked is on the beaches and terraces alongside the banks of the rivers; which goes a great way to prove that the rich finds of gold that have been got on the ocean-beaches have been washed down the rivers out of slips from time to time from the main range. The character of the gold also indicates that it has been carried a considerable distance by the action of water, and ground up by large stones and boulders travelling down by the force of the current. This action can be seen plainly in the Waiho River. Some rich pockets of gold have been got in the river-bed up at the gorge, where the bed-rock is bare, and where large boulders prevented the gold being scooped out of the pockets and crevices by the current of the stream. Small auriferous deposits have also been obtained on the terraces here, which probably might be due to glacier action, as the gold is coarse and angular, showing that it has not been subjected to the action of a stream with stones and boulders, which would round off all the angular corners and to a certain measure grind it up. If the gold, therefore, came down these rivers, there is every reason to suppose that rich auriferous-quartz reefs will yet be found in the high mountain-ranges; but their inaccessible nature, high altitude, and inhospitable climate will always render the mountain-lands difficult to prospect; and even if large auriferous lodes were found, they would have to be rich to pay for the extra expense connected with the working of them. Granite, mica-schist, and micaceous slate adjoin each other in the ranges south of the Mikonui River, which bears every indication of a country where gold, silver, tin, copper, galena, zinc-blende, and bismuth may be found. I was shown some cassiderite that was found at Bruce Bay in the beach-wash which evidently has at some time been washed down the Mahitahi River. I was also shown specimens of copper-ores (erubescite and chalcopyrite) that were found in the Thomas Range, between the Blue River and the Haast. There is also a large seam of coal near the mouth of the Paringa River. At Hunt's Beach and Bruce Bay there are still a few miners working on the beaches. Some of them at the latter place have done

ROSS UNITED GOLD MINING COY.

SKETCH OF

ELEVATOR FOR LIFTING TAILINGS.



G. P. WILSON DELT.

extremely well. My attention was directed to the country up Jacob's River; but the extremely wet weather and the flooded state of the rivers during my visit to this district prevented me from getting inland from the ocean-beach. There are no inland tracks from Cook River to the Mahitahi, and the country being densely timbered with thick undergrowth, and swampy in places, makes it extremely difficult to get provisions for men to prospect, however much they were inclined; and until the country is opened up by tracks, very little will be done here towards legitimate mining. Recently gold has been found in the terraces at the Abbey Rocks, where several parties of miners are at work, some of whom are doing remarkably well. The character of the gold obtained here is entirely different from any that is found south of Ross. It is much coarser, and does not appear to have travelled a great distance. The same character of gold, I was informed, was found at Bullock Creek, which is about sixteen miles south of the Abbey Rocks. From the nature of the country and character of the gold obtained, I think there is a prospect of a large area of payable ground being discovered in this neighbourhood; but with the limited population there is in this part of the country, and the difficulty of getting provisions, unless rich patches are found to cause a rush of miners to the place, the ground may remain a number of years before it is prospected. A few miners are employed here and there on the beaches between the Haast and the Okura Rivers. The sea has lately made inroads on a projecting point of land near the Okura River, which has given several miners profitable employment at surfacing. Gold has also recently been found in the Gorge River in conjunction with large quantities of ironsand and stream-nickel, the latter metal being of a highly magnetic character. The place where the gold has been found on this river is between the ocean-beach and the junction of the Jerry River, a distance of about five miles. The gold cannot so far be traced higher up than this point. Mr. Lindsay, a miner working on this river, informed me that a man will make from 8s. to 10s. per day on the beaches washing them with an ordinary cradle. He and his two sons got about 5oz. of gold in nine days working in this manner. Mr. Lindsay has prospected some of the low terraces alongside the river, and found them to contain auriferous drift which will pay good wages to work if water is brought on to them. He is now making arrangements to work the ground by hydraulic sluicing, and is getting iron pipes constructed for that purpose. I was informed that gold had been got in Longridge Creek, Ryan's and Hacket Rivers, and also on the terraces on the northern side of Big Bay, and in the Okura Creek, which flows into the Holyford about two miles from the sea; but in all these places, with the exception of the Gorge River, the gold that has been found is not of a payable nature for working. I was informed of a large quartz reef about eight miles up the Jackson River, which was represented as being 30ft. in thickness, containing a large amount of iron-pyrites said to contain gold; but at the time of my visit to this district the rivers were so flooded that I was unable to cross them. The character of the rocks and the appearance of the country would lead one to infer that it is a country where different minerals will be found; and the recent discoveries of tin and nickel in the Gorge River fully justify this view. There is a large belt of olivine rock passing through Mount Rickards about 5,000ft. above sea-level, having a granite belt on the western side; and where this olivine belt occurs again, on the Red Hill, about 6,000ft. above sea-level, the granite is on the eastern side. Towards the sea-coast, between Big Bay and Jackson's Bay, there is a narrow belt of limestone mixed in places with metamorphic slate, and on the top of this formation there is a deposit of moraine-matter that has at one time been deposited by glacial action from the high ranges. It is in the rivers cutting through this moraine where the gold, tin, and nickel have been found. This portion of the country is totally without roads or tracks, which makes it a difficult undertaking for persons to prospect it. A good horse-track is greatly required from Jackson's Bay to Gorge River, thence along the range to join the track leading from Martin's Bay to Lake Wakatipu. This would in a measure open up the country, and enable prospecting to be carried on.

Rimu.—This field still maintains a good population, and the miners, as a rule, are generally making fair wages. The ground here averages about 50ft. in depth, and the principle of working is by shafts and driving out the wash-dirt, which is about 5ft. thick, hauling up by means of horse-whims and whips, and stacked in a paddock. When this paddock is full, the wash-dirt is sluiced in the ordinary manner. There is no fall here, neither a sufficient quantity of water on the field to work the ground by hydraulic sluicing; and it is questionable if it could be worked in a more profitable manner, even were the circumstances favourable for hydraulic-working, as the gold is confined principally to the layer next the bottom.

Waimea and Stafford.—This district still maintains a good population, but the ground is generally of a poor character. Were it not for the good supply of water from the Government water-race this district would have almost been deserted, or, at least, there would have been a very limited number of miners able to get profitable employment. The ground that the Government water-race commands will yet support a limited population for some years; but it is being fast worked out, which, no doubt, in time, will either necessitate the race being extended or worked at a direct loss. The miners in this locality state that there is a large area of auriferous ground on the terraces on the opposite side of the Waimea Creek to that which the race commands. But an extension of the race to these terraces would involve an outlay of about £20,000. This extension was originally embraced in the scheme of the Waimea water-supply, and termed Branch C; but whether there is a sufficient area of payable auriferous ground

in this locality to justify this extension is a question that has to be carefully considered before undertaking it. The manager of the race has been instructed to carefully examine this locality, and report on the area, depth, and nature of the ground that is likely to be payable for working; and until this report comes to hand nothing definite can be said respecting it.

Kumara.—This is the largest payable alluvial goldfield that there is at the present time in the colony, and a field that bears every appearance of being able to support a large mining population for many years; but the tailings difficulty will soon crop up here. The bed of the Teremakau River will in a few years be raised to a considerable extent by the large quantity of tailings continually going into it. However, there is not much freehold land held near the banks of the Teremakau between Kumara and the ocean-beach that is likely to be affected. The whole of the working on this field is carried on by hydraulic sluicing, and the miners are carrying on this style of working in a very systematic manner. Every claim uses iron piping, and mostly the whole of them have Giant nozzles. The great depth of wash-drift, and the large amount of stones and boulders there are to contend with, which have to be hauled up to the surface in many instances, there being no room to stack them in the worked ground, will always make the working of the claims a slow process. The ground on this field, with few exceptions, is held by private individuals; and from the returns of gold the miners are making better wages generally than on any other alluvial field in the colony at the present time. This is owing principally to the works that have been constructed by the Government in connection with the water-supply, and by the Okuka Water-race Company, owned chiefly, if not solely, by one person.

Nelson Creek.—This district continues to maintain about the same population as formerly, but the amount of gold obtained is getting gradually less. Most of the ground that the Government water-race commands is getting pretty well worked out, with the exception of that in the vicinity of Brian Boru and on Nelson Creek flat, where a rush has recently taken place. If this latter ground proves payable for working it will be able to support a good population for some time; but the large amount of tailings now on the flat will increase the cost of working considerably, so that the ground has to be rich to pay. On the opposite side of Nelson Creek to that on which the Government water-race is constructed the Band of Hope Company has constructed a water-race from the right branch of Nelson Creek, which is capable of carrying about twenty sluice-heads of water; but this quantity is not always available in the creek where they get their supply. They have commenced to work what is known as the deep lead, and have erected a description of elevators, which they intended to use in lifting the tailings from the end of their sluice-boxes, as the Ross United Gold-mining Company does at Ross in working the upper levels; but the plant that they have at the present time is not at all suitable for this system of working, and has proved a complete failure. This is one of those cases which may be termed "penny wise and pound foolish." The first cost was but small; but, the construction being intrusted to persons who could have had no knowledge of this system of working, the result now is that, although they know that the ground is payable for working on a systematic principle, they have spent the whole of their capital, and have not even what may be termed a decent makeshift. At the request of Mr. Guinness, M.H.R., I gave this company a description of a suitable elevating-plant when in the district.

