1888.

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 UNDER-SECRETARY of MINES.

SIR,— Mines Department, Wellington, 1st May, 1888.

I have the honour to submit my annual report for the year ending the 31st March, 1888, on works which have been undertaken or executed under authority from the Mines Department, and also on the state of mining generally on the various fields I visited during last year, together with a report on the extraction of gold- and silver- ores.

The subjects are classified under the heads of "Subsidised Roads and Tracks," "Drainage- and Sludge-channels," "Aids to Prospecting," "Aids towards Treatment of Ores," "Aids to School of Mines," "Roads wholly constructed by the Mines Department," "Report on Gold- and Silver-mines," "Maharahara Copper-ore," "Treatment of Gold- and Silver-ores," and statistical tables showing the expenditure on works, &c.

SUBSIDISED ROADS AND TRACKS.

COROMANDEL COUNTY.

Road, Vizard's Claim towards Maribel.—This is a narrow dray-road round the side of the range between Matawai and Tiki, to afford facility to the claim-holders in the locality to get their auriferous quartz conveyed from their claims to the crushing-battery at Matawai Creek. The cost of the work has been £200, of which amount £133 6s. 8d. was paid as subsidy.

Extending and Widening Waitaia Road.—This is a horse-track leading from Mercury Bay towards Waitaia Creek, where gold was discovered several years ago. Recently a payable quartz reef has been discovered in this locality, and it is believed by the residents that other auriferous reefs will yet be found which will pay for working, and that this road will be partially the means of their being opened up. Portions of the track have been widened, and deviations have been made to avoid steep pinches. The cost of the work has been £100, of which amount £66 13s. 4d. was paid as subsidy.

Track, Tiki Bridge to Mercury Bay.—This track has been in course of construction for the last three years. Subsidies on different portions of it have been given from time to time under the names of Makarau to Waiau and Old Saw-mill to Awakanae. These portions are completed at a cost of £1,600, of which a subsidy has been paid to the extent of £1,066 13s. 4d. The total distance between Tiki Bridge and Mercury Bay is about twenty miles, but there is a portion of the track going over hard *Pakihis* which will not require construction. Still, there are several intervening portions which require to be constructed to fully utilise the road and make it safe for horse-traffic. These portions are estimated to cost £1,000. Of this amount £500 has been authorised as subsidy.

Extension Paul Creek Track.—This is a horse-track between Coromandel and Cabbage Bay. There are 4 miles 5 chains constructed on the Cabbage Bay end, and a short distance on the Coromandel end; but it requires about five miles of track to connect the constructed portions. The track requires to be extended from the Coromandel end to allow the miners facility to work their claims in Paul's Creek. This is estimated to cost £300, of which amount a subsidy has been authorised to the extent of £150.

Track, Tiki to Waikawau.—This is portion of the main line of road between the Thames and Coromandel, and includes two tracks, mentioned in the schedule of works completed. The track is constructed 6ft. wide, having as easy dray-road grades as the rough character of the country will admit. The cost of the work up to the 31st March last was £1,000, of which amount

£583 6s. 8d. was paid as subsidy. There are several portions of the track between Tiki and the sea-beach at Wilson's that require to be constructed yet to make it a good track for horse-traffic. These are estimated to cost £300, and a subsidy on this amount has been authorised to the extent of £150.

Track, Golden Belt.—This is a sledge-track between Matawai Creek and Tiki. It was formerly constructed as a horse-track, but had to be widened to allow a small dray to be used to convey the auriferous quartz from the claims in this locality to the crushing-battery. The cost of widening was £100, of which amount £50 has been paid as subsidy.

Road, Coromandel to Tokatea.—A portion of this road was repaired, namely, between the bottom of the Tokatea Range and the Saddle, which was greatly damaged by large slips, blocking the road completely up. The cost of repairs was £300, of which amount £150 was given as subsidy.

Road, Old Saw-mill towards Matawai.—This is a narrow dray-road from the crossing of the Waiau Creek to the crushing-battery at Matawai Creek to allow auriferous quartz to be conveyed to Coromandel, and also to get machinery up to the Matawai Battery. The work is in course of construction, and when completed it is estimated to cost £300. A subsidy has been authorised to the extent of £166 13s. 4d., of which amount £100 has been paid.

Extension, Harbour View Road.—This is a narrow dray-road leading from the Coromandel–Tokatea Road to the mining-claims on the northern side of the Tokatea Range, to the point called Harbour View. This road requires to be extended about one mile to a point where there are a number of tributers at work in the Tokatea Company's ground. These tributers have no other means of getting the quartz taken to the crushing-battery at the present time than by carrying the stone in bags on their backs, over the top of the range to the road on the southern side. The extension is estimated to cost £150. Of this amount a subsidy has been authorised to the extent of £75.

THAMES COUNTY.

Road, Sea-beach to Waiomo.—This is a dray-road from the sea-beach up the Waiomo Creek to its junction with the Paroquet Creek; thence up the Paroquet Creek to the mines. The whole of the work is completed at a cost of £750. Of this amount a subsidy has been paid to the extent of £375.

Road, Te Papa Gully.—This is for metalling a dray-road from Te Papa Gully to the Flat at Shortland to allow drays to convey the quartz from the mining-claims in the locality to the crushing-batteries. The cost of the work was £75. Of this amount £37 10s. was paid as subsidy.

Repairing Flood Damages.—This is for repairs to the Waiotahi, Moanataiari, Karaka, and Collarbone Roads, which had to be undertaken at once to make the roads passable, owing to the heavy floods in May, 1887, having damaged them to such an extent that all traffic was stopped. The cost of these repairs was £350, out of which a subsidy was paid to the extent of £175.

Road, Waiomo to Tapu.—This is for widening the bridle-track that went along the edge of the sea-beach into a dray-road for the purpose of facilitating the conveying of auriferous quartz to the crushing-batteries at either Tapu or Grahamstown. This work is in course of construction, and when completed is estimated to cost £1,500. Of this amount a subsidy has been authorised to the extent of £750, of which £524 12s. 10d. has been paid.

Road, Karaka Creek to Lucky Hit.—This is the extension of the Karaka Creek road to the mining-claim known as the Lucky Hit, which is required to enable the auriferous quartz from the mining-claims in this locality to be conveyed to the crushing-batteries at Grahamstown. The extension is estimated to cost £600, and a subsidy was authorised on this amount to the extent of £300, of which £167 5s. 3d. has been paid.

Track, Waiotahi towards Mercury Bay.—There is a bridle-track constructed for about six miles from the head of the Waiotahi Creek to Punga Flat, where some settlers are located. The track is now being extended towards Gum Town, which is a little above the head of Mercury Bay. The work is in course of construction, and when completed will tend to open up what is believed to be a payable auriferous country. The estimated cost of the tract is £616 3s. A subsidy has been authorised on this amount to the extent of £360 15s. 4d., of which £261 5s. 6d. has been paid.

Road, Hikutaia Goldfield.—A dray-road is being constructed up the side of the Hikutaia River towards Marototo. The portion under construction is through swampy ground, which had to be drained before a road could be of any practical utility. About a mile of the road is in course of construction, which is estimated to cost £400. Of this amount a subsidy has been authorized to the extent of £200, on which £73 17s. 7d. has been paid.

Road, Puriri to New Discoveries.—Several auriferous-quartz claims have been taken up on the side of the range, some of which show fair prospects. This road is to enable the claim-holders to get up machinery and to convey the quartz to the Thames Valley Road, in order to take it to the crushing-batteries at Grahamstown. The estimated cost of the work is £200, of which amount a subsidy has been authorised to the extent of £100.

Track up Te Mata Creek.—Gold was found in Te Mata Creek some fifteen years ago, and the bed of the creek has been worked in many places by sluicing for alluvial gold. Recently, gold has been discovered in quartz reefs and a commencement made to work them; but there is no road either to get machinery up or to convey the quartz to the batteries at Tapu or Grahamstown. The construction of this track will give better facilities for opening up this part of the country. It is estimated to cost, when completed, £200. Of this amount a subsidy of £100 has been authorised.

Track, New Find to Waiomo Battery.—This is a sledge-track from the Golden Drop Claim to the Waiomo Crushing Battery. Gold has recently been discovered on the south side of the Waiomo Creek, and a track will have to be constructed before any quartz can be conveyed from the claim to the battery. The cost of this work is estimated to be £110. Of this amount a subsidy has been authorised to the extent of £55, of which the sum of £30 has been paid.

Track, Alabama Creek.—This is a prospecting-track to open up the country. It is estimated to cost £60, and a subsidy on this amount has been authorised to the extent of £30.

OHINEMURI COUNTY.

Road from Battery Tramway to Waihi Gold- and Silver-mines.—This is a dray-road to enable machinery to be brought on the ground to work the mining-claims which have recently been floated into a large company with English capital. The estimated cost of the work is £300, of which amount a subsidy of £150 has been authorised.

Track to Marototo Mines.—This is a proposed prospecting-track from the gold-workings at Waitekauri along the range to Marototo. It is estimated to cost £100; and a subsidy has been authorised on this amount to the extent of £50.

Tramway, Karangahake to Railey's Reduction-works.—This tramway was advocated for several years, long before Railey's plant was erected, as the best means of getting the quartz taken from the claims on the Karangahake Range to the place where a crushing-battery could be erected. But since this tramway has been completed it has never been used, owing to the crushing company being put into liquidation. The cost of the work has been £400. Of this amount a subsidy was paid to the extent of £200.

Strengthening Bridge on Road, Paeroa to Waihi.—A large amount of machinery for the new English company at Waihi has recently arrived from England and America, and it was found necessary to strengthen some of the bridges on the road before the machinery could be taken to the company's machine-site. The estimated cost of the work is £200. Of this amount a subsidy has been authorised to the extent of £133 6s. 8d.

PIAKO COUNTY.

Track up Stoney Creek.—This is a prospecting-track for the purpose of opening up the country. When it was first proposed to be constructed it was estimated to cost £162 16s. 9d. Of this amount a subsidy was authorised to the extent of £108 12s. 2d., but the track was so badly laid out and constructed that only £36 of the subsidy was paid, and the balance of authority cancelled.

COLLINGWOOD COUNTY.

Bridge over the Aorere River.—This is a horse-bridge over the gorge of the Aorere River at Salisbury's Crossing, to enable supplies to be conveyed to the miners who are working in the Quartz Ranges. The cost of this bridge has been £173 14s. Of this amount £115 16s. has been given as subsidy.

WAIMEA COUNTY.

Track to Table-land Diggings.—This is a horse-track from Anatoki to Table-land Diggings. The track has been surveyed and graded for several miles, and a section of it is now in course of construction, which is estimated to cost, when completed, £260. Of this amount a subsidy was authorised to the extent of £130, of which £115 has been paid.

BULLER COUNTY.

Extension of Road, Croninville.—This is an extension of the road leading from the Westport–Charleston Road towards Croninville, to enable timber and materials to be supplied to the mining-claims in this district. The estimated cost of this extension is £100, of which amount a subsidy has been authorised to the extent of £50.

Track, Waimangaroa to Sea-beach.—This is a horse-track from Waimangaroa Township to the sea-beach, to give facilities to the miners who are living at Waimangaroa to get to and from their claims, and to get supplies. The track is estimated to cost £80, and a subsidy has been authorised on this amount to the extent of £40.

Road, Ngakawhau Railway-station to Mokihinui.—The portion of the road constructed here is over one of the small rocky bluffs between Ngakawhau and Mokihinui. The cost of the construction was £50, on which a subsidy was paid of pound for pound.

Track, Addison's Flat towards Ranges.—This is a prospecting-track into the ranges above Addison's Flat, for the purpose of giving facility to miners to prospect the back country. £20 has been spent on this work, out of which £10 was paid as subsidy.

Track, North Terrace, to Oparara Diggings.—A dray-road was constructed several years ago from the wharf, near the mouth of the Karamea River, for the use of the settlers at North Terrace. A horse-track has been constructed from this road towards the Oparara Diggings. This goldfields gives remunerative employment to settlers in the district when they have not work on their farms. The cost of this track has been £500, and a subsidy on this amount paid to the extent of £333 6s. 8d.

INANGAHUA COUNTY.

Track, Larry's Creek to Lyell.—A horse-track was constructed from Capleston to Larry's Creek about four years ago; and it is now proposed to continue this track across the country to join the Westport–Lyell Road, near Dee River, which is a distance of about fifteen miles. A subsidy was authorised for this work up to the extent of £750, on condition of the county spending a similar amount. A portion of this track is now in course of construction.

Track, Crushington to Globe Company's Workings.—This is a horse-track from the Inangahua River, near Crushington, over the range to join the horse-track, which is constructed up Oriental Creek to the Globe Company's Mine. The cost of the track has been £403, and a subsidy has been given towards its construction to the extent of £201 10s.

Track, Snowy Creek.—This is a prospecting-track to open up the country, and enable pack-horses to bring in supplies. The cost of the work has been £85 15s., of which amount a subsidy of £42 17s. has been paid.

Road, Reefton to Big River.—This was merely constructed as a horse-track, but now narrow-gauge drays are employed to convey the supplies to the mining-claims that are at work all along the line. The road is now constructed to the Big River Mining-district, a distance of eighteen miles from Reefton, and it promises to open up a large field for mining. The cost of the road from Devil's Creek to the Big River has been £1,792, of which amount a subsidy of £1,194 13s. 4d. has been paid.

Glenroy to Horse Terrace.—This is an extension of the horse-track constructed up the Matakitaki River to a point known as Moonlight's store. The extension leads from the old store, up the bank of the river, to Dead Horse Terrrace, where several miners are at work. The cost of the extension has been £254; and the amount of subsidy on this work was £122 10s.

GREY COUNTY.

Track, Irishman's to Lake Brunner.—This horse-track has been in course of construction for two years past, to open up the country and afford facilities for prospecting this portion of the district. It will also be the means of opening up some land that is suitable for settlement. The estimated cost of the track, when completed, is £2,400. Of this amount subsidies to the extent of £1,200 have from time to time been authorised, of which £900 has been paid.

Track, Deep Creek to Bell Hill.—This is a continuation of the horse-track which was constructed about four years ago from No Town to Deep Creek. This track is now being extended towards Bell Hill; several sections of it are under construction, which are estimated to cost £800. Of this amount a subsidy has been authorised to the extent of £400, of which £176 10s. has been paid.

Road, Hatter's Terrace.—This is a dray-road up the western side of Nelson Creek from the Grey Valley Road, to avoid the crossing of the creek, which is dangerous when flooded. The cost of the work has been £800, of which amount a subsidy of £400 has been paid since the end of last financial year.

Track, Baird's Terrace to Lake Brunner.—This is a continuation of the horse-track from Maori Creek or Dunganville to Baird's Terrace. It has now been extended to Lake Brunner at a cost of £400, of which amount a subsidy has been paid to the extent of £200.

WESTLAND COUNTY.

Track, Arahura to Browning's Pass.—A horse-track has been formed from the Arahura River for a distance of twenty-five miles above the Christchurch Road crossing. The work done consists principally of clearing the bush, cutting a track on the sideling, and generally making the track passable for horse-traffic. The cost of the work has been £3,311 6s., and a subsidy has been paid on this amount of £2,207 10s. 8d.

Track, Rough Wainihinihi to Upper Dam.—This is a horse-track from the Wainihinihi Creek over the range to the Kawahaka Creek, where the upper dam of the Waimea water-supply is constructed. This track it is believed will open up some country where payable auriferous ground will be discovered. The cost of the work has been £450. Of this amount a subsidy has been paid of £300.

Track, Okarito Forks to Teal Creek.—This is a horse-track with 3ft. metalled roadway and 12ft. clearing from the main Ross–Okarito Road at the forks of the Okarito River to Teal Creek, to open up the country for prospectors, and also to enable supplies to be conveyed to miners working in this locality. The cost of this track, which is 4 miles 30 chains in length, has been £600. Of this amount £400 has been paid as subsidy.

TUAPEKA COUNTY.

Road to open up Quarry, Waitahuna.—This road was made for the purpose of conveying stones for the construction of the piers of the bridge across the Waitahuna River. The cost of the road has been £160 9s. 10d., of which amount £106 19s. 11d. has been paid as subsidy.

Road, Waipori, via Bungtown.—This is for constructing a portion of the dray-road between the valley of the Waitahuna River and Waipori, which is really a portion of the main road between Lawrence and Waipori, *viâ* Waitahuna. This road can be used at all seasons of the year, whereas the old road, leading direct from Lawrence to Waipori, is often impassable owing to the depth of snow during the winter months. The cost of constructing the section just completed is £566 8s. 10d. Of this amount £283 4s. 5d. has been paid as a subsidy.

MANIOTOTO COUNTY.

Track, Shepherd's Hut to Vinegar Hill.—This is a horse-track for the purpose of getting supplies conveyed to those who are mining in this locality. The cost of the work has been £100. Of this amount £66 13s. 4d. has been paid as a subsidy.

Track, Kyeburn Peninsula to Main Road.—This is a road to connect the Kyeburn Peninsula with the main road leading to Palmerston, to get supplies and material brought to the miners who are working in this neighbourhood. The cost of this road has been £82. Of this amount £41 was paid as a subsidy.

LAKE COUNTY.

Road, Left Branch, Skipper's Creek.—This is a narrow dray-road which has been constructed up the left branch of Skipper's Creek, for the purpose of getting timber conveyed from the bush on both sides of this branch to the mining-claims at Skipper's. The cost of the work has been £63 9s. 10d. Of this amount £31 14s. 11d. has been paid as subsidy.

WALLACE COUNTY.

Road, Round Hill and Orepuki.—This is a road from the railway-station at Colac Bay to the Round Hill Diggings. There was formerly a corduroyed horse-track between these places, but it became so bad that it was scarcely passable for horse-traffic. A metalled roadway has now been made, at a cost of £1,050. Of this amount £500 has been paid as subsidy.

SUBSIDISED DRAINAGE- AND SLUDGE-CHANNELS.

Sludge-channel, St. Bathan's.—This is a sludge- or tailings-channel now in course of construction from Dunstan Creek to the mining-claims at St. Bathan's, to enable the ground to be worked to a depth of 70ft. below the old workings. The old quartz wash-drift in this neighbourhood contains a little gold all through it, which pays for washing by the hydraulic process. It is not yet known whether this extra depth of tail-race will be sufficient to bottom the ground where this quartz wash-drift was originally deposited. This tailings-channel was commenced in 1882, and will yet take about three years to complete; but it is now up to such a point that the gold obtained from the drift through which it is being carried almost pays for the cost of its construction. A subsidy of £1,000 was authorised for this channel on the principle of pound for pound, the whole of which has now been paid.

Drainage Tail-race, Ophir.—This is the continuation of a tail-race that was constructed up Black's Flat many years ago to drain the ground. This tail-race has been continued up to near the station homestead, which now drains the whole of the flat; but the ground that was expected to prove payable in the vicinity of this tail-race did not turn out according to expectations. A few parties of miners are working ground by means of this tail-race, but they are only making very small wages. It has been extended for over a mile, and has cost £2,300. Of this amount £1,150 has been paid as subsidy.

Repairs to Sludge-channel, Ross.—A heavy flood occurred last year, and washed away portions of the wing-dam. This was repaired at a cost of £109 1s. Of this amount £54 10s. 4d. has been paid to the Borough of Ross as a subsidy.

GRANTS TOWARDS THE CONSTRUCTION OF DRAINAGE- AND SLUDGE-CHANNELS AND OUTLETS FOR TAILINGS.

Storm-water Channel, Ross.—A heavy flood occurred about two years ago, which carried away the greater portion of the original channel constructed in 1867, flooding all the underground workings in Ross Flat. This channel had to be reconstructed before the workings could be again resumed, and £750 has been paid for doing this work.

Sludge-channel, Ross.—This is really for the construction of wing-dams, to prevent the sludge and tailings from the hydraulic sluicing-claims damaging the freehold land along the sea-beach. If this had not been done the proprietors of the land threatened to take proceedings against the miners to stop them from working. A grant of £1,500 was authorised for this work and constructing a new storm-channel, it being understood that one-half of this amount—namely, £750—would be spent on each. The work was done under the supervision of the Borough Council of Ross, and the whole of the £1,500 has been paid.

Tailings Outlet, Maerewhenua.—This was for the purchase of land on the flats on the northern side of the Maerewhenua River, to give an outlet for tailings from claims that are being worked in the mining reserve. The land on the side of the river being all freehold, the proprietors would not allow tailings to come through their properties. There has been £1,555 4s. paid for land purchase, and £40 for damages and building retaining-wall, making a total of £1,595 4s.

Thames Drainage Board.—The Drainage Board purchased the big pump and machinery at the Thames from the Deep Level Cross Company, and are working it by contributions, or rates raised from mining-claims within a certain area. This steam-engine and pumping-gear originally cost the colony £50,000, and on the provinces being abolished this plant was handed over to the county, who, after a certain time, allowed it to be sold to pay off some of their liabilities. The Deep Level Cross Company then became the purchasers, but, after working it for some time, they found the expense of working so great that they were glad to get clear of it at any price, and sold the whole plant to the Drainage Board for £2,500. About twelve months ago the Board represented to the Government that the pump could be worked with water-power, and that the cost of alteration would amount to £4,000; also, that the saving in cost of maintenance would be over £1,000 per annum. A subsidy of £2,000 was authorised for this work.

AIDS TO DEEP-LEVEL TUNNELS.

Tokatea Company, Coromandel.—This company lost the auriferous-quartz lode in the deep-level workings, and after constructing an adit for about 3,000ft. could not discover it. A subsidy was authorised to the extent of £350, on the principle of pound for pound to prospect the mine, and the whole of this subsidy has been paid, but the company has not yet been successful in finding a payable lode at these levels.

Deep-level Tunnel, Tapu.—This is an adit-level which was commenced at the level of the dray-road going up Tapu Creek, a short distance above Mr. Pepper's crushing-battery. It was intended to go through the range to cut the quartz lodes that were worked in the early days by the Half-moon Company, which would be a distance of 1,500ft. This adit is constructed for 617ft., but operations are now suspended, and prospecting is being done on a quartz-leader which was cut about 200ft. in from the mouth of the adit. Subsidies on the principle of pound for pound have been authorised from time to time to the extent of £600, the whole of which has now been paid. The total cost of the work has been £1,239 15s. 4d.

Deep-level Tunnel, Reefton.—This tunnel or adit-level was commenced in 1882, and has been carried on ever since. The original intention was to tunnel through the range from the Inangahua River, near Black's Point, to the Waitahu River, a distance of 2 miles 24 chains, to cut across all the lodes that might be found, and test whether payable reefs existed at great depths below the surface. This adit-level is now constructed for 2,706ft. It is expected soon to cut the line of the quartz lode which is found in the Venus Company's ground. The cost of constructing this adit-level up to the end of March last was £6,018. Of this amount £3,009 has been paid as subsidy. Another contract for its extension has been let, amounting to £474. This will absorb the balance of subsidy authorised, which is £237.

Deep-level Tunnel, Manaia, Coromandel.—About three years ago auriferous-quartz lodes were discovered in the Manaia District, and some of the stone crushed gave good returns. Lynch and party sunk down about 30ft. on the reef, and got very fair prospects, but the influx of water became so great that the workings had to be abandoned. A deep-level tunnel or adit-level was then constructed into the side of the range with the view of cutting across quartz lodes if any should exist. A subsidy of £250 on pound-for-pound principle was authorised for this work. Of this amount £225 12s. has been paid.

Deep-level Tunnel, Owharoa.—This is the continuation of an adit-level which was constructed several years ago to work out a quartz lode. The extension was to cut through a hard band of rock to see whether gold-bearing quartz could be found on the other side. The cost of this extension has been £300 8s. Of this amount £200 5s. 4d. has been paid as subsidy.

Deep-level Tunnel, Cedar Creek.—This low-level tunnel or adit was commenced about three years ago, to test whether the auriferous-quartz lode that was found cropping out in the bed of Cedar Creek, in the William Tell Company's ground, continued to go down. The adit-level is constructed for over 1,000ft. In this distance several quartz leaders or segregated veins were cut through, and a prospect of gold was found in some of them. The cost of the work was £1,200. Of this amount £600 has been paid as a subsidy.

Deep-level Tunnel, Bullion Mine, Tapu, Thames.—This was an extension of the deep-level adit which was constructed some twelve years ago. The object was to extend this adit-level in the direction of the Tapu Deep Level Tunnel, which was being constructed in this direction from the opposite side of the range. The cost of this extension was £300; of this amount £150 was paid as a subsidy.

Deep Levels, Kapanga Company, Coromandel.—The Kapanga Mine has been worked for the last fifteen years with English capital, but some two years ago the company was wound up, and the plant sold. Steps were then taken to form a new company to sink the shaft to a greater depth and prospect the mine, and £1,000 was offered as a subsidy on the expenditure of £20,000 to further test the ground, payments to be made at the rate of 5 per cent. on the total expenditure for this purpose. This was the means of another English company taking up the mine, and after the expenditure of £6,740, on which a subsidy of £337 has been paid, the company has been successful in finding a payable lode, which is now being worked.

AIDS TO PROSPECTING.

Cardrona Prospecting Association.—An association was formed at Cardrona to prospect the Cardrona Flat, where it was believed by those in the district that the lead of gold which was worked in the early days went down the flat, but after many attempts to prospect this flat the workings had to be abandoned, owing to the large body of water that was always met with. The association commenced operations about three years ago, and constructed a tail-race to carry away the water, but have not yet been successful in finding gold to pay for working. On prospecting works and for the construction of this tail-race £800 has been spent. Of this amount £400 has been paid as a subsidy.

Cromwell Prospecting Association.—An association was formed to carry on prospecting operations in the Cromwell District, and a subsidy of £250 was granted on the principle of pound for pound on prospecting works.

Royal Oak Prospecting Association.—This association was formed for the purpose of prospecting for auriferous-quartz lodes in the Carrick Range. A subsidy of £150 was authorised for this purpose on the pound-for-pound principle, the whole of which has been paid.

Pullar, Shelmerdine, and Basan.—This party reported that they had found gold in a quartz reef at Harbour Cove, at Portobello. About thirteen years ago prospecting was carried on here, and gold was found in some of the country rock. Three trial crushings were at that time made of parcels of one ton of hard rock, which yielded 8dwt.; one ton of soft rock, yielding 11dwt.; and half a ton of hard rock, which yielded 11dwt. of gold. A subsidy of £200 was authorised on the pound-for-pound principle to further prospect this locality, and to get machinery on the ground, the whole of which has been paid.

Fox and Party.—This was a prospecting party, one of which was paid regular wages, viz., 10s. per day, and another £1 per week, to prospect the southern portion of the West Coast. The money paid towards this party was £355 10s.

Carey and Hyndman.—These persons belonged to the prospecting party that were employed two years ago by the Red Hill Mineral Association, which was formed in Christchurch. On their return the representations of those men were such that there was every reason to believe that gold existed in the Big Bay District. A large prospecting expedition was fitted out, and these men went with the expedition to show where they thought gold would be found, and were paid £220 14s. 8d. towards getting provisions and outfits, and £1 each per week during the time they were away.

Miscellaneous Aids to Prospecting.—Various subsidies for prospecting have been given through County and Borough Councils, in accordance with regulations made under the Mining Act. The subsidies paid through these bodies have amounted to £2,265 7s. 4d., and the subsidies for works of this description to other parties not enumerated amount to £3,611 8s. 5d. The whole of the subsidies paid for prospecting during the last five years amount to £9,357 0s. 9d.

AIDS TOWARDS THE TREATMENT OF ORES.

Testing-plant, School of Mines, Thames.—Seeing the great disadvantages the miners are labouring under in not being able to extract anything like a fair percentage of the metals from the refractory ores which exist in the Thames, Karangahake, Te Aroha, and Waihi Districts, it was deemed desirable to have a small testing-plant, for treating small parcels of ores from the various mines, in order to ascertain their correct value. This testing-plant is now being erected in conjunc-

tion with the School of Mines, and, as soon as completed, tests will be made on certain charges being paid, which will be hereafter fixed by regulations. The cost of the plant, when completed, will be £1,200. The half of this amount was subscribed by the people in the district, and £600 was authorised as a subsidy, of which £390 18s. 3d. has been paid.

SCHOOLS OF MINES.

In 1885 Professor Black was engaged to initiate a system of teaching the miners in different centres of the colony, whereby they might distinguish any metalliferous ores they found, and also to determine the percentage of metals those ores contained. The telling way in which Professor Black put forward the necessity of miners being acquainted with metalliferous deposits, and the energy displayed by him in travelling all over the mining centres in the colony giving lectures, and showing, by experiments, the easy manner in which the different metals and minerals might be distinguished and tested, created quite an enthusiastic feeling among the miners, which has caused them to build small halls and fit up laboratories in all the principal mining centres in the colony.

During the first year's initiation of the Schools of Mines Mr. A. Montgomery, M.A., was appointed a teacher and lecturer for the Thames, Coromandel, and Te Aroha Districts, and the result is that there is a very influential School of Mines at the Thames. There is no place in the colony where a School of Mines is wanted so much as in this district. The gold is associated with a variety of metals, which make the ores very refractory to work. With the present method of treatment not more than 50 per cent. of the precious metals are obtained; and, indeed, it is very questionable if even this percentage is got.

The Schools of Mines in the North Island districts have been the means of causing the attention of the miners to be directed to minerals other than gold. Many of the lodes contain a far larger percentage of silver than gold, which in former years was altogether disregarded, and the ore, unless it contained sufficient gold to pay for the expense of working, was thrown away in the waste-heap. This state of things is now entirely altered. Silver is as much sought after as gold, but the great difficulty under which the mining industry is still labouring is a proper and cheap method of treatment, whereby the metals can be extracted.

The following is an extract from Mr. Montgomery's report: "The attendance for the quarter ending December, 1887, remained much as shown in my October report, but there was a slight falling-off in the school-children's attendance as the warm dry weather came in. For the first quarter of the present year there has been a very large increase in the attendance at the classes, as will be seen from the following table:—

—	Attendance of Pupils, October, November, and December, 1887.	Attendance of Pupils, February, March, and April, 1888.
Laboratory and practical chemistry	9	15
Architectural drawing	6	5
Mining mathematics	8	17
Assaying...	16	38
State schools pupils' chemistry class...	47	120
Total attendance at all classes	86	195
Total number of individuals attending classes (without including the school-children)	27	49

"A very encouraging feature is the large number of new students that have joined the classes this year, and that last year's students have this year nearly all returned. Most of the new students are of a most desirable sort—lads who have just left school and young men. The school-children's class has already borne fruit in supplying the other classes with a few of its older boys. Altogether, the prospects of the school, as far as regards the attendance of pupils, are most encouraging.