Reefton.—This is a district where quartz-mining is progressing slowly; but it is a district where, no doubt, mining will be carried on for many years after the alluvial fields are worked out. The large area of country here where auriferous-quartz reefs have been discovered, some of which pay handsomely for working, fully justifies the belief that this will yet become one of the largest permanent mining districts in the colony; but the country is so rough and broken, covered as it is with heavy timber and dense undergrowth, it makes prospecting a very costly operation. Although a large amount of money has been spent in making roads and tracks to open up the country and enable machinery to be brought to several mines, a great deal yet requires to be done in making tracks to enable prospecting to be systematically conducted. On alluvial fields water can almost everywhere be obtained to prospect the wash-drift; but before it is known whether many quartz lodes will pay for working, winzes have to be sunk following the underlie of the lode, and the stone taken to crushing-batteries before it is definitely known whether it is payable or not; and this can only be done by having a network of roads in a rough mountainous country. Many of the failures in quartz companies are attributable to the want of systematic prospecting before getting machinery on the ground; and too much reliance has been placed in the opinions of men regarding the quality of the stone from its appearance, which, in many instances, is very deceiving. The quartz companies that are in active operation in this district present a healthier appearance than they have done for some time past. Amongst the principal are the Welcome, Keep It Dark, United Inglewood and North Star, the Inglewood Extended, the Reform, Eureka, Globe, Nil Desperandum, Specimen Hill, the Hopeful Extended, Homeward Bound, Venus, Big River, the Inkerman, the Fiery Cross, Just in Time, Golden Fleece, and the United Alpine, at Lyell.

Welcome Company, Boatman's.—This is one of the most prosperous quartz companies in the district. Up to the 31st of December last gold to the value of £206,030 19s. has been obtained from the mine, and £103,500 paid in dividends, while the paid-up capital is only £3,750. They have recently opened out a deeper level, and struck the reef at 210ft. from the shaft, which looks equally as promising, if not more so, than the stone on the upper levels. The reef here is about 2ft. thick, and is expected to average from 2½oz. to 3oz. to the ton. The quantity of stone crushed

during the half-year ending 31st December last was 535 tons, which yielded, including the gold got for same period from Berdans, 1,012oz., representing a value of £3,896 4s. Everything in this mine is in good order, no expense is spared in the improvements of machinery, and the manager deserves every credit for the systematic manner in which the mining operations are carried on. The No. 8 level is at present defective in ventilation; but the manager is remedying this by making a connection with the other levels.

Fiery Cross Company, Boatman's.—This company are carrying on their mining operations, and have from time to time obtained a large amount of gold from the mine, although they have never paid the large dividends the adjoining company (the Welcome) has done. The total amount of gold obtained from this company's mine is 12,902oz., representing a value of £49,672 14s.

Just in Time Company, Boatman's.—This company and the Reform Company are working from the same shaft, which was constructed, along with winding-gear, &c., at the joint cost of the two companies. This company anticipate shortly to cut good stone, and if so they have every appliance for working it economically.

Reform Company, Boatman's.—This is a company that has taken up the ground formerly held by the Imperial Company; and they have been extending the level commenced by the originial company, and also constructed a lower level and cut the reef, which at first did not appear very promising; but recently, after driving on the lode for some distance, good, payable stone was struck, and it is anticipated that they will be able to give good returns. This company has a capital of £12,000, of which £1,289 is paid up. They crushed a hundred tons of stone from a winze on their upper levels, which yielded gold to the value of £422 8s. 11d. The expenditure on getting this mine in order, including the cost of raising the hundred tons of stone referred to, has been, up to the end of last year, £1,691 3s. 7d.

Homeward Bound Company, Boatman's.—This is a company which holds the ground adjoining the Welcome Company's lease, and from recent surveys are almost certain to strike the same reef that the Welcome Company are now working. This company has held this ground for several years, but have scarcely done any work beyond contributing to the construction of the low-level tunnel, which has been constructed at the joint expense of several companies to prospect the ground. The amount of capital expended up to the 30th January last was £1,083 4s. 9d. The nominal capital of the company is £12,000, of which £1,078 10s. has been paid up.

Eureka Company, Boatman's.—This is a company that has done a great deal of work. They constructed an incline-tunnel for over 2,100ft. and drove a considerable distance with cross-cuts; but have not been successful in finding the Welcome reef, which was at one time deemed to go through their ground. This incline-tunnel is 5ft. wide at the bottom, and 6ft. high inside the timber. It is constructed in a strong, substantial manner, and will make a splendid main roadway if a payable reef is found. This company has suspended operations for the present, and the ground is protected. They have spent nearly £12,000 on plant and labour.

Specimen Hill Company, Boatman's.—This company has suspended operations for some time. They have been contributing to the construction of the deep-level tunnel, which, when driven a sufficient distance, will enable them to prospect their ground thoroughly. They have spent about £5,500 9s. 11d. on plant and labour in working the mine, and obtained gold to the value of £670 14s. 2d. This company have a nominal capital of £10,000, of which £4,134 is paid up.

Keep It Dark Company, Reefton.—This is one of the best mines in the Reefton district, and one which is extremely well conducted in its underground operations; due regard being given to safety of the workmen employed, the stability of the main adits, passes, and stopes, combined with economy. During the year ending the 31st December last there was 9,949 tons of quartz crushed, which yielded about 6,064oz. of gold, representing a value of £23,571 13s. 9d. The expenditure during same period in working the mine, £8,832 9s. 2d.; while dividends were paid to the amount of 14s. 6d. per share, or £14,500. The capital of this company is £10,000, of which £2,625 is paid up. There is a crushing-battery of twenty heads of stamps adjoining the mine, and this battery is kept continually at work. It is driven with a 30-feet overshot water-wheel; but this wheel is beginning to show considerable signs of decay, and the company have arranged to erect one of Pelton's hurdy-gurdy wheels, which are now coming greatly into use, and which are the simplest and most effective water-wheels that have yet been invented. This company are working on the No. 2 level, and have stoped out the quartz for about 90ft. in height for the whole length of the lode, which is about 350ft., leaving about 80ft. yet of backs up to No. 1 level. A winze has been sunk down from No. 2 level, and the lode proved down for a distance of 100ft., where it continues to be about 8ft. in thickness. They are also sinking the shaft to a greater depth to enable a lower level to be constructed and the quartz opened out previous to the present block being worked out. At the time of my recent visit the shaft was down about 100ft. below No. 2 level. There are eighteen men employed underground, besides four men in sinking the shaft and nine men on the surface. These are able to get sufficient stone to keep the crushing-battery fully employed. Since this company has been in operation—viz., from May 1875, to 31st March last—they have crushed 73,352 tons of quartz, which yielded 44,663oz. of gold, representing a value of £171,952 11s., and have paid £80,419 in dividends.

Wealth of Nations Company, Reefton.—This company has constructed a low-level tunnel for about 800ft. and cut a body of payable stone, of which 260 tons were crushed, which yielded 127oz. of gold; but in stoping out this block only went up for about 30ft., when it cut out,

A winze was then sunk following down the stone, but the country seems greatly broken and disturbed. At a depth of 120ft. quartz leaders were met with, and from the quartz taken from this winze 91oz. of gold were obtained. The company is now engaged in sinking a shaft in the low-level tunnel to prospect the ground at a greater depth. The total yield of gold from quartz crushed and from the berdans for the year ending the 31st December last was 302oz., representing a value of £1,165 18s. 4d.; and the expenditure on the working of the mine during that period has been about £2,189.

Keep It Dark No. 2, Reefton.—This is a company that has lately been formed, and taken up ground adjoining the Nil Desperandum Company. They have struck a quartz lode near the surface which contains gold of a payable character; but it is not sufficiently opened out yet to warrant any definite opinion to be formed respecting it.

Nil Desperandum Company.—This company has been in existence for a number of years, but had done very little work for a long period previous to commencing operations last year. They have now erected an overshot reversible wheel for winding, and will soon be stoping out quartz. With the improved appliances, and good terms they have made with the Wealth of Nations Company to crush the stone, they anticipate working the mine successfully.