"For the period covered by this report the receipts from membership- and class-fees have amounted to £29 10s., and from fees for assays to £15 2s. The class-fees charged are very low, being only 5s. per quarter for each class, and 10s. membership-fee per annum. It would be highly inadvisable to raise the fees at present, as a higher fee would deter many of our students from attending. Most of them are young, and not in receipt of high wages, and cannot afford to pay high fees. When the value of the instruction received at the School of Mines has been demonstrated by the success of some of its old pupils the public will be able to appreciate it more rightly. It is a most difficult thing to convince ignorant men that scientific instruction is worth paying for, and unless they can get it very cheap they will not take advantage of it. After some experience of it they are ready to pay much higher fees to secure its continuance. By-and-by, when they clearly see that it is necessary to go through a course at the School of Mines to secure any of the better positions, such as those of managers of mines, as it will be necessary in the near future, the pecuniary value of the classes will be rightly estimated, and fees more proportionate to the character of the teaching can be charged. But in the present state of things it would be most inadvisable to raise the fees, so that they cannot be relied on as a source of much revenue for the school. The voluntary contributions of the public are also a very precarious source of revenue; besides that, reliance on them places the School of Mines in the very invidious position of having to

send round, hat in hand, every time money is wanted. Some steps should be taken to furnish the school with a steady source of revenue—enough to keep it out of debt for necessaries. It is at present in debt for these.

"Since my last report good progress has been made with the erection of the experimental testing-works. Separate tenders were called for the building, roasting-furnace, and crushing and amalgamating machinery in December, 1887. All these contracts are now very satisfactorily finished. A contract for delivery of water-pipes to connect with the town mains was also let in December, but as the pipes had to be procured from England, they only arrived a short time ago, but are now being laid, and will be all connected in a few days. Carpenters are now at work fixing platforms, tailing-pits, launders, &c., inside the building, and will have finished in a few days. When the whole of the works are completed that are now in hand they will cost £1,029, but there are several things yet to be got which will bring the total expenditure up to £1,200.

"At the time the estimate was made there had been no plans prepared, and it could only be regarded as an approximate one. It was thought sufficient, however, to cover the cost of a plant such as would do for the purpose. But when plans and details were undertaken it was seen that the original intention of having the coffer of the stamping-battery placed almost on the ground would result in a great deal of inconvenience, and increase the cost of working, while lessening the efficiency. It was therefore decided to raise the coffer 10ft. from the ground so as to allow crushed material to run direct to the furnace-feeding floor, to the pan and settler, and to the classifiers and concentrator. This increased the cost of foundations for the battery very considerably, and led to the contract price exceeding the estimate somewhat. The pan and settler obtained are also larger than those provided for in the estimate, as it was found that they could be obtained without any greater cost, Messrs Price Bros. having patterns for the larger size. The estimate for water-pipes was very much under the mark, because we made no doubt that we could get water from the mains in Pollen Street, and that about 600ft. of pipe would be sufficient, but when the time came to order the pipes we found we were forced to take water from Albert Street, a distance of a little over 1,300ft. The reverberatory furnace cost a great deal more than was estimated, but is of a much superior character to that estimated for. The committee was convinced that it was true economy to have the better class of furnace. The tender for the furnace, as designed, was £315, but by sacrificing some of the conveniences and reducing the dimensions the price was reduced to £232. For this we have a very good furnace of a sufficient size to do good work. The furnace originally intended was much smaller, and its cost compared with its duty would have been much greater. The only work that has now to be done to bring the portion of the plant already erected into a state to begin work is the erection of platforms and staging round the battery, pan, and settler, and the building of tailing-pits, shoots, and drains. A good deal of filling with earth will also have to be done to form a floor. If a concrete floor can be at all cheaply made it will be laid in the most necessary places. Until the part of the plant now erected is set in going order it is not intended to put up the classifying vats, concentrator, or chlorination- and leaching-vats. These are very necessary, and will be erected if possible, but it is better to complete the part in hand before going further, and then we can see what funds are in hand for further machinery. It will be possible to fix up some temporary apparatus to try leaching and chlorination of quantities of 56lb. to 112lbs., so as to try these processes, though there will not be anything like the satisfaction in making such tests as there is in having proper working tests on a suitably larger scale. The maintenance of the machinery and the working expenses have been, and are, a source of much thought to the committee, as it will be almost impossible to make the testing-plant self-supporting, and there will always be a current expenditure going on. A mechanic will have to be employed to look after the machinery, and another man will have to be occasionally employed to attend the roasting of the ore in the furnace; in short, there is an expenditure of about £200 per annum which the committee will have to provide for.

"The work of the experimental plant will be—

"(1.) To determine which of the many known processes in use here or elsewhere is most suitable for each sort of our ores here. Different treatment is necessary in different cases.

"(2.) To modify these processes so as to adapt them more fully to our local requirements.

"(3.) To afford prospectors an opportunity of getting stone tested under the most favourable conditions on a scale large enough to give real information. Assays, if not taken from large quantities of somewhat finely-crushed material, are often worse than useless because misleading. A sufficient quantity of material cannot be crushed by hand without immense labour. To have really good tests we must have means to crush samples of from one to five tons, from which reliable assay-tests may then be made. This cannot be done at present.

"(4.) To teach, practically, the miners and people of the goldfield the use of the various processes, and to show them how to work them themselves. It will not then be necessary to import 'experts' at high salaries. It is not so much want of capital as want of knowledge how to deal with our silver ores that is keeping the field back just now. If people could satisfy themselves by actual trial of the efficacy of any process they would find capital to put up all necessary machinery. But they are not disposed to spend money on plant that may prove useless when erected, and prefer to send the ore all over the world, begging for help from abroad. Help from abroad is costly."

In the South Island the School of Mines has done considerable service at Reefton. In this district the gold is obtained in a far more pure state than in the North Island, and it would be expected that a far greater percentage of the metal would be saved from the ordinary process of treatment. Mr. Fenton, who is teacher of the School of Mines in this district, has repeatedly warned the managers of mines that they are losing a large percentage of gold by the ordinary battery process, as on assaying the tailings they were found to contain a considerable quantity of gold after they were considered as a waste product. Recently, some of the mining companies have been prevailed upon to stack the tailings, and after treating them with berdans, as much as 14dwt. of gold per ton has been obtained.

The mining community, as I have stated on previous occasions, is the most conservative class in the colony. Miners believe in following in the footsteps of those before them, and look with suspicion on any new method as an innovation not worth the trouble of inquiring into. It is only by practical demonstration, and this carried on repeatedly, that they can be got to entertain any new method for the extraction of the metals from the ore. It is only recently that Mr. Fenton has got such companies as the Keep-It-Dark and Pandora to stack their tailings and treat them a second time.

I drew attention in my last annual report to the fact that not only is the gold and silver left in the tailings, but in ores where there is a quantity of sulphur and arsenic, a considerable percentage of the precious metals is carried away with the water and never settles in the tailings at all. In crushing raw ores containing a large percentage of sulphur and arsenic it is simply throwing away money by pretending to save the precious metals by amalgamation with mercury, as arsenic sickens the mercury, and so does sulphur; but the sulphur being a very light mineral, and possessing a great affinity for metals, a certain proportion of them floats on the surface of the water and is carried away. Again, antimony is found in some quartz lodes associated with gold, which sickens the mercury and creates a black scum on the surface, which prevents the gold from adhering to it.

To carry on mining on an intelligent basis any company of any note should have a person who is able to assay the ores; and if these assays are taken from a fair average of the stone the company is then in a position to see whether the mode of treatment is saving a fair percentage of the gold or not; also by making assays of this description they are fully acquainted with the different metals and minerals in the stone, and in a position to know the best method of treatment to adopt from the class of ore they have to deal with.

The Schools of Mines in such districts as the Thames and Reefton are invaluable institutions for forwarding the progress of the mining industry, and all those who intend to follow up that industry should avail themselves of the opportunity of becoming acquainted with the nature and treatment of metalliferous ores: indeed, if no assistance from Government were ever given to these schools the people in the different districts should endeavour to make them self-supporting, as the knowledge they are the means of disseminating is worth far more than all the cost of maintaining them.

The following statement will show the expenditure by the department on the Schools of Mines since they have been inaugurated:—

Financial Years	Subsidies towards the erection of Schools of Mines.	Chemicals and Apparatus, also Mineralogical Specimens, supplied to Schools of Mines.	Salaries of Teachers with Travelling-expenses, &c.	Total Sums paid to Schools of Mines by the Department.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1885–86	Nil.	36 19 9	1,223 9 10	1,260 9 7
1886–87	257 16 6	409 1 4	2,716 9 3	3,383 7 1
1887–88	253 15 9	253 14 1	1,714 9 6	2,221 19 4
Total	511 12 3	699 15 2	5,654 8 7	6,865 16 0

It will be seen from this that during the last three years subsidies towards buildings amounted to £511 12s. 3d.; the value of chemicals and apparatus for testing metals and minerals, and also for supplying mineralogical specimens to the various schools is £699 15s. 2d.; and the salaries and the travelling-expenses paid to the teaching-staff in connection with the schools, £5,654 8s. 7d.: making the total expenditure of £6,865 16s. This is exclusive of subsidy towards testing-plant at the Thames. In addition to this there was a liability at the end of March last of £337 4s. 3d.

Last year the teaching-staff was reduced to two—namely, one in the Thames District, in the North Island; and one at Reefton, in the Middle Island; whilst Professor Black and his assistant, in order to fulfil promises made to the several district committees, visited and gave lectures at the various schools in the Middle Island, previous to the withdrawal of State-aid, as it is intended that in future these schools shall be self-supporting.

It is only fair to state that the results from the inauguration of this scheme of technical education of the miners will not be felt for some time, but we may rest assured that the teaching will yet bear good fruits, and eventually be the means of having a more intelligent class of miners, and mining conducted on far more systematic principles. It will be also the means of giving those persons who wish to qualify themselves for the position of mine managers an opportunity of becoming acquainted with the theory of mining, and the effect that slides and heaves have on lodes, and the direction in which the lost lode is likely to be found, as well as a knowledge of the composition of gases found in mines, and the amount of ventilation necessary to insure the health of the workmen. Many mine managers at the present time know how a mine should be worked, but they have very little knowledge as to making a survey of the mine to ascertain where the workings are in relation to the ground the company holds. The Schools of Mines, to carry out their functions, ought to teach mining in all its branches, and by so doing they will qualify persons to take the management of mines who will be able to conduct the operations in an intelligent manner.

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

Road, Aorere Valley, to Karamea and Mokihinui.—This is a bridle-track from the end of the dray-road which is constructed from Collingwood up the Aorere Valley some eighteen miles.

About eight miles of the track has been constructed on the Aorere Valley end, which brings it to the saddle of the Gorge and Big Rivers. Two miles more of this end has recently been let by contract for £537 12s., which will bring the track on to the Gouland Downs. A survey is now being made from the Gouland Downs to the mouth of the Heaphy River, a distance of about twenty-four miles, of which seventeen miles and a half are completed. It is not intended at the present time to continue the survey further than the mouth of the Heaphy, as it will take some time before the surveyed portion of the track is completed.

From the mouth of the Heaphy River to the end of the Kohai Bluff, where the survey is completed, to Karamea is twelve miles, thus making the length of track that will yet have to be constructed to establish communication between Collingwood and Karamea thirty-six miles.

At the Mokihinui end twenty-six miles is constructed and a contract for 46 chains entered into, which brings the track up to the Little Wanganui River, where there is a good ford. Instructions have been given to connect this ford with a track to the Ocean Beach. When this is completed a line of communication would be established between Westport and Karamea, were it not that there is no ford or crossing-place at the Mokihinui River—a bridge being required to be constructed, at an estimated cost of £3,000. A track has also been constructed from Karamea for about four miles in the direction of the Kohai Bluff. The total cost of this work has been £22,375 10s. 5d. Of this amount £18,459 1s. 5d. has been paid, and the liabilities amount to £3,916 9s.

Whangamatu Harbour to Reefs, Thames District.—Recently, auriferous and argentiferous quartz reefs have been discovered at Whangamatu, about five miles up the valley of the Wairoa Creek from the harbour. This is the only way that the quartz can be sent to be tested, and also the route that a road would have to be constructed to take machinery on the ground should the lodes prove payable for working. In order to afford a means of getting these reefs properly tested £150 has been authorised to make the road up the valley passable for dray-traffic.

Road Motueka–Takaka, &c.—This is portion of the main dray-road between Nelson and Collingwood, going over the range between the Motueka and Takaka Valleys. The distance of the road constructed is sixteen miles and a half, which has cost £9,276 4s. 5d. Of this amount £8,949 14s. 5d. has been paid, and the liability on the work is £326 10s. This road was constructed for this department under the supervision of the Public Works Department, and is now completed less some few repairs in maintenance.

Owen Valley Road.—This is a narrow dray-road from the Nelson–Lyell Road to the Owen quartz reefs. The road commences at the Nelson–Lyell Road, two miles up the Buller River, above its junction with the Owen River, and goes across a low saddle into the valley of Maggie's Creek; thence up the Valley of the main branch of the Owen River to its junction with the Bulmer Creek a distance of 9 miles 20 chains. This road was constructed under the supervision of the Public Works Department, and has cost £2,195 3s. 8d., of which £2,045 3s. 8d. has been paid, leaving a liability of £150.

Track, Upper Anatoki.—This is a bridle-track up the Anatoki River to near its head, so that provisions can be taken to miners working near the sources of the Slate, Rocky, and Snowy Rivers. This track is now almost completed. The cost has been £850, of which amount £833 8s. has been paid, leaving a liability of £16 12s.

Track, Jackson's Bay to Gorge River.—A horse-track was partially constructed several years ago from Jackson's Bay up the Valley of the Arawata to the junction of the Jackson River; thence up the Valley of the Jackson and across the saddle of the range between the Jackson and Cascade Rivers. The portion of the track lately constructed commences at the crossing of the Cascade River and follows up the side of the Cascade to Saddle Creek; thence up the side of this creek to the saddle between the Cascade and Gorge Rivers; and thence follows down the southern side of the Gorge River to its junction with the Duncan River, being a distance of thirteen miles from the commencing-point, or about thirty-one miles distant from Jackson's Bay. Eight miles of this road is wholly completed, and the remaining five miles are under construction. This line of road has been surveyed and laid off with good dray-road grades up to the junction of the bridle-track from the head of Lake Wakatipu to Martin's Bay, at the place where the chair-crossing is—Pyke's River. The total distance of the line laid off is 46 miles 73 chains. When the present contracts are completed for the construction of the track to the Duncan River it will open up the country about the Gorge River; but before a line of communication could be opened right through from Jackson's Bay to Lake Wakatipu another fourteen miles would have to be constructed. This would bring the road to the track leading from Big Bay to the Red Hills, and about twenty miles distant from the horse-track leading either to Martin's Bay or Lake Wakatipu. This last twenty miles is over tolerably level land, requiring very little construction to make it passable for horse traffic; but the fourteen miles previously referred to would be the most costly to construct on the whole line of road, owing to the steep sidlings and slips over which the track would have to be made. The cost of the work, when the present contracts are completed, will be about £4,426 15s. 9d. Of this amount £2,850 6s. 9d. has been paid, leaving a liability of £1,576 9s.

Road, Arthur's Point to Skipper's.—This is a dray-road from the Queenstown–Arrowtown Road *via* Arthur's Point. The road is constructed up to the top of the range from Arthur's Point for a distance of a little over three miles, and it is also constructed on the end next Skipper's Point for about eight miles, leaving a portion in the centre of about four miles to complete. Instructions have been issued to the County Council to survey and get out plans and specifications for another section of this road, which is estimated to cost about £1,200. The cost of constructing this road up to date has been £7,570 4s. 1d., and another £1,000 is authorised for the work. When this road is wholly completed it will cheapen the cost of transit of provisions, mining materials, and machinery considerably at Skipper's and the Upper Shotover, and it will be the means of quartz being worked which is now considered of too low a grade to pay. Although the reefs at Skipper's have been worked for the last twenty-five years, and a large population always working on the Upper Shotover, the whole of the provisions have yet to be carried on pack-horses, and until the

last section of the road was completed, about eighteen months ago, the old zigzag pack-track over the hill above Stapleton's Beach had to be used for bringing up all the mining-machinery employed in the Skipper's District.

WATER-RACES.

The results of working the water-races have been more satisfactory for the past year than they were for the one preceding. The Waimea–Kumara Water-race and Sludge-channel show double the profit of the previous year, and the Mount Ida Water-race shows a profit of £100, whereas there has always in previous years been a loss on working. The Nelson Creek and Argyle Water-races show very little difference from their previous year's returns.

The increased profit last year on the Kumara Water-race and Sludge-channel is due, in a great measure, to the construction of No. 2 Channel, which relieved the original channel to such an extent that there has been a saving of £1,697 on the maintenance. The ratio of expenditure on maintenance on No. 1 Sludge-channel, previous to No. 2 Sludge-channel being constructed, was £3 to every £1 received in channel-fees. Therefore, the more parties of miners that used it the more the loss became. By the construction of No. 2 Channel, which cost the State £2,763, the saving on the maintenance of No. 1 was, for the past year, £1,697; and for the year previous, £258; making the total saving of £1,955, which, in a great measure, recoups the outlay on the construction of No. 2 Channel. Not only has there been a direct saving in the cost of maintenance, but the second channel allows the working of the claims to be carried on in a far more regular and satisfactory manner, and will be the means of far more ground being worked than otherwise would have been, as the space for tailings from the original channel is now very limited, and depends, to a great extent, on the floods in the river to carry the tailings away. The heavy floods in the early part of the present year have done a great deal towards carrying the tailings further down the river; but the time is not far distant when the original channel will become useless for conveying away the tailings from the claims, as the bed of the Teremakau River will soon be filled up with heavy material on which the force of the water, even in high floods, will have very little effect.

The profit on the working of the Mount Ida Water-race is due, in a measure, to the extension of the race to Spec Gully; to the wet season which has kept up a good supply of water; and also to the value of gold-dust obtained in washing-up a portion of the bottom of the sludge-channel.

In dealing with the water-races it will be advisable to show the results of working each separately, and then show the combined results of the whole.

WAIMEA WATER-RACE, WESTLAND.

This branch of the Waimea–Kumara Water-supply is kept in very good order and repair, seeing that there is over a mile of high fluming on the upper portion of the race, which has been erected for nearly fourteen years. A great number of the legs of the trestles and stringers have been, from time to time, replaced, and these repairs effected in such a manner that no stoppage has taken place in supplying water to the mining-claims using it. When a large amount of repairs has to be done timber and all material are brought on to the ground, and every holiday taken advantage of for executing the repairs.

During the last Christmas holidays several portions of the fluming have been replaced, and there is always a supply of timber on hand to effect repairs in case of an accident occurring. All the flumes along the race are in a fair state of repair. Some of the planks in the boxing are getting pretty well decayed; but these can easily be replaced, so long as the under-structure is kept good. Indeed, I see no difficulty in keeping up these repairs, and maintaining the race at the same yearly expenditure, for as long a period as there is a sufficient amount of payable auriferous ground to work, to utilise the quantity of water that the race is capable of supplying.

The following table will show the results of working this water-supply during the year ending the 31st March last:—

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.
1887.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	131 5 10	254 9 5	107 15 5	131 11 0	101	254	965 4 0
May	141 15 10	131 12 6	114 18 5	140 5 2	92	230	874 0 0
June	92 2 1	96 14 7	104 11 6	135 12 8	94	156	592 16 0
July	162 16 3	133 4 9	76 16 10	164 10 0	97	285	1,083 0 0
August	135 19 2	163 10 2	98 5 6	136 2 4	99	265	1,007 0 0
September	152 6 3	114 7 5	65 6 2	174 1 2	99	251	953 16 0
October	153 4 7	160 14 0	56 12 3	167 0 9	100	251	953 16 0
November	177 6 7	163 3 1	83 9 7	180 15 3	98	221	839 16 0
December	112 3 8	215 3 10	92 12 9	77 16 9	101	431	1,637 16 0
1888.							
January	65 5 0	13 2 1	111 8 6	129 18 0	87	135	513 0 0
February	130 14 7	114 10 4	56 16 0	146 2 3	93	202	767 12 0
March	157 11 5	233 4 2	59 5 0	69 4 4	90	279	1,060 4 0
Totals	1,612 11 3	1,793 16 4	1,027 17 11	..	1,151*	2,960	11,248 0 0

* Average 98.

NOTE.—Average weekly earnings, after deducting sales of water £1 16s. 3d. per man.

It will be seen from the above table that the value of sales of water for last year was £1612 11s. 3d., as against £1675 19s. 4d. for the previous year. The actual cash received for sales of water during the past year was £1,793 16s. 4d., as against £1,688 3s. 2d. for the year previous. It is, however, to be remembered that although the actual amount of cash received constitutes the receipts, yet, included in those receipts, there is always a certain amount of money that has been deposited in payment for water not supplied at the time the money was lodged, or in other words the practice of paying for water in advance necessitates there being always a certain amount of money in hand, which cannot be placed to the credit of the race until the water is supplied.

In dealing, therefore, with the working results, the actual sales of water is the real income, and should be treated as such, seeing that the water is paid for in advance. On this basis, therefore, the income has been £1,612 11s. 3d., and the expenditure on maintenance during last year £1,027 17s. 11d. as against £1,116 10s. for the year previous, leaving the net profit on the working of the water-race last year at £584 13s. 4d., or £7 more than the year previous.

The value of free water given to open out claims during the year was £19 16s., as against £22 16s. 8d. during the previous year; and the average number of miners employed whose claims have been worked with water from the race has been 98. The approximate amount of gold these miners have obtained during the year has been 2,960oz., representing a value of £11,248. This will make the average weekly earnings of the miners, after deducting the value of the sales of water, £1 16s. 3d. per man, or only 8d. per week less than the previous year. Taking the actual profits on the working of the race last year, it has paid about ½ per cent. on the cost of construction, which has been £118,762 11s. 8d.

Kumara Water-race, Westland.

This is the most important portion of the Waimea–Kumara Water-supply, and the branch which commands the largest amount of payable auriferous ground. The reservoir, tunnel, and main-ditch are all in good order, and the branch-flumes are all in a very fair state of repair. Portion of the ground on which the main-ditching is constructed is known to be auriferous; indeed, deviations of the race have been already made from time to time, and iron-piping substituted in lieu of ditching and fluming, to admit of the ground being washed away. As the claims get worked out, the same thing will take place again. Applications have lately been made by the holders of two mining claims, viz., Pascoe and Party and Palmer and Party, to be allowed to work the ground on which the main-race is constructed for some 21 chains in length. The amount of ground actually occupied by the race is very small; but it has to be borne in mind that the depth of the ground here is about 60ft., so that parties working on either side cannot come within at least 1½ chains of the race, in order to ensure its safety; and when the ground is rich it pays the miners to construct deviations, in order to work the ground on which the race is made.

There are a number of mining-claims at work at Nardoo Flat, which promise to pay fairly well for working, and it is a place where there is a large area of ground, should the whole of it prove auriferous. The main branch of the Kumara supply would have to be extended for about forty-two chains to command this ground, which is estimated to cost £800. The miners themselves are willing to undertake to construct the extension, if the value of construction is afterwards allowed them in water, which is a very reasonable proposal. The area of auriferous ground in the neighbourhood of Kumara that the water-supply commands will take many years to work, and give employment to a large number of miners.

The following table shows the results of working this water-race during the past year:—

Month.	Sales of Water.	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.
1887.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	535 5 10	790 8 6	92 12 0	53 16 5	193	954	3,625 4 0
May	679 7 8	678 2 6	78 16 3	53 15 1	187	923	3,507 8 0
June	167 10 10	205 15 2	72 10 4	47 2 4	185	259	984 4 0
July	656 4 7	611 6 8	95 19 8	62 3 11	184	1,003	3,811 8 0
August	684 16 1	718 16 0	88 9 6	63 16 1	184	1,055	4,009 0 0
September	694 5 0	625 17 5	63 15 7	54 6 0	187	1,004	3,815 4 0
October	591 12 1	620 10 8	84 18 10	70 4 4	187	903	3,431 8 0
November	710 0 0	629 3 0	70 8 8	60 2 8	187	961	3,651 16 0
December	525 10 10	808 14 6	89 17 1	38 9 11	185	997	3,788 12 0
1888.							
January	519 15 5	216 1 10	66 12 6	70 14 8	181	724	2,751 4 0
February	670 17 6	808 6 8	89 11 5	48 16 2	181	821	3,119 16 0
March	734 4 5	730 5 3	89 0 2	75 14 1	181	946	3,594 16 0
Totals	7,169 10 3	7,443 8 2	982 12 0	..	2,222*	10,550	40,090 0 0

* Average 185.

Note.—Average weekly earnings of miners, after deducting value of sales of water, £3 8s. 5d. per man.

This shows the value of the sales of water for the last year to be £7,169 10s. 3d., as against £6,470 14s. 4d. of the year previous, being an increase in the value of the sales of water of £698 15s. 11d. This increase is due to the mining-claims being worked more regularly since the construction of No. 2 Sludge-channel, and to the plentiful supply of water last year, owing to the wet season. The expenditure on maintenance for the last year has been £982 12s., as against

£1,398 18s. 10d. of the previous year, thus showing a decrease in expenditure of £516 6s. 10d. Taking the expenditure on maintenance from the value of the sales of water, the net profits on the working of this water-race is £6,183 18s. 3d. for the last year.

The value of free water given to miners to open claims during last year was £347 6s. 5d., as against £1,547 18s. 11d. during the year previous; and the average number of miners employed in claims worked with water from this water-race during last year was 185, as against 215 during the year previous; and the approximate amount of gold obtained by these miners last year was 10,550oz., representing a value of £40,090, which makes their average weekly earnings, after deducting the value of the sales of water, £3 8s. 5d. per man, which is 12s. 8d. per man less than the previous year. Taking the net profit on the working of this water-race during last year—namely, £6,183 18s. 3d., and the cost of construction, which is £37,400 2s. 11d., it shows that it has paid a little over 16½ per cent. on the outlay.

Kumara Sludge-channel, Westland.

The expenditure on the maintenance of this sludge-channel, which was formerly £3 for every £1 that was received for channel-fees and gold, is now reduced to £2 6s. 2d. for every £1 received for fees and gold-dust got from the channel. This saving is due to the smaller number of miners now using the channel since the No. 2 Sludge-channel was constructed. The dump for tailings is, however, getting less every year, and it now depends in a great measure on the floods in the Teremakau River to clear away from time to time the tailings that accumulate.

Arrangements have recently been made with Seater, Blake, and party, who hold the right to a tailings-site granted to Sellars and party, which prevented the branch of the sludge-channel being carried down the flat, whereby the whole of this tailings-site can be covered with tailings, and the channel extended down the side of the river. This will hold tailings from the workings for a considerable time, and allow the extension of the channel to be carried as far down the river as the fall will permit. It is probable that this extra accommodation for tailings will be sufficient to work out the claims now using the channel; but it would not be advisable to allow any further claims to be worked by this channel until those now using it are nearly worked out, as the time is not far distant when the bed of the Teremakau River will be raised to such an extent that this channel cannot be used to convey away the tailings unless it is altered to a less grade, and that would mean that it would carry less material away and require a great deal of flushing-water.

The following table will show the results of working the sludge-channel for the last year:—

Month.	Channel-fees.	Value of Gold-dust obtained from the Channel.	Amount of Cash received for Channel-fees.	Expenditure.	Amount of outstanding Moneys at End of each Month.	Number of Men using the Channel.
1887.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
April	93 12 3	87 15 0	118 3 3	273 14 8	1 15 10	85
May	104 8 11	62 8 6	118 1 6	458 11 11	8 19 5	85
June	..	8 7 6	18 9 4	186 0 9	5 8 2	..
July	88 11 8	62 7 0	67 8 4	343 14 11	0 6 11	85
August	90 5 10	80 19 0	106 5 6	441 1 10	3 17 1	84
September	94 4 0	69 2 0	60 5 1	383 13 3	7 11 0	84
October	109 16 4	43 10 0	153 13 4	459 6 10	2 3 4	84
November	108 13 5	69 10 0	76 16 6	463 16 2	1 10 7	84
December	84 2 6	58 9 6	124 10 5	313 18 9	0 11 6	84
1888.						
January	71 1 3	57 16 0	38 0 9	299 11 0	2 4 10	74
February	103 19 7	60 16 0	131 1 10	297 1 5	..	84
March	126 10 10	63 13 0	146 19 3	340 0 10	1 12 9	89
Totals	1,075 6 7	724 13 6	1,159 15 1	4,260 12 4	..	922*

* Average 77.

It will be seen from this table that the value of channel-fees during last year was £1,075 6s. 7d., and the value of gold-dust got in the channel £724 13s. 6d., making the total income for the year £1,800 0s. 1d.; as against £1,304 3s. 8d. for fees and £957 19s. for gold-dust for the previous year, which made the total income £2,262 2s. 8d. This is a decrease of £462 2s. 7d. on the income; but there is more than a corresponding decrease in the cost of maintenance. The expenditure in maintenance last year was £4,260 12s. 4d., as against £5,957 11s. 5d. for the year previous; thus showing a saving of £1,696 19s. 1d.: but this saving still shows a loss on the working of the channel of £2,460 12s. 3d.

The average number of miners now working ground by means of this channel is 77, as against 114 during the previous year; and the value of the free use of channel given the miners during the year has been £6 10s. The total cost of the construction of this work to date has been £17,200 12s. 6d.

Waimea–Kumara Water-race and Sludge-channel, Westland.

Although the working of each portion of this water-supply has been shown separately, it must be treated as one work, as it is all under the same management and the supply of water is partially from the same source. The following table will therefore show the results of the working during the last year:—

Month.	Sales of Water, Channel-fees, and Value of Gold-dust obtained from Channel.	Amount of Cash received for Sales of Water and Channel-fees.	Expenditure.	Amount of Outstanding Moneys at the End of each Month.	Number of Men employed.	Approximate Amount of Gold obtained.	Value of Gold.
1887.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	847 18 11	1,163 1 2	474 2 1	187 3 3	294	1,208	4,590 8 0
May	988 0 11	927 16 6	652 6 7	202 19 8	279	1,153	4,381 8 0
June	268 0 5	320 19 1	363 2 7	188 3 2	279	415	1,577 0 0
July	969 19 6	811 19 9	516 11 5	227 0 10	281	1,288	4,894 8 0
August	992 0 1	988 11 8	627 16 10	203 15 6	283	1,320	5,016 0 0
September..	1,009 17 8	800 9 11	512 15 0	235 18 2	286	1,255	4,769 0 0
October	898 3 6	934 18 0	600 17 11	239 8 5	287	1,154	4,385 4 0
November	1,065 10 6	869 2 7	617 14 5	242 8 6	285	1,182	4,491 12 0
December	780 6 6	1,148 8 9	496 8 7	116 18 2	286	1,428	5,426 8 0
1888.							
January	713 17 8	267 4 8	477 12 0	202 17 6	268	859	3,264 4 0
February	966 7 8	1,053 18 10	443 8 10	194 18 5	274	1,023	3,887 8 0
March	1,081 19 8	1,110 8 8	488 6 0	146 11 2	271	1,225	4,655 0 0
Totals	10,582 1 7	10,396 19 7	6,271 2 3	..	3,373*	13,510	51,338 0 0

* Average 81.