Globe Company, Reefton.—This company has at present discontinued stoping out quartz. They have formerly been working on the upper levels, but the quartz in this portion of the mine is getting very poor in grade. During the twelve months previous to the stoppage of the crushing-battery they crushed 4,000 tons of quartz, which gave about 1,022oz., representing a value of £3,963 6s. 5d. They have recently sunk a shaft for 250ft. in depth, and are constructing another level. Previous to sinking this shaft they sunk two winzes, one 70ft. and the other 120ft., and proved the reef to be 10ft. wide; which, from the appearance of the stone, is expected to go at least 10dwt. per ton. They have also erected a water-wheel 38ft. in diameter, for transmitting power by means of an endless rope from the battery to the mine, a distance of 105 chains, to connect with the winding-gear at the main shaft. This company has a crushing-battery of twenty heads of stamps, driven by a turbine water-wheel, situated on the south side of the Inangahua River, opposite Crushington; they also have an aërial tramway connected from the mine to the battery, a distance of 96 chains. This tramway was designed and constructed by Messrs. Kincaid and McQueen, ironfounders, Dunedin, and works remarkably well. It goes over two ranges between the mine and battery, one of which is about 1,100ft. above the level of the battery, the terminal point at the mine being 900ft. above the battery. It consists of an endless rope, kept about 10ft. apart by pulleys fixed on trestles, which are fastened at certain distances on prominences along the line. At the end next the mine there is an inclined shaft fixed in framing at about right angles to the line of rope, and on the top of this shaft is fastened a horizontal grooved pulley, about 10ft. in diameter, which holds the endless rope. There are two grooved pulleys about 16in. in diameter, fastened on each of the cap-pieces of the trestles, to carry the rope. At the end next the battery there are skids laid down on the same inclination as the line of rope, and on these skids are fixed iron rails, on which a trolly is placed, carrying the framing, shaft, and grooved pulley to hold the endless rope. There is a weighted box attached to the lower end of this trolly, which keeps a steady tension on the rope, and prevents it from unduly sagging when working. Carriers are attached to the rope at intervals by two half-round clips bolted together, holding the rope between them. These stand out horizontally from the rope for about 4in., thence hang vertically; and to these carriers the buckets are attached, which are each capable of holding about 2cwt. of quartz. In order to set the endless rope in motion the buckets are first filled, on the top of the range, above the battery, with mullock, and the weight of loaded buckets on the rope between this point and the battery is sufficient to set the rope in motion, after which it works automatically, having a brake at each end for stopping when required. The buckets also empty automatically by coming in contact with an inclined bar at a point over the hopper into which the quartz passes. This inclined bar raises a catch, which allows the buckets to turn completely over, and when once emptied they return to the end next the mine, where they are again righted in position, and the catch put in its place. The buckets are filled at the end next the mine while they are in motion by means of a traveller on an oblong horizontal iron ring. This tramway is capable of transmitting about 50 tons of quartz to the battery per day of from eight to ten hours. Annexed is a sketch-plan, showing the general arrangement and gearing at terminal points. Since the erection of this tramway another of the same description has been erected by the Venus Company.

Venus Company, Reefton.—This company have recently erected an aërial tramway from the mine to the battery, which they purchased from the Energetic Company at Murray Creek, and are stoping out quartz that promises to give good returns.

Inglewood Extended Company, Reefton.—This company's mine is situate on the side of the range facing the Waitahu River. The ground formerly was held by the Inglewood and North Star Companies, who have amalgamated, and have been re-formed under the present name. The quantity of quartz crushed during the year ending the 31st December last was 1,889 tons, which yielded 1,284oz. of gold, representing a value of £4,932 14s. 9d. The value of dividends paid from this mine has been £1,200.

Inkerman Company, Reefton.—This company's mine is situated at Rainy Creek, about seven miles from Reefton. They have a large body of quartz in their mine, which is of low-grade quality, and so far has not given any favourable returns. The company has a good crushing-battery of thirty heads of stamps, and several Berdans, driven by a steam-engine. The

value of gold from quartz crushed for the half-year ending 30th September last was £5,426 5s. 2d.; and the expenditure on the mine and battery during the same period was £5,494 3s. 5d.; of this amount there was £1,766 spent in battery-plant.

Big River Company, Reefton.—This company's mine is situated in the Big River district, about sixteen miles south of Reefton. The ground has been held for several years, but until recently very little has been done beyond prospecting. About 130 tons of quartz is on the surface ready for crushing as soon as their battery is completed, which is now in course of erection. The lodes that have been cut in this company's mine are very broken and liable to run completely out; yet some of the quartz, when found, is of good quality. It is expected that the lode will be better defined as it gets deeper and assumes a more uniform character.

Alpine Company, Lyell.—Since this company have commenced to work from No. 6 level they have been carrying on their operations very successfully. During the year ending the 6th of April last the quantity of stone crushed was 8,881 tons, which yielded about 8,222oz. of gold, representing a value of about £30,318, and £17,200 paid in dividends. The quartz lode in this company's mine varies from 4ft. to 40ft. in width, which is all stoped out and sent down to the battery; and, from the amount of gold obtained, the yield has been nearly 1oz. per ton.

In the Reefton and Lyell districts quartz-mining is looking much better than it did twelve months ago. The deep quartz lodes in the levels are getting proved that they contain equally as much, if not more, gold than lodes on the upper levels, and this is giving other companies encouragement to continue on their workings.

Westport District.—The quartz reefs at Mokihinui continue to be worked with success. The Red Queen Company has during the last year crushed 1,650 tons of stone, yielding 2,362oz. of gold, which shows the quartz in this district to be of a rich character. However, the lode is narrow, with foot- and hanging-walls very hard, so that the quartz costs more to raise per ton than in the Reefton district. At Waimangaroa the Great Republic crushed during last year 1,065 tons of quartz, which yielded 1,432oz. of gold, also giving a high yield per ton. It is only some three or four years ago since this reef was discovered.

CRUSHING-MACHINERY.

There is no subject connected with mining that deserves more attention than machinery for the reduction of ores, not only in this colony, but in every country where metalliferous lodes exist. The rich lodes that have been found, and for many years worked advantageously, are getting gradually poorer, and require a cheaper method to be employed than that adopted at the present time by reducing the ore with cumbersome and expensive stamping-batteries.

In this colony there are many large lodes of low-grade auriferous quartz that cannot be worked profitably with the present method of reduction, and there is no instance that stands out more prominently than the mining district of Te Aroha, where a large quartz lode is known to extend between two and three miles, and in certain places giving as much as 2oz. of gold per ton; but when the yield comes below 15dwt. per ton it is found not profitable to work. On this field there is one of the best stamping-batteries erected in the colony. No expense has been spared to make it as complete as this class of machinery can be made; yet the working expense and wear and tear are so costly that low-grade quartz cannot be worked to pay with present appliances.

The prosperity and greatness of any country, and none more so than Great Britain, are due in a great measure to the mineral wealth it contains; and it may truly be said that the future greatness of New Zealand will depend in a great measure on an energetic and systematic development of her mineral resources. The rich agricultural lands are confined to valleys, plains, and low undulating country; but there is a large percentage of high mountain-land that is only suitable for pastoral purposes, unless it contains mineral wealth. Fortunately, nature has so formed this colony that the metalliferous deposits are chiefly confined to the high lands; but, unless machinery of a more improved character be introduced to reduce the various ores at a much cheaper rate, and these deposits worked remuneratively, they will fail to add to the permanent wealth of the colony.

Until lately mining in this colony has been chiefly confined to gold and coal; but, recently, attention has been directed to argentiferous lodes, which exist at Karangahake and Waihi, in the Ohinemuri district, and smelting-furnaces for the reduction of this class of ore have been erected. So far these furnaces have not proved a success, owing to the class of ore not being of a suitable character for smelting at a cheap rate. The smelting-furnaces that are erected at Karangahake and the Thames are specially adapted for smelting argentiferous and auriferous ores containing a large percentage of galena and iron, as these minerals are specially required as fluxes, in conjunction with lime, to make the silica run freely; but where the ore is deficient of either galena or iron the cost of fluxes to smelt the silica is so great that it requires ore of a high grade to pay for its manipulation. Different classes of argentiferous ores require different treatment. Those containing galena and iron are specially adapted for smelting, while ores containing chlorides and chloro-bromides of silver can be manipulated far more advantageously and economically by chlorination and amalgamation. Therefore the same class of machinery that is suitable for the reduction of auriferous quartz is also suitable for the reduction of many kinds of argentiferous ores.

In introducing new crushing-machinery there are three essential things to consider—viz., (1) the cost of the plant and the number of working-parts subject to wear and tear; (2) a compact and portable machine, so as to get over the difficulty of transit in a mountainous

country; (3) a machine that will reduce the ore at a much less cost than by the stamping-battery.

There will be a difficulty at first to contend against in introducing new machinery to supersede the stamping-battery, which has heretofore been recognized here as the best method for reducing auriferous quartz; for, although the mining community is a very intelligent one, it is also a very conservative one, and looks with suspicion on any improvements in mining-machinery until they are thoroughly tested; and even then some are very loth to adopt them. It must, however, be patent to any person that, unless a better class of machinery is employed in the reduction of auriferous quartz, there are many of the present mines that must either suspend operations or continue working from hand to mouth, without giving the shareholders that remuneration they are entitled to for the outlay of their capital. This subject has lately been well ventilated in California, and different machines have been constructed for reducing ores, amongst which are machines constructed on the stone-breaking principle, and with steel rolls; the latter being now deemed the most effective. In 1882 the Bertrand Mill-owners, in Nevada, introduced steel rolls for crushing, and were so successful with their machines that the dictum that hitherto prevailed—viz., that stamping-batteries were the most efficient method of reducing ore—was shown to be a fallacy; for not only are the rolls much cheaper in the first instance, but, having fewer wearing parts, the maintenance is but trifling compared to stamps; and the quantity and fineness of material crushed is also far greater than by a stamping-battery, in proportion to the power employed for working the machinery.

On examination of the principle of crushing-machines, the quantity of material crushed must be in proportion to the area of the crushing-surface, whether it be by pressure or weight. Therefore the area of the surface of a stamping-battery is in proportion to the number of stamps employed and the speed at which they are driven.

To analyse the crushing effect of rolls against stamps, it will be necessary to take into account the crushing-surface of both. Say, taking the average of stamps at 8in. in diameter, making seventy-five blows per minute, and steel rolls 26in. in diameter, and 15in. long, making a hundred revolutions per minute—the area of stamp-head, being 50·26 square inches, multiplied by the number of blows per minute, gives 3,769·5 square inches crushing-surface for each stamp used. The rolls being covered with steel tires 2½in. in thickness, to get the average crushing-surface during the time the tires last the rolls have to be taken at 24in. in diameter, or 24 by 3·1414 by 15 by 100—equal to 113,090·4 square inches; which, if divided by the crushing-surface of each stamp per minute, shows the rolls to be capable of crushing as much as a stamping-battery of thirty heads; but were the speed of the rolls increased to 150 revolutions per minute, then they would be equal to forty-five heads of stamps.