This shows the value of sales of water, channel-fees, and gold-dust obtained from the channel to be £10,582 1s. 7d., as against £9,450 17s. 4d. for the year previous: being an increase of £1,131 4s. 3d. for the last year. The total expenditure in maintenance last year was £6,271 2s. 3d., as against £8,473 0s. 3d. for the previous year. The net profits on the workings for the last year are £4,310 19s. 4d., or four times as much as they were the year previous.

It is gratifying to find that the arrears due for water and channel-fees are being gradually reduced. Some two years ago they amounted to £2,623 5s. 7d., and on the 31st of March last they only amount to £146 1s. 2d. This, in itself, speaks highly for the remunerative nature of the auriferous ground that this water-supply has been the means of working. The average number of men employed in mining-claims worked with water from this supply is 281 (exclusive of men getting blocks and mining-timber, &c.), and the average earnings of the miners after deducting sales of water have been £2 16s. 9d. a man per week. Taking the total cost of construction, which has been £173,363 7s. 1d., and the net profit on the working during last year, it has paid nearly 2½ per cent. on the outlay.

Nelson Creek Water-race, Nelson.

The construction of this water-race was commenced in May, 1874, and completed in January, 1878, having been in full working-order for ten years. During this period the sales of water have amounted to £15,836 15s. 7d., and the cost of maintenance to £11,881 1s. 4d.: thus leaving a balance of profit on the working of the water-race for ten years amounting to £3,955 14s. 3d. The amount of gold obtained by parties working with water from the race is estimated to be 30,143oz., representing a value of £115,396 19s. 6d.

The water-race has now arrived at a stage when the future sales of water will not cover the cost of maintenance, owing to the bridges and flumes being in such a decayed state — constantly requiring repairs. Most of the bridges and flumes are across wide, deep gorges, and cost a large amount of money to construct, several of the spans of bridging being 150ft. in length. The aggregate length of bridging and flumes on the main race is 1 mile 16 chains, which cost to construct about £26,000. The timber in portions of the bridges and flumes is entirely decayed, and a continual renewal has to be going on, which necessitates a certain number of maintenance-men being constantly employed. Unless these large bridges are carefully watched, and repaired when any of the timber breaks, the whole structure would soon fall down, as has been the case with one of the large bridges on the branch race. However, there is not much water required to be supplied from the branch, as the ground known to be auriferous is getting nearly worked out, so that a small tunnel can be made to convey all the water required for about £110. The miners have agreed to construct this tunnel on receiving free water to the value of their labour. The ditching and tunnels are all in a good state of repair. The re-timbering of the tunnels is proceeded with as the old timber gets decayed.

With regard to the future prospects of this water-race there is yet a considerable amount of auriferous ground that will pay for working at the lower end of Try Again Terrace. Some years ago this ground was considered too poor to work, but it has been taken up recently and found to give remunerative returns. There is, however, a great drawback to the working of the ground in this locality, owing to the freehold land held by Drennan Brothers at the bottom of the terrace, which prevents certain portions of the terrace being worked. There is also a considerable amount of ground in the vicinity of Surprise Creek considered payable for working, and also in German and Brian Boru Gullies. With the exception of these places the known payable auriferous ground which the water-race commands may be said to be worked out. I have carefully examined the condition of the water-race, and think that, with careful supervision, the bridges and flumes can be made to last for another three or four years—that is, by replacing the worst decayed portions of the timber, which can be done with the ordinary number of maintenance-men employed for the last two years; but no hope can be held out that the future cost of maintenance will be covered by the sales of water. Probably the loss on working may amount to from £200 to £300 per annum.

The following table will show the results of working this water-race last year :—

Month.	Sales of Water.	Expenditure.	Number of Men Employed.	Approximate Amount of Gold obtained.	Value of Gold at £3 16s. 6d. per oz.
1887.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	124 18 4	99 18 8	60	199	761 3 6
May	142 1 8	100 8 8	62	208	795 12 0
June	141 7 6	94 2 6	56	184	703 16 0
July	78 3 4	96 2 0	48	144	550 16 0
August	80 12 6	98 5 0	51	150	573 15 0
September	69 16 8	96 12 0	41	120	459 0 0
October	45 10 0	93 12 0	43	92	351 18 0
November	73 17 6	97 1 0	41	108	413 2 0
December	91 5 10	100 4 0	40	129	493 8 6
1888.					
January	59 11 8	93 12 0	36	74	283 1 0
February	76 11 8	98 13 6	32	113	432 4 6
March	66 5 0	105 4 0	31	102	390 3 0
Totals	1,045 1 8	1,173 15 4	541*	1,623	6,207 19 6

* Average, 45.

This shows the value of the sales of water for last year to be £1,045 1s. 8d., as against £1,071 19s. 2d. for the year previous; being a decrease of £26 17s. 6d. from last year. The expenditure on maintenance was £1,173 15s. 4d., which is only 4s. more than the year previous. The loss on working last year was £128 13s. 8d., or £27 1s. 6d. more than the previous year.

The average number of miners employed in claims worked by means of this water-race is forty-five, as against fifty-nine the year previous, and the approximate amount of gold obtained by these has been 1,623oz., representing a value of £6,207 19s. 6d., making their average weekly earnings, after deducting sales of water, £2 14s. 1d. per man. The value of free water given to open out claims and test ground during the year was £353 6s. 8d. The total cost of constructing this work has been £90,721 4s. 8d.

Argyle Water-race, Nelson.

This water-race is in very good repair, and, with the exception of small slips that may occasionally take place after heavy rain, there is no likelihood of any expenditure being required for repairs beyond what can be done by the maintenance-men. The supply of water in the dam at the time of my visit was very low, there being only about 3ft. 6in. above the sill of the sluice-gate; but the heavy rains since have no doubt again filled the dam.

The average daily supply of water required for the claims that are being worked by this water-race is about five sluice-heads for nine hours. Most of the water is being used at the lower end of the race. The ground above Ballarat Gully, where the race originally terminated, is getting nearly worked out. O'Leary and party, who hold most of the known payable auriferous ground at the lower end of the race, have constructed a ditch and about 900ft. of a siphon across a gully which is about 150ft. in depth, to take the water to their claim. This does away with the necessity of any further extension of the race being ever required, as O'Leary and party's supply-race will work the whole of the auriferous ground on the terrace up to the Nile River.

With regard to the future prospects of this water-race, there is sufficient ground to work which is known to be payable to utilise the water from the race for several years, but there is no possibility of any large revenue being derived from it. Still, the race can be worked at a small profit, which will probably amount to from £50 to £80 per annum. This will not pay interest on the cost of construction, but it will be the means of giving remunerative employment to a limited number of miners, and allow ground to be worked which otherwise would lie idle.

The following table will show the results of working this water-race during last year :—

Month.	Sales of Water.	Expenditure.	Number of Men Employed.	Approximate Amount of Gold obtained.	Value of Gold at £3 16s. per oz.
1887.	£ s. d.	£ s. d.		Oz.	£ s. d.
April	46 11 7	29 18 0	21	50	190 0 0
May	42 12 0	39 4 0	19	50	190 0 0
June	36 16 9	31 13 9	18	47	178 12 0
July	34 9 0	41 10 1	22	57	216 12 0
August	40 14 9	31 1 0	21	85	323 0 0
September	32 1 2	38 7 0	20	50	190 0 0
October	34 5 4	29 18 0	23	48	182 8 0
November	35 6 10	29 18 0	17	45	171 0 0
December	32 2 3	32 16 0	21	45	171 0 0
1888.					
January	33 15 4	29 18 0	23	46	174 16 0
February	51 1 7	32 19 0	21	45	171 0 0
March	35 16 2	31 1 0	21	62	235 12 0
Totals	455 12 9	398 3 10	247*	630	2,394 0 0

* Average, 20.

It will be seen from this table that the value of sales of water during last year amounted to £497 12s. 9d., as against £480 8s. 5d. the year previous, being an increase in the sales of water of £17 4s. 4d. The expenditure on maintenance last year was £403 11s. 4d., as against £382 6s. 5d., or £20 4s. 11d. more than the previous year. This is accounted for by breaks occurring in the siphon which conveys the water across Ballarat Gully. The net profit on working this race last year was £76 17s. 1d.

The average number of men employed in claims worked by means of water from this race during last year has been twenty, and the approximate amount of gold obtained by them was 630oz., representing a value of £2,394, which leaves their average weekly earnings after deducting sales of water, at £1 17s. 3d. per man. The value of free water given to test ground during the year has been £84. Taking the net profits on the last year's workings and the cost of construction, which amount to £14,711 3s. 11d., it has paid a little over three-tenths per cent. on the capital invested.

Mikonui Water-race, Westland.

There has been no further work done on this water-race during the last year. The portion constructed—namely, three miles at the lower end—was leased to the Mont d'Or Company—at the rate of £100 per annum; but recently the rent has been reduced to £50 per annum on condition that the company re-timber the tunnels and keep them in repair for a period of five years. The expenditure on this work up to date has been £25,644 9s. 6d., but it is estimated that an additional £60,000 would be required to complete it before a supply of water could be got.

Mount Ida Water-race, Otago.

This water-race is managed by a trust, and has up to last year cost more to maintain than the revenue derived from it. The receipts and expenditure from this water-race are for the year ending December, 1887, and not to the 31st March, as for the other water-races, which are managed direct by the department.

The principal unworked ground that this water-race commands is in the vicinity of Home and Spec. Gullies. There are some very good claims in Home Gully, but the majority of the miners still adhere to working the ground in the old style, with very little pressure and a canvas hose, instead of getting iron pipes and utilising the whole head that can be got from the water-race, so that they could bring down the material in the face with the water and puddle it, instead of picking down the material before using the water. Some parties are now using pipes and working the ground in a systematic manner, which was represented to me as paying well. Most of the ground on the Naseby side of Hogburn Gully is pretty well worked out—that is, the ground the race commands; so that the time is not far distant when the revenue from this water-race will principally depend on the ground which the extension commands. There is, however, a large tract of country between St. Bathan's and Naseby where very little prospecting has been done, and where there is a likelihood of payable gold-bearing wash-drift being yet found. If such were discovered this water-race would become a valuable property, as it commands a large area of ground.

The following table will show the results of the working of this water-race during the last 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.
1887.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		Oz.	£ s. d.
January	30 2 3	175 1 4	96 1 4	..	..	300.	1,125 0 0
February	44 12 4	103 11 10	124 19 6	..	..	230	862 10 0
March	89 6 10	154 18 5	115 7 4	..	..	220	825 0 0
April	79 11 5	92 1 11	78 18 4	..	..	250	937 10 0
May	170 9 3	77 1 8	130 15 1	..	..	190	712 10 0
June	136 7 5	64 0 10	81 16 4	..	..	150	562 10 0
July	74 12 7	48 10 0	103 18 10	..	..	100	375 0 0
August	114 11 1	50 13 6	85 8 10	..	..	160	600 0 0
September	140 4 2	165 12 6	88 14 10	..	..	400	1,500 0 0
October	192 0 4	74 5 1	101 7 4	..	..	350	1,312 10 0
November	136 19 1	135 14 0	154 12 2	..	..	300	1,125 0 0
December	186 0 7	213 9 8	93 18 5	..	..	450	1,687 10 0
Totals	1,394 17 4	1,355 0 9	1,255 18 4	..	..	3,100	11,625 0 0

* No monthly record kept. The outstanding accounts in December, 1886, were £1,135 3s. 4d.; in December, 1887, £1,315 13s. 11d. The bulk of these have accumulated during the last eleven years. The balance outstanding between the years mentioned above has since been paid.

† A full supply of water gives employment to about a hundred and thirty men. The number of men employed is regulated by the quantity of water supplied. When water is scarce they are engaged in "falling," and other dry work.

This shows that the receipts last year were £1,355 0s. 9d., and the actual sales of water £1,394 17s. 4d.; whereas the receipts the year previous amounted to £1,445 7s. 1d., and the value of the sales of water to £1,454 11s. 11d.: showing that the receipts for the year previous were £90 6s. 4d., and the value of the sales of water £59 13s. 7d., more than they were last year. Notwithstanding this, the expenditure last year was £1,255 13s. 4d., as against £1,613 1s. 4d. the year previous, being a decrease in the cost of maintenance last year of £357 8s. The net profit on the working of this race last year was £99 7s. 5d. if the actual receipts be taken, or £139 4s. if the value of the sales of water be taken. The latter amount shows the actual profit on the year's transactions.

The average number of men employed in claims worked by means of water from this water-race is 130, and the approximate amount of gold obtained during the last year was 3,100oz., representing a value of £11,625; which gives the average weekly earnings of the miners, after deducting the value of the sales of water, as £1 10s. 3d. per man, or 11d. less per man than the previous year. Taking the actual profit for the year as £139 4s., and the cost of construction, which amounts to £66,766 3s. 8d., it has only paid 0·21 per cent. on the outlay.

Summary of Water-races.

The net profits and losses on each of the water-races, whether managed by the department or by a trust, have been shown separately, and on the same basis as any commercial transaction. But the colony derives certain collateral advantages which a private company could not share—namely, Customs and goldfields revenue; and, although these water-races have not been a commercial success, still they are no doubt the means of a number of people being employed on the goldfields that otherwise would have left the colony or turned their attention to something else; and it is well known that there are very few men working on the goldfields who are content to settle down unless they are connected with mining in some form or have a competency to live on. The value of these works to the colony consists, therefore, mainly in the population they are the means of supporting and the amount of gold obtained through their construction. Without entering upon the revenues derived from Customs duty or other goldfields revenue other than duty on gold obtained by their means, the direct profit last year to the colony, and percentage on their construction, would be as follows:

	£	s.	d.	
Waimea-Kumara Race and Sludge-channel ...	5,476	17	4,	3·15 per cent.
Nelson Creek Water-race	33	12	4,	*nil.*
Argyle Water-race	110	8	11,	¾ per cent.
Mount Ida Water-race	409	1	5,	$\frac{6}{10}$ per cent.

This does not show them to be profitable investments, as nothing is taken into account for the redemption of capital, which may be considered as entirely lost, as these water-races are of no practical value when the ground is worked out.

The following table shows the direct profits and losses, also the amount of duty received for gold which the water-races have been the means of obtaining:—

Name of Water-race.	Receipts. £ s. d.	Expenditure. £ s. d.	Profit or Loss on Working. £ s. d.	Average Number employed.	Approximate Amount of Gold. Oz.	Value of Gold obtained. £ s. d.	Duty received on Gold obtained. £ s.	Total Profits or Losses, and Value of Duty. £ s. d.	Total Cost of Construction. £ s. d.
Waimea-Kumara and Sludge-channel.									
Nine years ending 31st March, 1887	73,340 14 6	51,016 17 0	22,323 17 6	436	157,773	602,629 0 6	.. ..	.. ..	.. ..
Year ending 31st March, 1888	10,396 19 7	5,271 2 3	4,125 17 4	281	13,510	51,338 0 0	.. ..	.. ..	.. ..
Total	83,737 14 1	57,287 19 3	26,449 14 10	419	171,283	653,967 0 6	17,128 6	43,578 0 10	173,363 7 1
Nelson Creek.									
Nine years ending 31st March, 1887	14,791 13 11	10,707 6 0	4,084 7 11	60	28,520	109,089 0 0	.. ..	.. ..	.. ..
Year ending 31st March, 1888	1,045 1 8	1,173 15 4	*128 13 8	45	1,623	6,207 19 6	.. ..	.. ..	.. ..
Total	15,836 15 7	11,881 1 4	3,955 14 3	59	30,143	115,296 19 6	3,014 6	6,970 0 3	90,722 10 8
Argyle.									
Nine years ending 31st March, 1887	4,009 7 3	3,600 17 4	408 9 11	17	6,078	23,233 7 0	.. ..	.. ..	.. ..
Year ending 31st March, 1888	455 12 9	398 3 10	57 8 11	20	630	2,394 0 0	.. ..	.. ..	.. ..
Total	4,465 0 0	3,999 1 2	465 18 10	17	6,708	25,627 7 0	670 16	1,136 14 10	14,701 15 3
Mount Ida.									
Nine years ending 31st March, 1887	13,160 8 2	16,168 15 2	*3,008 7 0	92	20,911	79,493 0 0	.. ..	.. ..	.. ..
Year ending 31st March, 1888	1,355 0 9	1,255 18 4	99 1 5	130	3,100	11,625 0 0	.. ..	.. ..	.. ..
Total	14,515 8 11	17,424 13 6	*2,909 5 7	96	24,011	91,118 0 0	2,401 2	*508 3 7	65,776 3 8
Grand Totals ..	118,554 18 7	90,592 15 3	27,972 2 4	591	232,145	886,009 7 0	23,214 10	51,176 12 4	344,553 16 8

* Loss on working.

It will be seen from this table that the total cost of these works has been £344,553 16s. 8d, the total receipts from sales of water £118,564 18s. 7d., and the value of gold duty obtained through the working of claims by their construction £23,214 10s., making a total of £141,769 8s. 7d.; while the expenditure on maintenance has been £90,592 15s. 3d.: leaving a profit to the colony of £51,176 13s. 4d. during the ten years they have been in operation. The Mount Ida still shows a loss, even on this basis, of £508 3s. 7d.

MINING GENERALLY.

COROMANDEL.

Mining in this district is in a healthier condition than it has been for several years. There are three large companies that have taken up mines here—namely, the Kapanga, Corcmandel, and another company who have purchased the ground adjoining the Success Company. All these companies are formed with English capital, and have set to work in prospecting the ground and erecting machinery, which shows that these mines are intended to be worked systematically and on commercial principles. This is the only way in which mining can be made to pay. The system of taking up ground and holding it for whatever traffic can be done in shares is ruinous to mining as an industry, and brings it into disrepute among those who are seeking a venture where they can embark their capital with safety.

There are a good many miners yet working on the Tokatea Range, making fair wages, notwithstanding that it is riddled with drives and adits. The peculiar character of this goldfield is that the best gold is got in small veins intersecting the tufa rock in every direction. Sometimes these veins are like the blade of a knife, and sometimes widening out to 4in. in thickness. Claims that have from time to time been given up as being worked out are again taken up by other miners, and made to pay for working. Every small quartz leader or vein is followed up, and in many instances months are spent in driving without coming on a patch of gold-bearing stone.

The Tokatea Range is a portion of the Coromandel field which is well suited for small parties of miners. When auriferous quartz is found in these small veins they generally yield from 7oz. to 11oz. of gold per ton, and, the veins being small and rich, there is no necessity of having heavy crushing-machinery erected, nor is there any need of persons going to the expense of erecting machinery of their own for the small amount of quartz obtained. Every one gets out a few tons, and sends it to the custom mill at the foot of the range.

It will be seen from the following statement, showing the amount of quartz crushed and the yield of gold therefrom, that the Tokatea Range is still a rich place, which will be likely to support a good mining population for many years yet to come. There was 57 tons of quartz crushed from six claims, which yielded 1,015oz. 9dwt. of gold, or an average of 17oz. 14dwt. of gold per ton.

Name of Claim.	Amount of Quartz got or crushed.		Yield of Gold from Quartz.	
	Tons	cwt.	Oz.	dwt.
Bachelor's	7	5	253	0
Rob Roy	18	0	211	14
Young American	6	15	120	6
Gem	5	0	128	12
Queen of the North	5	0	115	17
Kaipawa	15	0	186	0
Total	57	0	1,015	9

Also, the following is the year's return from other small claims, where the quantity crushed is not known:—

	Oz.	dwt.
Golden Crown	25	4
Sterling Castle	29	10
Kennedy Bay View	13	17
Earl	29	10
City of Glasgow	65	8
Sunrise	8	12
Total	172	1

Tokatea Company.—This company's mine is now let in different portions to tributers, who pay the company 20 per cent. of the gold they obtain. At the time of my visit there were sixteen tributers at work, principally on the side of the range facing Coromandel, about 60 chains in an easterly direction from Harbour View. These tributers have to bag their quartz and carry it up the range on their backs for 300ft., and down for a similar distance to the road constructed round the southern side of the range from the saddle. All these tributers send their quartz to the custom mill on the Coromandel side of the range. There is a large reef running through this company's ground, but it carries very little gold near the surface. Some very rich stone was got in this lode on the third, fourth and fifth levels; but, on a lower level being constructed to cut the reef, it became broken up, and the place where the stone was expected showed the lode-walls plainly, but instead of containing quartz it was filled with mullock between the walls. Since this company took up the mine dividends amounting to £63,625 have been paid to the shareholders. During last year 26 tons of quartz was crushed, which yielded 1,027oz. of gold, or nearly 40oz. to the ton.

Kapanga Company.—This is the third company formed to work this ground. About two years ago the company was wound up, and the plant and machinery sold. The present company was formed in England, exclusively with English capital, and Mr. Hodge was sent to the colony to take charge of the mine as manager. The old machinery was purchased and all put in good repair; the foundations and trestles of the pumping-gear renewed, as well as new connecting-rods and balance-bob for working the pumps. Instead of it having the appearance of a rattletrap, as it had when the old company was at work, all the machinery and gearing have undergone a thorough overhaul, and are now fixed up in a substantial manner, working very smoothly.

The shaft has been sunk from the depth of 420ft.—which was the deepest level reached by the old company—to 509ft. A chamber has been constructed at 500ft. level, and an adit-level along the course of the lode is in course of construction. The Kapanga lode was cut in the bottom of the shaft, where it was about 18in. in thickness, but found to be carrying very little gold. An uprise from this adit to the 420ft. level is in course of construction, and when this is completed it is intended to again resume sinking operations. Where the lode is opened out at the lower level it is mixed with mullock, but on driving along its course a shot of gold is likely to be found.

It is well known that the quartz lodes, especially in this colony, do not carry a shot of gold for any great length along the lode, seldom more than 300ft. in one continuous ledge, and in many localities not more than 80ft. in length. From the character of the surrounding country rock, and the well-defined walls of the lode, there is every probability of a good shot of gold-bearing stone being found at this depth.

As soon as the chamber was opened out on the lower level, the upper level at 300ft. was extended on the line of Scotty's Reef, where a new gold-bearing ledge of stone was discovered, which has so far turned out very satisfactory. The length of this new shot of gold-bearing stone is from 70ft. to 100ft., and at the time of my visit the highest stope was 84ft. above the adit-level. Working on this lode commenced in June last year, and up to the end of March last 1,734 tons of quartz had been crushed, which yielded 3,335oz. of gold.

It is very gratifying to find that this mine has been made to pay for working in so short a period after commencing operations, and more especially as this is a mine which has been worked exclusively by English capital for the last fourteen years without giving any returns; but this is not to be wondered at, considering the manner in which the old company carried on its operations. As an instance of this, on the 300ft. level an overshot water-wheel was erected to pump the water out of a winze, and water brought from the surface to drive this wheel, which had to be again lifted by the pump in the main shaft to the surface. Every credit is due to the present manager for the systematic manner in which the workings are now carried on: due regard being had to the safety of the workmen employed and to the economical working of the mine.

Coromandel Company.—This company is under the same management as the Kapanga Company, and is formed with both English and colonial capital. The ground that this company hold was formerly held and worked by the Union Beach and Telephone Companies, and to this has been added Blagrove's freehold. Since the company has commenced operations a great deal of driving and prospecting has been done. The water is drawn down to the 180ft. level, and the ground above this is being opened out and prospected.

At present the company is engaged in the erection of a powerful direct-acting Cornish beam pumping-engine: the cylinder is 40in. in diameter, and the stroke of the piston 9ft. It is calculated that this engine, working at about three strokes per minute, will keep the mine thoroughly drained. Some idea can be formed of the massiveness of this new machinery when it is stated that the beam alone weighs 13 tons. The foundation for this engine is built of brick and concrete, and a building is erected with ponderous studs and cross-beams, the corner studs being 18in. square, of the heart of kauri, and the girders for carrying the beam are 30in. square. The walls of this building are 45ft. above the foundations for the engine, which are built 12ft. below the surface of the ground

A new boiler has been fixed in position, being built in with bricks, and a new chimney-stack erected, 60ft. in height, 18,000 bricks being used in its construction. A new 12in. plunger-pump is being fixed in the old Union Beach shaft to take the whole drainage of the mine from this shaft at the 180ft. level, and a new shaft, known as the Palmerston, is now being sunk on the face of the hill, about 300ft. distant from the old shaft. This shaft is now down about 50ft. below the 180ft. level. The Palmerston shaft is the one from which all mining operations will be carried on at lower levels. There are connecting-rods from the balance-bob at the old shaft to the new one, and pumps will be placed in the latter as soon as the water becomes troublesome, which will be worked by a T bob. The pumps in the shaft will only lift the water to the 180ft. level, and from there the water will flow through boxes placed in the level to the old shaft, to be lifted by the new plunger-pump. About 50,000ft. of kauri has been used in the erection of the engine-house and pump-rods.

Whether this company will be successful or not in making its mine a profitable venture, it is setting a good example to mining companies here in the construction of good machinery, and erecting it in a substantial manner. All the work yet done goes to prove that it is the intention of this company to work their mine on commercial principles, and not merely for the purpose of making money by trafficking in shares. When the mine is properly opened out and the whole of the machinery erected, they will be in a position to make low-grade quartz pay for working. Since they commenced operations 130ft. of winzes has been sunk, and 63ft. of uprises, 60ft. of adits, and 184ft. of cross-cuts constructed. Also, the new shaft, which is 12ft. by 6ft., has been sunk 72ft. The expenditure up to the end of last year was about £6,000 on machinery and works.

Royal Oak Company.—This company's mine during last year has produced some very rich auriferous quartz from the low level; indeed, it may be termed all specimen-stone. From 2½ tons, 316oz. was obtained, and from the upper workings, which are let to tributers, 11½ tons was crushed,

which yielded 401oz. of gold; thus making a total of 14 tons of quartz crushed, and 717oz. of gold, being at the rate of 51oz. of gold per ton.

Success Company.—Some very rich patches of stone were obtained from this company's mine some years ago. It cannot be termed a quartz reef, but merely a small vein of quartz that has been followed up. In some places there was a small shot of gold in the seam; but of late years very little has been obtained from this mine. An English syndicate has purchased a block of land on the line of the Success leader or vein, known as the Taumatawahine Block. They have done a good deal in the way of cutting trenches on the surface, with the view of cutting through leaders and veins; but so far nothing of any note has been discovered.

Waikoromiko District.

There is very little work being done in the Waikoromiko locality. McGregor's claim, which was discovered about fifteen months ago on Native land, is now applied for as a licensed holding, the land being given by the Native owner to the Governor on the same conditions as the Native lands at the Thames for mining purposes. Seventy-four pounds of picked stone from this claim yielded 13oz. 18dwt. of gold.

Matawai and Tiki Districts.

Mining in these districts is in a very quiet state at the present time. Nothing of any consequence is doing at Tiki and at Matawai. The claim formerly known as Vaughan's has not produced gold last year according to expectations. A low level was constructed previous to the present owners holding this ground, and during last year 50ft. of driving was done on the reef on the lower adit-level and 90ft. on the upper levels; but the quartz showed to be of low grade for this district. From the surface level 99 tons was crushed, which yielded 124oz. of gold.

At Castle Rock, Vizard's claim has not maintained the reputation that was expected from the prospects obtained when the lode was first cut in the lower level; but the class of ore obtained from this mine is very refractory, and cannot be treated by the ordinary battery process with success, as it contains a percentage of antimony, which sickens the mercury, and renders it unfit for the purpose of amalgamation: 10 tons of quartz from this mine yielded 50oz. of gold.

Manaia District.

This is a district where auriferous quartz was first discovered about three years ago. Several claims were at that time taken up, and prospecting continued for some time; but nothing of any note was found before last year, when Blackmore and party discovered a rich quartz leader near the surface on the side of the bridle-track—constructed by subsidy from this department. This leader is about 6in. in thickness, from which 25 tons of quartz has been crushed, yielding 198oz. of gold. The Premier Mine, which is on private property near the beach, produced 3½ tons of quartz, which yielded 105oz. of gold.

Waiomo District.

This district was opened up by Lowry Brothers, who, after prospecting and tracing loose gold up the bed of the Paroquet Creek to near its head, came on a large body of rich auriferous quartz alongside of the creek. The reef, when first discovered, was of a very soft, ferruginous character, and contained a deal of loose gold, but after sinking down for some distance on the lode the stone gradually became poorer. For some time after Lowry Brothers had commenced to work the reef the stone was sufficiently rich to pay for packing from the mine to the sea-beach, a distance of about two miles and a half, over a track in which the horses had to plunge to the belly at every step. The quartz was then placed in boats and taken to Tapu and also to Grahamstown to be crushed, the cost of transit alone being about £6 per ton. Only the best of the stone was taken away at this time, and the rest of it stacked on the ground, awaiting the dray-road to be constructed, and a crushing-battery erected near the Waiomo Creek, so that it could be more cheaply conveyed to and crushed at this battery. During the time the original prospectors held this claim they got about 1,400oz. of gold from the quartz crushed by the expensive mode just described.

Several other claims were taken up on this reef, and after being engaged for about twelve months in prospecting, the owners of the adjoining claims to the Paroquet purchased the prospectors' interest out and formed a company to work the three original claims, namely, the Paroquet, Maori, and Waiomo, with a capital of £25,000, none of which is yet paid up. This new company has erected a crushing-battery of twenty heads of stamps and six berdans at the junction of Waiomo and the Paroquet Creek. The road is now constructed from the mine to the battery, and the manager expects the company to be in a position to pay for this machinery out of the profits of the mine before the bills which are given as payment are matured. This company has taken steps to open out and prospect the mine considerably before arranging to erect machinery. There are two adit-levels constructed, one of which is 46ft. below the old workings, and the other 60ft. under the second level, which gives 106ft. of backs. The run or shot of gold in the lode is about 90ft. in length, having an average thickness of about 3ft. In some places the lode widens out considerably and in others it is very narrow. A winze has been sunk down from the upper workings to the bottom level, showing that the reef carries payable gold for the whole of the way. In some places the lode is 6ft. in thickness and in other portions it gets very narrow, almost pinching entirely out. From the amount of gold that can be seen in the lode when the winze is sunk there is little doubt but that this will be a payable mine for some time at least. It is known that there is a block of stone 90ft. long and 106ft. in height that will pay well for taking out, but beyond this nothing more can be said. Recently 60 tons of quartz has been crushed, which yielded about 85oz. of gold.