In conducting experiments on the percentage given with the different classes of water-wheels at the Thames two years ago, I found that the best-constructed Leffel turbine only gives 67 per cent. of the power due to the head of water, whereas these wheels are guaranteed to give from 77 to 80 per cent. with a brake; thus showing that a large amount of power was expended in overcoming the friction of a stamping-battery. Indeed, it can be seen at a glance that the amount of friction in lifting the stamps from a state of repose each time, causing them by friction to revolve, must be very considerable. It may be adduced in favour of stamps that the sudden drop gives an impact to the blow, which it may do to some extent; but this may be entirely discarded, as it is more than balanced by the extra amount of material that there is in the stamping-mortar over that between rolls, which causes the stamps in many instances to cushion, and therefore destroys the effect of the blow. The duty done by stamps cannot be calculated on the same principle as a ram falling on the head of a pile, because the quantity of loose material that lies in the mortar alters the condition of the blow entirely. The stamp has not only to crush the material, but likewise has to force it through the grating, which must be taken as power wasted. Whatever system is adopted in feeding stamps, there can never be the uniformity there is with rolls, neither can the particles or grains of the crushed material be so uniform in character. To take everything into account, even the greatest advocates for stamps must admit there is much useless power expended in reducing ore by this method. Stamps have a maximum of velocity, which can be soon reached, beyond which the fall is reduced; but with rolls held rigidly together the action is constant at any given time: the greater the velocity of the rolls the greater the crushing-power, as the crushed material must be in proportion to the area of the crushing-surface.

No better criterion can be given for the necessity of improved crushing-machinery than that of the great expenditure entailed in crushing the auriferous quartz at Te Aroha. The quartz has to be conveyed from some of the mines to the crushing-battery for nearly two miles on a tramway which has several steep grades, and these grades are fitted with brakes for lowering the trucks, which entails a deal of manual labour, thereby increasing the cost of haulage to a considerable extent; but the crushing-battery, although one of the best in the colony, is very imperfect. After the crushed material has passed through the gratings over the quicksilver and blanket-tables the residue contains about as much gold, if not more, than is extracted from it. This has been satisfactorily proved by the tailings being crushed in Berdans, and after leaving the first sets of these Berdans they were operated on a second time, and still found to contain sufficient gold to pay for manipulation. The character of the gold on this field is extremely fine, and requires a different system of treatment to that adopted in any of the Australian Colonies; but this is a field where there is ample room for great improvements to be made,

and where fortunes can be realized by employing improved machinery for crushing and saving the gold.

Since the Bertrand Mill-owners have adopted rolls, other mill-owners have followed in their footsteps; and the results have been so satisfactory that it leaves no room for doubt of the superiority of rolls to stamps. The short time that rolls have been in use has not enabled the quantity they are capable of crushing to be accurately determined, as the quantity is limited to the area of the screens that have been attached to them; but enough is known respecting their capabilities to recommend them for general use. It has been found that two sets of rolls 15in. long and 26in. in diameter, travelling at a velocity of one hundred revolutions per minute, is equal in efficiency to a crushing-battery with fifty heads of stamps, 7cwt. each, having 10in. drop, and making seventy-five blows per minute. To enable a comparison to be made between the cost of a stamping-battery of fifty heads and two sets of rolls, the number of working-parts must be taken into consideration, as each part contributes to the wear and tear and cost of maintenance. The following will show the different pieces of each of the systems: Crushing-battery: Bearings on intermediate shaft, 6; bearings on cam-shaft, 11; plummer-blocks for intermediate and cam-shafts, 17; stamp-shanks, 50; stamp-head bosses, 50; shoes for stamps, 50; false bottoms for stamps, 50; cams for lifting stamps, 50; dies on stamps-hanks, 50; guides for stamp-shanks, 100: total number of working parts, 434. Two sets of rolls: Bearings on shafts of rolls, 4; plummer-blocks for same, 4; crushing-rolls tires, 4; side-plates, 4; wearing surfaces for each two sets of rolls, 12: total number of working-parts, 28. The working-parts of the stamping-battery are subject to rapid wear, and many of them are liable to break, but most of them can be easily replaced; still, the large number of working-parts, although many of them are small, require constant care and attention to keep them in a proper state of repair so as to prevent a stoppage of the machine. Stamps and shanks are very liable to break; and, although they are readily replaced, the time employed in doing so in course of a year is considerable. The screens have not been taken into account, as they are common to both machines; although the wear and tear on the gratings of the stamp-mortar must be greater than that for the rolls, as the stamps thrust the crushed material with considerable force against the gratings, whereas the crushed material from the rolls is by gravitation. The wear in rolls is almost exclusively confined to steel tires and cheek-pieces. Of the steel tires 80 per cent. can be safely used in crushing before it is necessary to replace them; whereas it is not generally safe to wear more than 60 per cent. of the shoes and false bottoms of the stamping battery. The statistics of the wear and tear on rolls is as yet confined to the Bertrand Mill, where two sets of rolls crushed 20,000 tons of ore in about 250 days. This time is estimated, as the rolls now are crushing about a hundred tons per day; but when first starting they did not put through so large a quantity. During the time they were at work two new sets of tires were used, and cheek-pieces, which they got from New York. The cost will be as follows: Two sets of steel tires, at foundry, £153; cheek-pieces, £60; freight on same, allowing ample margin, £100: total, £313. The wear and tear in twenty-four hours would therefore be, including labour in effecting repairs, about £1 10s.

Mr. T. Egleston, Ph.D., in writing on this subject in *Engineering* of the 13th and 20th November last, says: "These rolls are now in successful operation at the Bertrand Mill and Cory Mill, in Nevada, and the Haile Mine, in South Carolina. It has been shown recently that two sets of 26-inch rolls at the Bertrand Mill can easily crush 150 tons of hard ore in twenty-four hours so as to pass threugh a No. 16 screen. How much more they can do is not known, as they have never had full screen and elevator capacity. The Mount Cory Mill has crushed, in the same time, 50 tons through a No. 30 screen. The usual capacity for the best stamps on the same kind of ore is 2 tons per stamp, which makes the rolls equal to a fifty-stamp mill. At the Bertrand Mill 9,000 tons of ore were crushed without paying a dollar for repairs, with the expenditure of less than one-half the power required to do the same amount of work in a stamp-mill; while the total repairs up to date have been only about one-quarter cost of the stamp-mill repairs, at this mill 15,000 tons of ore passed through the fine-crushing rolls before new tires were necessary. After crushing 20,000 tons the coarse-crushing tires were still good for two months' wear. It is considered that each set of rolls, with a set of repair-linings of composition metal, would be capable of crushing 20,000 tons, the only expense for repairs being tires and cheek-pieces. The cost for renewals for a set of 26-inch rolls during 1885 will be—Two sets of tires, $530; freight on 3,204lb., at 3 cents, $98; composition lines for journals and cheek-pieces, $100, total, $728—say £145. For comparison of expenses we will assume that two sets of 26-inch rolls are equal to a thirty- and not a fifty-stamp mill, as has been shown by actual experiments, and the thirty heads of stamps, weighing each 850lb. to 900lb., dropping eighty to eighty-five drops per minute, with a fall from 7in. to 9in. It has been found at the Bertrand Mill that two sets of 26-inch rolls, with a consumption of four cords of firewood, will crush a hundred tons of moderately-hard quartz or other ore in twenty-four hours, so that it will pass through a No. 16 screen. A thirty-stamp mill, to do the same amount of work, will consume six cords of firewood; thus showing that the rolls only take two-thirds of the power to do the same amount of work as a stamping-battery. To take the first cost of the plants (as shown in 'The Production of Gold and Silver in the United States,' Washington, 1883), a thirty-stamp mill costs as follows, erected at Nevada: Plant at foundry, Chicago, $5,850; freight to locality, $2,718; lumber in erection, $1,800; cost of erecting, $4,000; cost of buildings in excess over a building for rolls, $1,500; cost of engine-boilers, excess over rolls, $1,250: total, $17,118. The cost of two sets of 26-inch

rolls in New York, $4,500; and the weight, 28,438lb. These require an automatic feeder weighing 2,000lb., costing $200. The cost, therefore, is as follows: Cost of two sets of 26-inch rolls and one automatic feeder, $4,700; freight to locality, $780; cost of setting up, including lumber, $700: total, $6,180; or a saving of $10,938 against stamps." These figures are taken from calculations made of the cost of the different classes of machines in the United States; and I see no reason to doubt their correctness. In any case the difference is so great that, even admitting the first cost of rolls to be half the cost of a stamping-battery of equal power, and working expenses one-third less than that of the stamp-mill, then there is a great saving; but this is not all, for the cost of wear and tear in a stamp-mill to do the same amount of work as two sets of 26-inch rolls would be at least one-half more, or, to put it in round numbers, the total saving by adopting rolls would be at least £5 per day.

Plan and sections of S. R. Krom's steel crushing-rolls can be seen in the *Engineering and Mining Journal*, New York, of the 10th October, 1885; and I have no doubt that machines on this principle will soon supersede the old-fashioned stamping method of reducing ores and quartz.

In adopting steel rolls the ore must first be operated on by a pulverizer to reduce it to somewhat uniform size before the rolls are effective. This may also be said with regard to stamps. It has been found at the Clunes, in Victoria, that the quantity of quartz crushed by the stamping-batteries was greatly increased when a stone-breaker was used in the first instance to reduce the quartz. The increase of work done by stamps more than compensated the cost of using the stone-breaker. With regard to the fineness of crushed material, the steel rolls are proposed to be adopted in some parts of California to crush the tailings from a stamping-battery; which is a reversal of all former ideas on the subject.

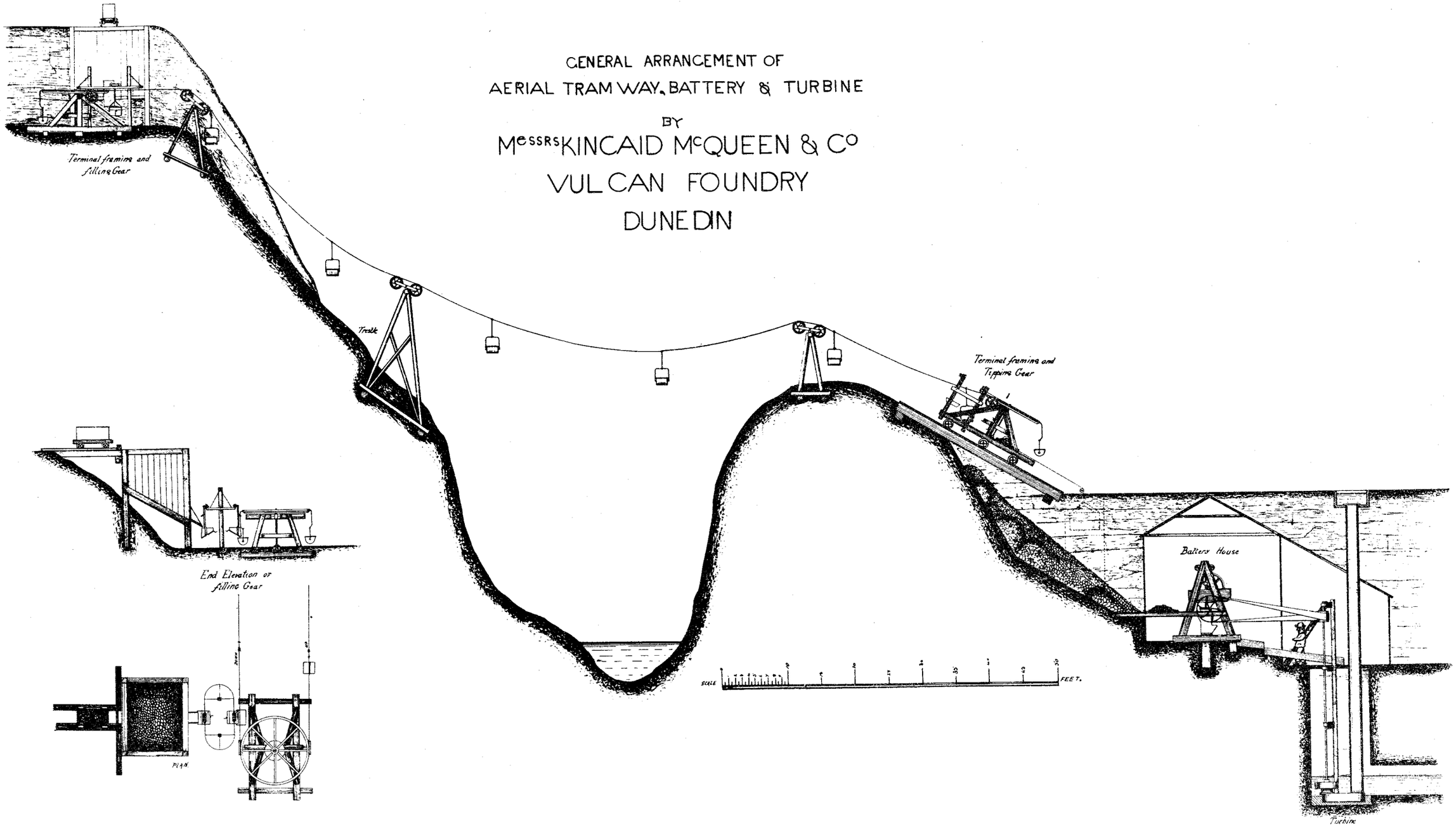
There is no doubt a great deal to learn with regard to the most economical method of reducing ores from what I have seen and read about recent improvements in crushing-machinery in other countries. The systems adopted in America are applicable here; and any improved appliance that lessens the cost of labour, or the cost of reducing ores, or the saving of gold and silver, will materially assist in making many of the poor-grade quartz lodes in many parts of the colony remunerative for working.

VALUE OF WORKS CONSTRUCTED.

The total value of works constructed under the direction of the Hon. the Minister of Mines, since the votes were under the control of the department, for the development of the mineral resources of the colony, either wholly undertaken by the Mines Department or by subsidies to local bodies and mining companies, and the amount expended by the Mines Department, and the liability on same on account thereof, are as follows:—

Nature of Work.	Total Cost of Construction or Amount authorized to be expended.	Expenditure by way of Subsidy or otherwise by Mines Department.	Amount of Liability by Mines Department on Works in Progress.
Up to Year 1882-83 and 1883-84.	£ s. d.	£ s. d.	£ s. d.
Water-races	29,252 1 11	14,853 9 5	14,398 11 6
Roads on goldfields	21,437 11 2	13,089 16 0	8,347 15 2
Roads and tracks undertaken by County Councils, and subsidized by Mines Department	52,841 17 0	21,844 16 7	10,207 15 9
Works undertaken by prospecting associations, subsidized by Mines Department	13,216 13 4	3,350 0 0	3,400 0 0
Construction of drainage- and sludge-channels, subsidized by Mines Department	5,750 0 0	2,468 15 4	781 4 8
Totals	122,498 3 5	55,606 17 4	37,135 7 1
1884-85.			
Water-races	4,846 1 9	14,596 2 9	4,648 11 6
Roads on goldfields	13,667 10 1	9,630 9 6	12,384 15 9
Roads and tracks undertaken by County Councils, and subsidized by Mines Department	13,566 14 1	6,293 16 6	12,739 17 6
Roads to mines, other than gold, subsidized by Mines Department	4,594 10 0	111 19 0	2,888 1 0
Works undertaken by prospecting associations, subsdized by Mines Department	850 0 0	108 0 0	3,692 0 0
Construction of drainage- and sludge-channels, subsidized by Mines Department	4,050 0 0	1,050 0 0	1,931 4 8
Diamond and other drills	3,600 0 0	1,858 0 0	..
Totals	45,174 15 11	33,648 7 9	38,284 10 5
1885-86.			
Water-races	10,428 14 7	6,063 2 3	6,964 4 4
Roads on goldfields	27,543 18 8	12,360 14 9	27,567 19 8
Roads undertaken by County Councils, and subsidized by Mines Department	14,773 2 3	13,043 15 9	12,477 9 2
Roads to mines, other than gold, subsidized by Mines Department	1,738 13 6	4,327 0 10	490 12 8
Works undertaken by prospecting associations, subsidized by Mines Department	11,860 18 0	1,999 5 7	6,389 5 9
Construction of drainage- and sludge-channels, subsidized by Mines Department	10,459 1 9	3,994 16 6	6,995 9 9
Totals	76,804 8 9	41,788 15 8	60,885 1 4

GENERAL ARRANGEMENT OF
AERIAL TRAM WAY, BATTERY & TURBINE
BY
MESSRS KINCAID McQUEEN & Co
VULCAN FOUNDRY
DUNEDIN



End Elevation of filling Gear

SUMMARY.

Nature of Work.	Total Cost of Construction or Amount authorized to be expended.	Expenditure by way of Subsidy or otherwise by Mines Department.	Amount of Liability by Mines Department on Works in Progress.
	£ s. d.	£ s. d.	£ s. d.
Water-races	44,526 18 3	35,512 14 5	6,964 4 4
Roads on goldfields	62,648 19 11	35,081 0 3	27,567 19 8
Roads and tracks undertaken by County Councils, subsidized by Mines Department	81,181 13 4	41,182 8 10	12,477 9 2
Roads to mines, other than gold, subsidized by Mines Department	6,333 3 6	4,438 19 10	490 12 8
Works undertaken by prospecting ssociations and companies, subsidized by Mines Department	25,927 11 4	5,457 5 7	6,389 5 9
Construction of drainage- and sludge-channels, subsidized by Mines Department	20,259 1 9	7,513 11 10	6,995 9 9
Diamond and other drills	3,600 0 0	1,858 0 0	..
Total	244,477 8 1	131,044 0 9	60,885 1 4

From this it will be seen that works to the value of £244,477 8s. 1d. have been undertaken, £131,044 0s. 9d. paid on these works, and that the liabilities on 31st March last were £60,885 1s. 4d. The value of works undertaken at the end of March, last year, was £167,672 19s. 4d., of which amount £88,255 5s. 1d. was paid by Government; and the liability at same date was £38,284 10s. 5d.: thus showing the value of new works undertaken during the year ending 31st March last to be £76,804 8s. 9d.; while the amount of money passed for payment on these works during the same period was £41,788 15s. 8d.