On my visit to this district on a former occasion I was satisfied from the appearance of the reef that it would continue to go down for some distance, and even now, in the bottom level, the foot-wall still preserves its well-defined character, but the hanging-wall is not defined; the quartz

and tufaceous sandstone merge into one another. I think, however, this will be a district likely to give employment to a mining population for some years. At the same time the system of working mines on the principle on which the Paroquet Company has started cannot be too severely criticized, namely, working the mine and erecting machinery on credit, instead of calling up their capital. When a mine is so heavily handicapped as this it takes a long time to clear itself, and if the slightest mishap takes place the creditors come down and wind the company up.

Ostrich Mine.—This adjoins the south end of the Paroquet Mine. At the present time a level is being driven from the Paroquet Creek to cut the reef; this level is considerably lower than the lowest one in the Paroquet ground, and, therefore, if gold is struck in the Ostrich claim it will go a great way to establish the permanency of the reef.

Golden Gem Mine.—This mine is situated on the south end of the belt of country in which the Paroquet reef exists, about a mile distant from the Paroquet workings. The ground was partially worked several years ago. At that time the lode was found too poor to pay for working, but now, when a crushing-battery is erected in the vicinity, it is deemed to be a payable undertaking. The shareholders have constructed about half a mile of a good tramway from the mine to the crushing-battery, and have now every facility for landing the quartz at the battery at a cheap rate.

Golden Drop Mine.—This mine is situated on the south side of the Waiomo Creek, about a mile and a half from the crushing-battery. It was discovered by Lowry Brothers, the prospectors of the Paroquet claim. Up to the time of my visit very little work had been done. The face of the reef was laid bare, and some stone broken out, which is stacked in a paddock. The reef seems a jumbled up broken mass in the face, with no well-defined side-walls. I saw a little gold on some stones that have been taken out, but the gold appears to be in the joints of the stone, and not through the stone itself. On the face of the stones there were blotches of very fine gold leaf, which gave a rich appearance on first sight, but on close examination it becomes very doubtful whether it will pay for working. Several dishfuls of stuff were washed from different parts of the face, but in no instance was any gold got. An adit has been driven in for a few feet and the reef cut through, but the mouth of the adit was closed up, so that I could not see the reef at this place, none of the shareholders being at the claim at the time of my visit. There is not sufficient prospecting yet done to know whether the claim will prove payable for working or not.

Te Mata District.

This is a district where a considerable deal of loose-quartz gold has been found from time to time in the bed of the creek; but until recently it has never been traced to any reef. Gentle Annie Creek, which is one of the branches of Te Mata Creek, has been worked by sluicing, and portions of it paid very well. This gold has now been traced up to reefs, or what may be more properly termed quartz leaders, and a good deal of prospecting is at present being carried on in different places all over the district. I visited the two principal claims, namely, Birch and Baker's and Whitly and party's. The former claim is situate on the north side of Gentle Annie Creek, about 750ft. above sea-level, and about four miles distant from the mouth of Te Mata Creek.

Birch and Baker's Claim.—The reef in this claim is from 6in. to 15in. in width, and shows very fair gold near the outcrop. The gold is not, however, evenly distributed through the stone, but in small seams or veins. The reef has been trenched for some distance along the top, and at the time of my visit the proprietors were taking out 5 tons to be tested by Mr. Fraser's plant in Auckland, but I have not learnt the result. There is no work yet done to prove whether this field will be a payable district or not. The reefs that are discovered can only be termed quartz leaders, and the whole of the workings in this district are confined to prospecting on leaders or gold-bearing veins close to the surface. Nothing has yet been done to prove whether they continue to go down carrying gold.

Whitly and Party's Claim.—This is a claim on the spur between Te Mata and Gentle Annie Creeks, and near the junction of those creeks. Trenching along and across the spur has been carried on to a considerable extent on the surface without anything having been discovered of any note. In December last this party discovered a leader of quartz about 6in. in thickness on the side of the spur, and a very good prospect can be obtained on the cap, but at the time of my visit scarcely any driving had been done on the leader. An adit-level was in course of construction to cut the reef at a lower level. Recently 2 tons of quartz has been crushed, which yielded 16oz.

Tapu Creek.

Mining has almost been at a standstill here during last year. Most of the miners who used to be in this locality have gone to Te Mata and Waiomo, but some of them have again returned and commenced to work their old claims. Very rich quartz was got in this district in the early days; but the reefs, which are generally very narrow, do not appear to carry gold down to any great depth; at least they have not been proved to do so as yet.

Thames District.

The recent new finds at Marototo, Puriri, Waiomo, and Te Mata have had the effect of removing a little of the gloomy aspect of mining affairs in the Thames District, and have tended to raise more buoyant hopes of a revival of the mining industry. The introduction of foreign capital in carrying on mining in this district will also infuse a new spirit in mining operations, and cause prospecting to be carried on more vigorously than it has been for the last few years. The yield of gold for the last year shows an increase over the previous year, and, when once capital is introduced to work the mines advantageously, there is a prospect of this proving a good field for investment.

The great disadvantage which this district is labouring under more than any other mining district is the large quantity of refractory ores found, without knowing how, or, at least, having a proper method to treat them. All the gold here is alloyed with silver, and some of the ores contained sulphides, chlorides, tellurides, selenides, and antimonides of metals, which makes them complex in character and difficult to treat with the present appliances.

A gentleman, Mr. Parkes, has recently come out from England to superintend the erection of metallurgical works at the Thames, whereby he claims to be able to save the whole of the metals in the ore. This gentleman represents a syndicate who has taken out a patent process for the treatment of auriferous and argentiferous ores, both by a dry and wet process, and who has sold the right to use it in New Zealand to a company in Auckland. From what I could learn during my interview with Mr. Parkes he intends to smelt the ores, which he says can be done, even if they contain 97 per cent. of silica, at a cost not exceeding £2 per ton; but the great success claimed for the process is that the ores can be smelted in a cupola without any condensing-chambers to collect the fumes, and that none of the metals are carried away. The following is an extract from the *West Coast Times* on Mr. Parkes's process:—

"It is known that Mr. Alexander Parkes, an English metallurgist, bearing a high reputation, is now on a visit to New Zealand with the object of starting reduction works at the Thames, for the purpose of dealing with the refractory ores in that district. Before leaving England an exhibition was given at the Experimental Works, East Greenwich, by the company with which Mr. Parkes is connected—the Parkes Gold and Silver Smelting Company—at which various ores of a refractory nature were 'put through' successfully. The raw ore is first crushed roughly, then intimately mixed with the fluxes, and put in the reverberatory smelting furnace; it is then allowed to smelt for three to four hours, when the ore and fluxes become one liquid mass of molten material. The slag, which swims on the top in a fine fluid state is now skimmed off, and the regulus tapped, which flows out into iron or sand moulds. This regulus contains all the gold and silver and other metals. The regulus is allowed to cool and disintegrate. It is then placed in a calcining furnace, and about half the sulphur burned out of it. It is then mixed with oxide of lead and smelted, and the gold, silver, and copper combine with the lead, and form an alloy. When this is considered complete, the lead is tapped and run into moulds. This lead is then smelted in the cupelling furnace, and oxidised in the usual way, leaving behind it the precious metal. The fluxes vary in their kind and proportions, according to the particular nature of ore to be operated upon. The operations are also varied to a considerable extent. The regulus of some ores does not require calcination, and the lead is mixed with the ore before being put into the furnace, and in cases may be even mixed with the regulus in the furnace after the slag has been skimmed off. The ore the company had been smelting off was the 'Alexandra,' from Queensland, which was a very refractory one, and contained lead, sulphur, copper, zinc, and upwards of 50 per cent. of silicious insoluble matter. In dealing with this ore the operations were conducted without the slightest difficulty. There were only 2dwt. 10gr. of gold found in the ton of slags, out of 2oz. 12dwt. in the ton of the ore; and 2dwt. 10gr. of silver in the ton of slag, out of 1oz. 5dwt. contained in the ton of raw ore. The fluxes used for this particular ore are lime, salt cake, iron ore, fluor spar, and coal; in all 920lb. to the ton of ore, and costing only 4s. 9½d. Those who witnessed the tests were representative men from all parts of the world, and at the conclusion pressing invitations were given to Mr. Parkes to visit South Africa and Queensland to erect smelting works in those places, substantial guarantees being offered. The essence of the process seems to be in the fluxes used, which consist of blue billy, sulphate of soda, lime, fluor spar, and carbon in certain proportions, according to the character of the ore to be treated. The ore is pulverised without being previously calcined, and is then mixed with the fluxes, which are also in the form of powder. The mixture is then smelted in an ordinary copper smelting furnace, and the resulting regulus is treated with water before it is quite cold, which causes its rapid disintegration. This saves the operation of mechanical disintegration which is necessary with regulus produced in the ordinary way. The regulus is subsequently calcined and then melted with lead to collect the gold and silver, the lead being afterwards cupelled for bullion. Although the tests hitherto applied have been successful, it is quite likely that some may still refuse to submit to the treatment. The most important feature in connection with these ores is their difference from each other. In the same mines, ores of entirely different constitution are frequently met with often requiring a very different process."

I am very doubtful, however, whether the smelting process will ever be carried on with New Zealand ores at a cheap rate. The cost of obtaining necessary fluxes will always make it an expensive process here. With regard to the wet process, the ores are first ground in a dry state and afterwards lixiviated in their raw state, notwithstanding that they contain a large amount of arsenic and sulphur. Mr. Parkes could not describe this process to me, as the patent has not yet been secured, but he affirms that ore can be treated by this means at a very cheap rate. Time will show whether Mr. Parkes's processes are the success he represents. It is to be hoped they will be, although I have my doubts on the subject; but should he be successful there will be large bodies of ore worked at a profit, which are now being cast into the waste-heap as worthless material.

At Grahamstown, where the principal mines are situated, they have a heavy drag in paying contributions towards keeping the big pump at work, especially in those mines which are not working on payable stone, but merely carrying on prospecting works. It was proposed about two years ago to apply water as a motive power in lieu of steam to work the pumping-machinery, which was estimated to cost about £4,000, of which amount a subsidy of £2,000 was authorised; but as soon as the subsidy was authorised the Drainage Board wished to get the money to pay off their liabilities, instead of applying it to the purpose for which it was granted. It was shown at the time this subsidy was authorised that if alterations were made whereby the pump could be worked with water-power when water was available, and in dry weather connected with the steam-engine, the saving in cost of maintenance would be over £1,000 per annum.

Deep Level Cross Company.—This company holds the ground on which the big pump and gear are erected. They formerly purchased the whole plant when it was sold by the county; but the expense of working being so great, and their mine not proving remunerative, they sold it to the Drainage Board about three years ago for £2,500. The whole of the purchase-money not yet being paid, they still hold a lien on the plant. This company's ground adjoins the New Prince Imperial Company's claim, where a rich lode was worked two or three years ago. The same reef runs into this company's ground, but it was never so rich, and did not hold out for any length of time. During last year only 86 tons of quartz was crushed from this mine, which yielded 152oz. of gold. Steps are now being made to float a new company in England to purchase this mine.

New Prince Imperial Company.—This company was formed in 1882, and has been steadily working the mine ever since. Soon after the company commenced operations they struck a rich ledge of auriferous stone, which enabled them to pay £60,750 in dividends; but during the last two years the stone has been of very low grade. During last year a new lode was found on the hanging-wall side of the main lode, which promises to give good returns for working as soon as it is properly opened out. There has been 1,279 tons of quartz crushed during the year, which yielded 1,206oz. of gold.

Caledonian Company.—This company now holds the ground that formerly belonged to the New Caledonian and Crown Companies. In former years this was the richest ground in the Thames District. Over £600,000 was paid in dividends in one year. Of late years it has done little more than pay expenses for working. In this company's mine antimonial or ruby silver is found in conjunction with gold in the lode. Last year 1,548 tons of quartz was crushed, which yielded 1,467oz. of gold.

Cambria Company.—This company was formed in 1884 with a nominal capital of £44,700, of which £12,837 was declared paid up, and £1,181 has been paid in calls. Since that period the company has paid over £77,000 in dividends. Some very rich stone was obtained in this company's mine about two years ago, which was thought to be a portion of the same lode that the Caledonian Company worked in the early days, and the mine still continues to be worked successfully. Several gold-bearing leaders have been cut through and partially worked. There is still a good block of stone in the main lode between No. 3 and No. 4 Levels. In this mine there are numerous gold-bearing leaders or veins of quartz interstratified with the country rock which will pay for working, and it is likely to be a mine that will pay for a considerable time. During the year about a ton of specimens was crushed, which yielded 2,509oz.; and 6,562 tons of quartz was crushed, which yielded 3,810oz. A parcel of tailings also yielded 242oz., making a total of 6,661oz. of gold obtained during last year.

Waiotahi Company.—This has been a regular dividend-paying company for the last thirteen years, and is one of the best-worked mines in this field. Everything connected with the workings shows indications of careful management. The working during last year has been chiefly confined to small leaders or veins of auriferous quartz, which, in some places, do not show more than ½in. in thickness; but these are followed up and found generally to widen out to 3in. and 4in. They have also been working a portion of the main reef above No. 4 Level. The numerous leaders of auriferous quartz found in this mine traversing the country rock in every direction will take a long time to work out on the upper levels. Indeed it is hard to say how long a mine of this description, with careful management, may last. The amount of quartz crushed last year was 2,497 tons, which yielded 3,203oz. of gold.

Saxon Company.—The ground that this company now holds formerly belonged to the London, Old Beach, and Golden Run Companies. It was taken up about four years ago. After employing wages-men to open out the mine, they were unsuccessful in finding a lode of a payable character. They then let the mine on tribute, and after the tributers had been at work for some time they put in a cross-cut from No. 3 Level and cut a reef about 18in. wide, which yielded about 3oz. to the ton. After this find they again employed men on wages, and sunk a winze on this reef, the quartz from which yielded 51oz. of gold from eleven loads of quartz. Recently they have been stoping out the reef, which looks very promising; and occasionally a few pounds of specimen-stone is picked out of the reef. There are a number of small leaders or veins of gold-bearing quartz in this claim, and with judicious and careful management it is likely to be a payable gold-producing mine for some time. This mine is situated between the New Prince Imperial and Queen of Beauty Company's ground, and in the line where rich stone might be expected.

Trenton Company.—This company's ground is situated in such a position that there are several reefs leading into it. From its situation there is every indication that this mine will yet become a valuable property. Indeed, there is no mine in this district that is better worthy of prospecting, as it is one which, I think, will yet pay well for all the outlay. Arrangements were made with the Saxon Company to extend their adit-level on the reef for some distance into this company's ground; but after driving 175ft. the cost of haulage was so great that they abandoned it. This company have now arranged to sink their own shaft, and have purchased a larger winding-engine to replace the one formerly used. There has been 130 tons of quartz crushed from the lode the Saxon Company worked, which yielded 104oz. of gold.