Notwithstanding the amount of money that has been spent in works for the development of mining, there still remains a great deal to be done in constructing tracks to open up mineral country, more especially on the West Coast between Collingwood and the Mokihinui River, and also that southern portion of Westland south of Ross, and in that portion of Otago between Martin's Bay and Lake Wakatipu. Indeed, in that portion of the country there is very little known, as there are scarcely any roads or tracks of any description. The country, to a large extent, is very rough and broken, with a large area of high mountain-lands, which are valueless unless they contain minerals. No doubt, if minerals of a payable character were found, there are valleys intersecting the high country that would be taken up and settled upon; but at the present time there is no chance of any land being taken up here for settlement for the reason that no tracks penetrate the country.

Annexed is a list, taken from the Mines departmental records, of works that have been constructed, and in progress, for developing the mineral resources.

I have, &c.,

HENRY A. GORDON,
Inspecting Engineer.

The Hon. the Minister of Mines.

LIST of WORKS on GOLDFIELDS undertaken wholly by the Mines Department, or by Subsidies to County Councils, Local Bodies, and Prospecting Associations, in progress on the 31st March, 1886.

Locality and Nature of Works.	Total Cost or Amount Authorized.	Amount of Contribution paid by Mines Department.	Amount due by Mines Department on Works still in Progress.
NORTH ISLAND.			
ROADS (SUBSIDIZED).			
Coromandel County.	£ s. d.	£ s. d.	£ s. d.
Making and repairing track from Kapanga Mine to Paul's Creek ..	290 0 0	..	193 6 8
Extension, Vaughan and Vizard's Track	300 0 0	100 0 0	100 0 0
Extension of track, Tiernan's to Castle Rock	150 0 0	..	100 0 0
Road from Lynch's paddock to Matawai Battery	180 0 0	..	120 0 0
Widening and extending road to Harbour View	100 0 0	..	66 13 4
Widening and extending road to Harbour View Mines	150 0 0	..	100 0 0
Making and improving track, Golden Belt to Tiki	245 0 0	159 8 10	3 17 10
Track, Bismarck Battery towards Kennedy Bay	250 0 0	..	166 13 4
Continuation of Waikoromiko Track	100 0 0	..	66 13 0
Continuation of Success Track	200 0 0	..	133 6 8
Road, Makarau towards Waiau	600 0 0	200 0 0	200 0 0
Road, Old Saw-mill towards Awakanae	700 0 0	266 13 4	200 0 0
Road up Manaia	1,500 0 0	250 7 0	749 13 0
	4,765 0 0	976 9 2	2,200 3 10
Thames County.			
Prospecting track to open up Karangahake Goldfield, extending towards Te Aroha	1,334 0 0	522 14 0	366 6 0
Track up Maungawherawhera Creek	100 0 0	61 2 10	5 10 6
Metalling road, Kaueranga Valley to Otanui Creek	650 0 0	267 13 0	165 13 8
Road, Tapu Battery to Mines	160 0 0	44 0 0	62 13 4
Widening road from bridge over Hape Creek to Otanui Mines ..	500 0 0	63 15 0	269 11 8
Tauranga Road to Karangahake Bridge-site	380 0 0	10 0 0	243 6 8
	3,124 0 0	969 4 10	1,113 1 10
Ohinemuri County.			
Road to Ohinemuri Coalfield	250 0 0	..	166 13 4
Bridge over Ohinemuri River near Karangahake	416 0 0	40 0 0	237 13 4
Track up Tui Creek	300 0 0	103 0 0	97 0 0
Prospecting-track, Whangamata and Waitekauri	200 0 0	..	166 13 4
	1,166 0 0	143 0 0	668 0 0
Piako County.			
Track to claims at Buck Reef	150 0 0	..	100 0 0
Track, Fern Spur to Butler's Spur	300 0 0	..	200 0 0
	450 0 0	..	300 0 0
Hutt County.			
Track to reefs, Terawhiti	300 0 0	106 13 4	93 6 8
SOUTH ISLAND.			
Collingwood Road Board.			
Bridge and approaches over Aorere River	220 0 0	..	146 13 4
Marlborough County.			
Track, Deep Creek to Dead Horse Creek	68 0 0	..	45 6 8
Buller County.			
Track, Northern Terrace to Oparara, Karamea..	500 0 0	250 0 0	83 6 8
Track, Lyell Bluff to Victor Emmanuel Claim..	650 0 0	200 0 0	233 6 8
Track to connect beach at Little Wanganui with track leading to Mokihinui	150 0 0	..	100 0 0
Road to Cape Foulwind	450 0 0	200 0 0	100 0 0
Extension of road to Denniston	450 0 0	..	300 0 0
	2,200 0 0	650 0 0	816 13 4
Inangahua County.			
Track, Reefton to Big River	1,792 0 0	1,084 6 8	110 6 8
Owen River Road to Uno Battery	300 0 0	..	200 0 0
	2,092 0 0	1,084 6 8	310 6 8
Grey County.			
Track, Kangaroo Forks to Blackwater	150 0 0	..	100 0 0
Track, Blackwater, Red Jack's to Nelson Creek	450 0 0	150 0 0	250 0 0
Track, Red Jack's to Nelson Creek	150 0 0	..	..
Road, Barrytown to Deadman's	2,240 0 0	912 0 0	581 6 8
Irishman's to Lake Brunner	900 0 0	150 0 0	450 0 0
Limestone to Maori Creek	800 0 0	..	533 6 8
	4,690 0 0	1,212 0 0	1,914 13 4
Westland County.			
Track, Rough Wahinui to Upper Dam, Kawhaka	450 0 0	..	300 0 0
Extension of track, Gentle Annie Terrace	220 0 0	..	146 13 4
Track, Okarito Forks to Teal Creek..	600 0 0	..	400 0 0
Browning's Pass Reefs	3,000 0 0	..	2,000 0 0
	4,270 0 0	..	2,846 13 4

LIST of WORKS on GOLDFIELDS, &c.—*continued.*

Locality and Nature of Works.	Total Cost or Amount Authorized.	Amount of Contribution paid by Mines Department.	Amount due by Mines Department on Works still in Progress.
SOUTH ISLAND—*continued.*			
ROADS—*continued.*	£ s. d.	£ s. d.	£ s. d.
Lake County.			
Road to Invincible Mine, Rees River	300 0 0	14 2 1	185 17 4
Arrowtown to Macetown, connection of roads	225 0 0	..	150 0 0
Arrowtown to Macetown, maintenance	200 0 0	83 14 6	16 5 6
Track, Mount Criffel Diggings	150 0 0	33 11 0	66 9 0
	875 0 0	131 7 7	418 11 10
Southland County.			
Improving road through Waikaia Bush	150 0 0	66 13 4	33 6 8
Road, Waikaia to Switzers	150 0 0	..	100 0 0
Road near Waikaka Township	150 0 0	..	100 0 0
	450 0 0	66 13 4	233 6 8
Tuapeka County.			
Track from Roxburgh Road at Shingle Creek to Campbell's and Pomahaka Creeks	450 0 0	12 15 0	287 5 0
Improving from Waitahuna River to the top of terrace on the road leading to Copper Mine	200 0 0	..	133 6 8
Approaches to Waitahuna Bridge	200 0 0	..	133 6 8
	850 0 0	12 15 0	553 18 4
Taieri County.			
Road, Mullocky Gully to Silver Peaks	600 0 0	200 0 0	200 0 0
Maniototo County.			
Road to connect Shepherd's Hut Flat and Vinegar Hill	100 0 0	..	66 13 4
Wallace County.			
Track, Round Hill to Colac Bay and Orepuki	525 0 0	..	350 0 0
Fiord County.			
Track, Dusky Sound	300 0 0	..	200 0 0
Roads to open up Mines other than Gold.			
Kanieri Coalfield	600 0 0	53 5 4	246 14 8
Ohinemuri Coal-seams	300 0 0	60 0 0	140 0 0
Richmond Hill to Copper Mine	469 13 0	209 4 0	103 18 0
	1,369 13 0	322 9 4	490 12 8
Roads constructed wholly by Mines Department.			
Arthur's Point to Skipper's	6,998 1 7	5,226 13 5	1,771 8 2
Brighton to Seventeen-Mile Diggings	4,199 9 4	1,199 9 4	3,000 0 0
Cobden to Seventeen-Mile Diggings	1,954 3 4	1,154 3 4	800 0 0
Mokihinui to Karamea *viâ* Rough and Tumble	11,818 1 11	6,648 16 4	5,169 5 7
Mokihinui Quartz Reef to Specimen Creek	1,500 0 0	891 13 3	608 6 9
Wilberforce Reef	2,000 0 0	1,718 7 7	281 12 5
Cedar Creek Road	3,000 0 0	442 14 0	2,557 6 0
Tracks, Collingwood to Motueka and Karamea	7,000 0 0	248 19 7	6,751 0 5
Owen Valley Reefs	500 0 0	42 7 6	457 12 6
Waikaia Bush	1,000 0 0	241 15 5	758 4 7
Waitahuna Bridge	750 0 0	..	750 0 0
Aorere Valley to Karamea	1,000 0 0	250 0 0	750 0 0
Opening up Mokau River	500 0 0	440 10 9	59 3 3
Lyell to Mokihinui	1,654 0 0	300 0 0	1,354 0 0
Road to Criffel Diggings	1,000 0 0	..	1,000 0 0
Wangapeka to Karamea	1,500 0 0	..	1,500 0 0
	46,373 16 2	18,805 16 6	27,567 19 8
WATER-RACES.			
Argyle–Charleston	7,486 7 5	7,135 9 1	350 18 10
Waimea–Kumara	10,678 13 9	10,478 13 9	200 0 0
Nelson Creek	769 5 6	387 5 0	382 0 6
Mokinui	16,307 19 5	13,976 14 5	2,331 5 0
Round Hill Water-race	2,400 0 0	..	1,600 0 0
Mount Ida	3,100 0 0	3,100 0 0	..
Water-main to Bull's Battery	350 0 0	..	100 0 0
Contingencies	434 12 2	434 12 2	..
Water-supply, Criffel Diggings	3,000 0 0	..	2,000 0 0
	44,526 18 3	35,512 14 5	6,964 4 4
DRAINAGE- AND SLUDGE-CHANNELS.			
Kumara Sludge-channel No. 2	2,768 2 2	1,440 13 9	1,327 8 5
Muddy Creek Channel	2,000 0 0	700 5 11	299 14 1
St. Bathan's Channel	2,000 0 0	217 3 9	782 16 3
Lawrence Drainage-channel	750 0 0	150 0 0	600 0 0
Sludge-channel, Ross	1,500 0 0	..	1,500 0 0
Carried forward	9,018 2 2	2,508 3 5	4,509 18 9

List of Works on Goldfields, &c.—*continued.*

Locality and Nature of Work.	Total Cost or Amount Authorized.	Amount of Contribution paid by Mines Department.	Amount due by Mines Department on Works still in Progress.
Drainage- and Sludge-channels—*continued.*	£ s. d.	£ s. d.	£ s. d.
Brought forward	9,018 2 2	2,508 3 5	4,509 18 9
Sludge-channel, Pipeclay Gully	1,300 0 0	402 14 4	296 4 8
Drainage-channel, Ophir	1,500 0 0	610 13 6	389 6 4
Long Gully Sludge-channel	200 0 0	..	100 0 0
Maerewhenua Water-supply	1,500 0 0	..	1,500 0 0
Repairs of damage done by floods to storm-channel, Ross ..	400 0 0	..	200 0 0
	13,918 2 2	3,521 11 3	6,995 9 9
Prospecting Subsidies.			
Deep-level tunnel, Reefton	6,900 0 0	2,397 0 0	1,081 0 0
Deep-level tunnel, Boatman's	600 0 0	150 0 0	150 0 0
Cardrona Prospecting Association	800 0 0	223 2 6	176 17 6
Deep Lead, Naseby	1,066 0 0	300 0 0	350 0 0
Manuka Flat, Lyell	1,250 0 0	..	500 0 0
Tokatea Gold-mining Company, Coromandel	700 0 0	42 6 6	307 13 6
Tuapeka Prospecting Association	900 0 0	438 10 0	11 10 0
Owheroa deep-level tunnel	400 0 0	..	200 0 0
Tapu deep levels	1,500 0 0	..	750 0 0
Cromwell Prospecting Association	500 0 0	93 9 0	156 11 0
Prospecting Company, Red Hill, Southern District	700 0 0	..	350 0 0
Oterongia Prospecting Association	1,000 0 0	25 6 3	474 13 9
Tapanui Borough Council	200 0 0	..	100 0 0
Tuapeka County Council	24 0 0	..	6 0 0
Coromandel County	200 0 0	..	100 0 0
Thames County	200 0 0	..	100 0 0
Stores and provisions supplied to prospecting parties	187 11 4	187 11 4	..
Southland County	500 0 0	..	250 0 0
Buller County	500 0 0	..	250 0 0
Grey County	1,000 0 0	..	500 0 0
Westland County	1,000 0 0	..	500 0 0
Prospecting Brock's Run, Mataura River to Catlin's River ..	150 0 0	..	75 0 0
	20,277 11 4	3,857 5 7	6,389 5 9

Summary of Works.

Roads on goldfields (subsidized)—	£ s. d.	£ s. d.	£ s. d.
Coromandel County	4,765 0 0	976 9 2	2,200 3 10
Thames County	3,124 0 0	969 4 10	1,113 1 10
Ohinemuri County	1,166 0 0	143 0 0	668 0 0
Piako County	450 0 0	..	300 0 0
Hutt County	300 0 0	106 13 4	93 6 8
Collingwood Road Board	220 0 0	..	146 13 4
Marlborough County	68 0 0	..	45 6 8
Buller County	2,200 0 0	650 0 0	816 13 4
Grey County	4,690 0 0	1,212 0 0	1,914 13 4
Westland County	4,270 0 0	..	2,846 13 4
Lake County	875 0 0	131 7 7	418 11 10
Southland County	450 0 0	66 13 4	233 6 8
Tuapeka County	850 0 0	12 15 0	553 18 4
Taieri County	600 0 0	200 0 0	200 0 0
Maniototo County	100 0 0	..	66 13 4
Wallace County	525 0 0	..	350 0 0
Fiord County	300 0 0	..	200 0 0
Inangahua County	2,092 0 0	1,084 6 8	310 6 8
	27,045 0 0	5,552 9 11	12,477 9 2
Roads to open up mines other than gold	1,369 13 0	322 9 4	490 12 8
Roads wholly constructed by Mines Department	46,373 16 2	18,805 16 6	27,567 19 8
Water-races	44,526 18 3	35,512 14 5	6,964 4 4
Drainage- and sludge-channels	13,918 2 2	3,521 11 3	6,995 9 9
Prospecting subsidies	20,277 11 4	3,857 5 7	6,389 5 9
Totals	153,511 0 11	67,572 7 0	60,885 1 0

Henry A. Gordon,
Inspecting Engineer.

LIST of WORKS on GOLDFIELDS constructed wholly by the Mines Department, or by Subsidies to County Councils, Local Bodies, and Prospecting Associations, and completed on the 31st March, 1886.

Locality and Nature of Work.	Total Cost.	Amount of Contribution paid by Mines Department.
NORTH ISLAND.		
ROADS.		
Coromandel County.	£ s. d.	£ s. d.
Improving Road to Iona and Just in Time Companies' mines	200 0 0	133 6 8
Making and improving track from Tokatea towards Kennedy Bay	320 0 0	213 6 8
Making and improving track from Golden Belt to Tiki	239 3 3	159 8 10
Making road from Ring's Bridge to Kapanga Mine	150 0 0	100 0 0
Making road to Kapanga Mine	132 0 0	88 0 0
Temporary track from Tokatea Saddle to Waikoromiko	50 0 0	33 6 8
Continuation of track from Success Company's mine to top of main range	80 0 0	53 6 8
Completion of road from Tokatea Saddle to Tokatea Battery	50 0 0	33 6 8
Widening road from Matawai to Vaughan's claim	357 0 0	238 0 0
Improving track, Mercury Bay to Waitai	100 0 0	66 13 4
Continuation and improving Waikoromiko track	150 0 0	100 0 0
Emily Battery to Rocky Creek	60 0 0	40 0 0
	1,888 3 3	1,258 15 6
Thames County.		
Making new road from Ohinemuri River to Karangahake quartz-mine	650 0 0	433 6 8
Dray-road to connect Otanui mines with crushing-battery at Maungawherawhera Creek	710 0 0	473 6 8
Improving roads from Waitekauri Road to Katikati Road	250 0 0	166 13 4
Improving road up Karaka Creek to LuckyH it Company's mine	263 1 0	175 7 4
Improving road to upper mines, Waitahi	258 18 10	172 12 7
Karangahake to battery	300 0 0	200 0 0
Ralph's Battery, Waitekauri	399 1 0	199 10 6
Otanui Road to mines	299 18 0	199 18 8
Road to Wick's Battery	70 0 0	46 13 4
Rocky Point Road, Tararu	300 0 0	200 0 0
Thames Borough boundary to hematite mine	350 0 0	233 6 8
	3,850 18 10	2,500 15 9
Piako County.		
Extension and completion of Te Aroha Tramway	18,000 0 0	12,000 0 0
Tramway to Fergusson's Battery, Waiorongomai	1,500 0 0	1,000 0 0
Road, Waiorongomai	500 0 0	333 6 8
	20,000 0 0	13,333 6 8
Hutt County.		
Road to connect Otorongo Bay with Albion Company's battery; also to connect Terawhiti quartz-mine with battery	509 16 6	210 17 0
SOUTH ISLAND.		
Tuapeka County.		
Making road from top of Terrace to Waipori Bush	300 0 0	200 0 0
Road, Beaumont to Remarkable Bush	300 0 0	200 0 0
Improving road from Waipori Township to antimony mines, Lammerlaw Ranges	200 0 0	133 6 8
Waipori Township to Waipori Bush	200 0 0	133 6 8
	1,000 0 0	666 13 4
Southland County.		
Improving tracks from Mataura to Nokomai	75 0 0	50 0 0
Improving road, Waikaka to Leatham	150 0 0	100 0 0
Improving road from Waikaka Township to Leatham Creek	30 0 0	20 0 0
Improving road from Waikaka to Waikaka railway-siding	150 0 0	100 0 0
Widening and improving bush-track to Waikawa	150 0 0	100 0 0
Waikaia to Whitcombe	150 0 0	100 0 0
	705 0 0	470 0 0
Westland County.		
Improving track, Boutcher's Creek to Gentle Annie Terrace	120 0 0	80 0 0
Bridle-track to Kanieri Lake	719 11 0	359 5 6
Bridle-track to Eel Creek	168 9 0	84 4 6
Tunnel-track, Galway Beach to Gillespie's Beach	437 5 0	218 12 6
Road from Duffer's Creek, Greenstone Road, to Fifteen-mile peg, Christchurch Road	726 9 0	480 4 6
Continuation of track, Back Creek to Eel Creek	249 4 0	166 3 4
Bridle-track, Duffer's Creek, Bowen and Okarito Road, to sea-beach	333 18 0	222 12 0
Ross Borough boundary to Mount Greenland	1,280 15 0	853 16 8
Track, Kanieri Lake to Humphrey's Gully	279 2 0	186 1 4
Track, Larrikins' to Loopline Dam	449 11 0	299 14 0
	4,764 4 0	2,950 13 4
Grey County.		
Road from Notown to Deep Creek	1,100 0 0	550 0 0
Road from Langdon's to Moonlight	1,600 0 0	800 0 0
Contribution from Goldfields vote towards main road	2,296 6 6	2,296 6 6
Track, Waipuna to Clarke's River	1,200 0 0	800 0 0
Track, Cameron's to Cape Terrace	700 0 0	466 13 4
	6,896 6 6	4,912 19 10

List of Works on Goldfields, &c.—*continued.*

Locality and Nature of Work.	Total Cost.	Amount of Contribution paid by Mines Department.
SOUTH ISLAND—*continued.*		
Roads—*continued.*		
Inangahua County.	£ s. d.	£ s. d.
Dray-road from Soldier's Creek to Devil's Creek	647 0 0	431 6 8
Dray-road from Inangahua to Rainy Creek Battery	909 10 0	606 6 8
Dray-road from Capelstown up Little Boatman's Creek	379 0 0	252 13 4
Dray-road from Capelstown up Main Boatman's Creek	697 0 0	464 13 4
Dray-road from Westport Road to Inangahua River	224 5 0	149 10 0
Track from Devil's Creek to Big River	134 3 6	89 9 0
Track from Waitahu River to Capelstown	358 0 0	238 13 4
Survey and expenses	250 0 0	166 13 4
Track from Cariboo to Big River	728 0 0	3b4 0 0
Dray-road up Murray Creek to United Inglewood claim	3,472 0 0	2,314 17 4
Road from Reefton to Big River *viâ* Devil's Creek	614 0 0	307 0 0
Road up Big River	922 19 0	615 6 0
Continuation of dray-road up Little Boatman's Creek	169 7 6	112 18 4
Road from Capelstown to Larry's Creek	640 0 0	426 13 4
	10,145 5 0	6,539 0 8
Buller County.		
Deviation of road from Candlelight Flat to Deep Creek, Charleston	370 0 0	246 13 4
Road from Orowaiti Lagoon to North Terrace	256 18 6	171 5 8
Prospecting-track from Razorback to Paparoa Range	100 0 0	66 13 4
Track from Seatonville to Larrikins'	438 9 6	292 6 4
Waimangaroa to Denniston	787 0 0	393 10 0
Road to connect alluvial workings with Charleston Road	400 0 0	266 13 4
Track, Four-mile Creek towards Grey Valley	300 0 0	200 0 0
Road to connect alluvial diggings, north of Deadman's Creek	278 0 0	185 6 8
Ngakawhau to Mokihinui, *viâ* beaches	100 0 0	66 13 4
Road to connect Ngakawhau Railway with Mokihinui Coal Company's workings	193 0 0	128 13 4
	3,223 7 0	2,017 15 4
Lake County.		
Track, Skipper's to Phœnix and Scandinavian Reefs	292 2 3	194 14 10
Track to connect scheelite-mine with Lake Wakatipu	225 0 0	150 0 0
	517 2 3	344 14 10
Wallace County.		
Track, Colac Bay to Round Hill	200 0 0	133 6 8
Maniototo County.		
Road to Serpentine Diggings	136 10 0	91 0 0
Collingwood Road Board.		
Road, West Wanganui	300 0 0	200 0 0
Diamond and other Drills.		
Inangahua County Council (diamond)	2,000 0 0	1,000 0 0
Springfield Colliery Company (diamond)	1,250 0 0	625 0 0
Westland County Council (tiffin)	350 0 0	233 0 0
	3,600 0 0	1,858 0 0
Aids to Prospecting.		
Construction of low-level tunnel, Terawhiti	750 0 0	150 0 0
Queen of Beauty Company, prospecting deep levels	300 0 0	150 0 0
Caledonian Low Level Company, prospecting deep levels	300 0 0	150 0 0
Red Hill Gold-mining Company, prospecting deep levels	600 0 0	300 0 0
Caledonian Low Level Company low-level tunnel	2,700 0 0	300 0 0
Lyell Creek Extended Company low-level tunnel	300 0 0	150 0 0
New Cromwell Gold-mining Company	250 0 0	100 0 0
Deep Level Association, Waipori	450 0 0	300 0 0
	5,650 0 0	1,600 0 0
Drainage- and Sludge-channels.		
Drainage-channel, Lawrence (total cost, approximate)	3,000 0 0	2,000 0 0
Subsidy towards purchase of Messrs. Laidlaw and Crawford's freehold in Spotti's Creek to allow tailings to be deposited (Tinker's diggings)	500 0 0	400 0 0
Damage by floods, Thames	1,000 0 0	500 0 0
Sludge-channel, Smith's Gully, Bannockburn	1,000 0 0	251 1 0
Round Hill Sludge-channel survey	52 19 7	52 19 7
Compensation to J. Costello, damage done by tailings	788 0 0	788 0 0
	6,340 19 7	3,992 0 7
Roads wholly constructed by Government.		
Lyell to United Italy claim, Eight-mile	2,899 17 6	2,899 17 6
Reconnaissance survey of road, Italy claim, Eight-mile to Seatonville, Mokihinui	300 0 0	300 0 0
Construction of road, Arrowtown to Macetown	9,570 6 8	9,570 6 8
Road to open up Woodstock Goldfield	1,000 0 0	1,000 0 0
Ahaura to Amuri	2,504 19 7	2,504 19 7
	16,275 3 9	16,275 3 9

LIST of WORKS on GOLDFIELDS, *&c.—continued.*

Locality and Nature of Work.	Total Cost.	Amount of Contribution paid by Mines Department.
ROADS TO OPEN UP MINES OTHER THAN GOLD.	£ s. d.	£ s. d.
Aniseed Valley to Champion Copper Mine	4,963 10 6	4,116 10 6

Summary of Works.

	£ s. d.	£ s. d.
Roads—Subsidies to County Councils.		
Coromandel County	1,888 3 3	1,258 15 6
Thames County	3,850 18 10	2,500 15 9
Piako County	20,000 0 0	13,333 6 8
Hutt County	509 16 6	210 17 0
Tuapeka County	1,000 0 0	666 13 4
Southland County	705 0 0	470 0 0
Westland County	4,764 4 0	2,950 13 4
Grey County	6,896 6 6	4,912 19 10
Inangahua County	10,145 5 0	6,539 0 8
Buller County	3,223 7 0	2,017 15 4
Lake County	517 2 3	344 14 10
Wallace County	200 0 0	133 6 8
Maniototo County	136 10 0	91 0 0
Collingwood Road Board	300 0 0	200 0 0
	54,136 13 4	35,629 18 11
Diamond and other drills	3,600 0 0	1,858 0 0
Aids to prospecting	5,650 0 0	1,600 0 0
Drainage and sludge-channels	6,340 19 7	3,992 0 7
Roads wholly constructed by Mines Department	16,275 3 9	16,275 3 9
Roads to open up mines other than gold	4,963 10 6	4,116 10 6
Totals	90,966 7 2	63,471 13 9

HENRY A. GORDON,
Inspecting Engineer.

RETURN showing the RECEIPTS and EXPENDITURE on, and Collateral Advantages derived by the working of, the Water-races constructed and maintained by Government during the Year ending the 31st March, 1886.

Name of Water-race.	Receipts.	Maintenance.	Profit or Loss.	Cost of Construction.	Total Cost of Construction.	Percentage on Capital invested.	Number of Men employed.	Approximate Amount of Gold obtained.	Value of Gold obtained.	Average Earnings of Men after deducting Cash paid for Water.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.			Oz.	£ s. d.	£ s. d.
Waimea	1,750 14 10	1,131 18 1	*618 16 9	...	118,575 15 2	About ½%	107	3,520	13,376 0 0	109 6 2
Kumara	10,381 11 1	1,454 19 5	*8,926 11 8	37,400 2 11	54,600 15 5	Abt. 9¼%	236	13,856	52,653 3 0	169 1 10
Kumara Sludge-channel ...	2,366 1 3	6,215 13 0	†3,849 11 9	17,200 12 6						
Nelson Creek	1,073 14 2	1,104 13 4	†30 19 2	...	90,151 19 1	Loss.	64	2,358	9,019 7 0	124 3 0
Argyle	435 2 8	391 17 8	*43 5 0	...	14,192 17 11	Nearly ½%	21	464	1,774 16 0	63 16 0
Mikonui	100 0 0	...	100 0 0	...	25,624 2 7	In construction	...	...	...	...
Totals	16,107 4 0	10,299 1 6	5,808 2 6	...	303,145 10 2	...	428	20,198	76,823 6 0	141 17 2

* Profit. † Loss.

HENRY A. GORDON,
Inspecting Engineer.

[*Approximate Cost of Paper.*—Preparation, nil; printing (1,700 copies), £37 12s. 9d.]

By Authority: GEORGE DIDSBURY, Government Printer, Wellington.—1886.