Kuranui Nos. 1, 2, and 3 Mines.—These mines are held separately by private persons. No. 1 Mine is owned by S. Turtle, and during last year 350 tons of quartz were crushed from it, which yielded 580oz. of gold.

No. 2 Mine is the property of R. Comer, and is worked by tributers principally on small leader and veins of quartz which traverse the country rock; 1,634 tons of quartz has been crushed, yielding 1,530oz. of gold.

No. 3 Mine was the property of T. Hicks, but has lately been purchased by P. Hansen, who has also lately acquired the Kuranui Battery, and who intends to work some of the leaders of quartz and country rock in a face, putting it all through the crushing-battery. The ground he proposes

working in this manner was very rich in the early days, and was known as the Shotover claim. The quantity of quartz crushed from this mine during last year was 600 tons, which yielded 440oz. of gold.

New Alburnia Company.—This company was formed in 1885 with a nominal capital of £20,000, of which £10,000 was declared paid up, and £1,000 has been paid in calls. There are three distinct channels of reef country in this company's ground, divided from each other by bands or dykes of dioritic rock. There is a large body of quartz in the lode at the lower adit-level, which is constructed for 2,600ft. in length, but has, so far, proved of too low grade to pay for working. The workings are confined to the upper levels, from what is known as the Whau Adit-level, to the surface. A great deal of prospecting has been carried on during last year, and levels opened out. From one of the main lodes occasional patches of specimens are obtained. The present prospects of the mine are very promising, and it is likely to afford employment to a large number of men for a long time. There has been 887 tons of quartz crushed during the year, which yielded 1,597oz. of gold.

New Manakau Company.—This company was formed in 1883 with a nominal capital of £30,000, of which £15,000 is declared paid up, and £1,500 has been paid in calls. Their ground adjoins the Waiotahi Company's mine, and is under the same management. It is full of leaders and veins of auriferous quartz, which pay for working. A good deal of driving and stoping has been done during last year, and 400 tons of quartz has been crushed, which yielded 640oz. of gold.

Moanataiari Company.—This company was formed in 1868, and since they have commenced operations dividends to the amount of £121,365 have been paid. Of late years the mine has been chiefly worked on tribute, with but moderate results; yet some of the ground pays the tributers very well for working. This company has one of the finest adit-levels in this district; it is constructed into the hill at 30ft. above sea-level for a distance of 2,800ft. There is a double line of rails laid in this adit-level, and the trucks are hauled out by means of horses. This is really an adit-level which, were it extended, would prospect the ground in the back country at a cheaper rate than it is possible to do otherwise, and no doubt the time will come when the mines at the back will be given up and eventually fall into this company's possession, and become a valuable property. During last year 130 tributers were working in this mine at one time, in addition to several wages-men. There has been 1,301 tons of quartz crushed, which yielded 3,901oz. of gold. Recently, an English company has been formed, with a capital of £75,000, who purchased this mine, £50,000 being given for the mine and to the promoters, leaving £25,000 to work the mine and pay off the present liabilities.

Reuben Parr Company.—This company's ground is situated near the head of the Moanataiari Creek. They are working from adit-levels and winzes sunk below the lowest adit; but the water here is troublesome, and makes the reefs costly to work. This ground could be worked to good advantage were the Moanataiari adit-level extended, and would pay well. During last year there has been 180 tons of quartz crushed, which yielded 200oz. of gold.

Queen of Beauty Company.—There have been no mining operations carried on in this company's mine during last year. Recently a large area has been applied for as a special claim, with the view of floating a large company on the English market. There has also been a large area applied for by a company in Block 27, which the reef in the Queen of Beauty Company's ground is expected to go through. This block has been under offer to an English syndicate, but I have not heard whether they are likely to take it up.

Karaka Creek.

A great many of the mines here are held by private individuals, and have been worked for the last thirteen years with very satisfactory results.

The City of Manchester Mine is held by two men—Messrs. Scott and Taylor—who work the mine in a very systematic manner. The reef is 15in. in thickness, and during last year 228 tons has been crushed, which yielded 536oz. of gold.

The City of Adelaide Mine is also held by private individuals, who have got 300 tons of quartz crushed during last year, which yielded 412oz. of gold.

The Lone-hand Mine, which belongs to T. Barclay, is worked pretty well out from the upper adit-levels to the surface. The gold that has been got last year is from small leaders and veins which traverse the county rock. A low-level adit has been constructed for 675ft., and a winze sunk from the upper level to meet it. The reef in the winze is about 18in. in thickness, but the stone is of rather low grade. There has been 25 tons of quartz crushed during last year, which yielded 136oz. of gold.

The Hokianga Mine, belonging to Jenkins and party, has given steady returns for a number of years. The gold is chiefly found in small leaders and veins traversing the country rock, and some of these are especially rich, where they occur at the junction of black mullocky seams. There has been 25 tons of quartz and some picked specimens crushed during the year, which yielded 286oz. of gold.

Auckland Company.—This company has been working the mine, with but moderate success. During last year 114 tons of quartz was crushed, which yielded 305oz. of gold. This mine was taken up about three years ago, and the company had not started operations long when a payable reef was found; but of late the stone has been of a low-grade character.

North Star Company.—This company's ground is situated at the head of Te Papa Gully, at a good elevation. The work has been carried on by tributers, who have stoped out 378 tons of quartz, which yielded 664oz. of gold.

Otanui.

Some of the claims here are being worked with moderate success, but the quartz generally is of low grade. In the Eureka Company's mine there are two blocks of stone from 3ft. to 4ft. in

thickness, which, with the facility there is for conveying the stone to the battery and crushing it, low-grade stone pays for working. There has been 555 tons of stone crushed from this company's mine during the year, which yielded 353oz. of gold. This company was formed in 1882, with a subscribed capital of £16,800, of which £1,977 has been paid in calls; but no dividends have yet been declared.

PURIRI DISTRICT.

Auriferous-quartz reefs were discovered and worked in this district sixteen years ago, and some of them were worked for a time and afterwards abandoned. During last year prospecting has been carried on, and auriferous quartz in two different localities discovered, which are deemed to be payable for working.

Ngawhakapoupou Claim.—An auriferous-quartz lode going through this claim was recently discovered by a party of Natives. About sixteen years ago a shaft had been sunk in the lode to a depth of about 25ft., and the lode on the hill or eastern side of this shaft partially worked. The Natives went down this shaft and commenced opening out the lode on the other side, and discovered some very rich stone: 28cwt. of which was forwarded to the Thames to be crushed, and yielded 11½oz. of gold, the value of which was £2 17s. per ounce. The lode is about 2ft. in thickness, but the best portions of it is in a seam about 3in. thick, next the hanging-wall. A low level is being constructed, which will cut the reef at about 50ft. below the bottom of the shaft. This claim is situated on the western slope of the range facing the Puriri Flat, about two miles from the Thames Valley Road. There is a small gully leading up from the flat to the shaft where the gold was discovered, and in the bed of this gully several tons of loose quartz have been taken out and crushed, which yielded 12dwt. of gold per ton.

Bedford and Party's Claim.—This claim is situate on the western side of the Puriri Creek, about three miles and a half up from the Thames Valley Road. A leader of auriferous quartz 6in. in thickness was found cropping out on the surface, close to the side of the creek. This has been opened out on and an adit constructed for some distance into the hill. From what I could see of this leader, and from the prospects washed, it is questionable if it can be worked with profit. The shareholders are, however, sanguine of it proving payable, and are erecting a battery of six heads of stamps and two berdans, which is to be driven by a Pelton hurdy-gurdy water-wheel. As this claim is a long way distant from any crushing-plant the expense of erecting a small plant of their own will possibly be the cheapest way of properly prospecting the ground, and with such a plant being erected in the locality, it will be an inducement for others to prospect the country in this vicinity, as they will be able to get the stone tested without going to any large expense for conveyance. Stone is now being taken out from adit, which is constructed and stacked on the ground waiting the erection of the battery.

MAROTOTO DISTRICT.

This is entirely a new district for mining. About ten months ago R. McBrin discovered a large quartz lode cropping out on the surface at the side of a steep gully leading down to McBrin's Creek. At the time the discovery was made several specimens of the ore, forwarded to me by Mr. McLaren, were assayed at the Colonial Laboratory, and found to contain bullion at the rate of 2,226oz. to the ton, about 80oz. of this being gold and the rest silver; and some assays made at the Thames School of Mines gave higher results. After these rich samples, and the great excitement that so rich a discovery caused at the time, any one visiting the workings after the mine came to be opened out a little would no doubt feel disappointed. It is true that there is a thin seam at the outcrop of the reef, which is very rich in chlorides of silver as well as gold; but as the adit-level goes into the hill this seam gradually becomes poorer in quality; also in sinking a winze on the lode the ore became of much less value. At the time of my visit in January last an adit-level was constructed into the face of the hill for about 50ft., and a winze sunk down near the mouth of the adit for 35ft. The lode is about from 6ft. to 8ft. in thickness, and has a narrow seam running through it of very rich lode stuff. This seam, as previously stated, becomes of less value as the lode goes into the hill, and also as it goes down. An adit-level was commenced on the opposite side of the gully, but at the time of my visit this level had just been started, so that I could not form a definite opinion respecting it. I have since learned, however, that this adit is constructed for 80ft., and very good stone has been got on one side of the reef for about 2ft. in thickness.

With regard to the prospects of this mine, there is every appearance of getting a quantity of good ore, but its richness has been greatly over-estimated; yet, I think, there is little doubt but it will prove eventually a valuable discovery. At the time of my visit 25 tons of the ore had been sold at the mine to Mr. H. C. Wicks in several parcels, the first bringing £20 per ton, the second £17 10s., the third £15, and the fourth parcel, which was being put in bags while I was there, brought £4 per ton. Since then several lots have realised £10 per ton. Mr. Wicks purchased last year altogether 30 tons for £420. One and a half tons of ore which were sent to Sydney realised £380. In this last parcel there was 41oz. of gold and 600oz. of silver per ton. It has to be borne in mind that all these parcels consisted of picked ore taken from narrow seams in the lode.

The reef can be traced over two miles in a southerly direction, and wherever it has been cut—especially in the Prospectors' claim—it shows gold and silver; but far more prospecting will yet have to be done, and the lode tested at deep levels, before it can be ascertained whether there is a large auriferous and argentiferous deposit here or not. This requires to be done before any steps are taken towards the erection of a plant for treating the ore. The bullion, being principally silver, requires a different mode of treatment than that which is at present adopted at the Thames. Out of a parcel of ore that Mr. Wicks forwarded to Freiburg for treatment, 6cwt. was given to Price and Sons, at the Thames, to test, which they did by crushing the ore dry, afterwards roasting it in a reverberatory furnace, and then amalgamating it with mercury in berdans. By this method, bullion was extracted to the value of £17 13s.

This mine is situated on the side of a high range, which is on the eastward side of McBrin's Creek, and about three-quarters of a mile southward of the junction of McBrin's and the Marototo Creeks, the latter creek being the principal branch of the Hikutaia River. The distance to the Thames Valley Road is about nine miles. There is no difficulty in getting access to this place as almost a level road can be made up the valley of the Hikutaia and Marototo Creek to the junction of McBrin's Creek. From this point a track has been constructed to the mine over a range 1,400ft. above sea-level, and then drops again 500ft. into the fall of McBrin's Creek. Instead of following this route, a good line for a track could have been got following the sideling on the east side of McBrin's Creek up to the mine. I have been informed that a company from Sydney has purchased this mine intending to carry on mining operation energetically.

McIsaac's Claim.—This claim is situated about 40 chains to the southward from the boundary of the Marototo Company's ground, and as far as yet ascertained is on the same line of reef as that company. The bullion, however, in the ore is of entirely a different quality; there is not nearly the same proportion of silver in the ore, and, consequently, it is of a much higher value. Where the reef is cut in this claim it shows to be about 9ft. in width. Two adit-levels have been constructed, one on each side of the small creek where the reefs were first discovered. In the southern adit the reef splits, and a horse of mullock comes in between. A fair prospect can be got in a portion of this reef, but to take it in a face the lode consists of too low-grade ore to pay for working. The lode has also been cut at a lower level: at the southern boundary of this claim, where it is about 15ft. in thickness. A small parcel of stone from this claim was forwarded to the Thames for treatment, and from what I could learn the bullion was worth about £2 per ounce. The gold occurs in the ore in a very freely divided state and will be difficult to save by the ordinary method of treatment. Arrangements have been made with some gentlemen in Christchurch, who agree to erect machinery, for treating the ore for a certain number of shares in a company to be formed. The remainder of the shares to be divided among the original proprietors.

O'Shea and Party Claim.—About 30 chains south from the boundary of McIsaac's claim. This party has taken up ground on the westward side of Peel's Creek, and has constructed an adit-level into the face of the hill, cutting the reef, which is about 12ft. in thickness, a portion of it carrying a fair percentage of gold.

Arizona Claim.—This claim adjoins the southern boundary of O'Shea and party's claim. An adit-level has been constructed into the hill for 100ft., and continued for 70ft. on the reef, which is about 6ft. in thickness at this point. One ton of quartz was crushed from this claim, which yielded 8dwt. of gold.

This district seems to contain a number of reefs, but as far as testing their value is concerned very little has been done. There was not sufficient prospecting done in any of the claims to justify the erection of large crushing-machinery. What is wanted in this place is a small hand- or horse-machine on the ground to test small parcels of ore at different portions along the lode, and also at different levels. By this means the value of the claims would be accurately ascertained. The character of the bullion seems to differ greatly in each claim. The further southward on the line of reef the higher the proportion of gold to silver; but in the whole of the claims the gold is found in such a finely-divided state in the ore, that not more than 33 per cent. of the bullion is likely to be saved by the ordinary crushing battery process.

The outlet for the mining-claims on the south end of these reefs will be by a road constructed down the side of Peel's Creek, but it will be a far more expensive road to construct than the one to the Marototo claim as the country is more broken.

Whangamata District.

This is a district where auriferous quartz was obtained several years ago, but scarcely any work was then done. The recent prospectors—Messrs. Mackay, Kelly, Harris, and McWilliam—discovered a quartz lode on the top of a narrow ridge facing the Wairoa Creek on the east side. This claim is about six miles up the valley of the Wairoa Creek from the Whangamata harbour. This valley is very suitable for the construction of a road either to get machinery brought on to the ground or to get the quartz sent to the harbour, where it can be shipped to the Thames or Auckland for treatment.

Where the reef crops out on the surface it appears a large blow, but, nevertheless, the stone shows a fair percentage of silver, which is in the form of sulphides. At the time of my visit to the locality scarcely any work had been done beyond blasting away a portion of the large blow referred to. Since then an adit-level, 40ft. below the outcrop, has been constructed, and the lode cut through Subsequently this adit has been extended for 30ft. along the course of the lode, and a winze sunk at the end of the adit for about 8ft., showing the lode to be about 3ft. in thickness. Gold is seen throughout the whole of the lode, but the richest portion is next the foot-wall. There was 11cwt. of lode stuff forwarded to Messrs. Fraser and Sons of Auckland, which yielded 14oz. of bullion. There is a large proportion of silver in the bullion, but I did not ascertain what its value was. Sulphide of silver can be seen very freely in some portions of the lode. Further prospecting will have to be done on this reef, and it will have to be tested at as deep levels as the creek will permit to get anything like an idea whether the lode will be permanent or whether it will cut out as it goes down.

A. Wilson and Party's Claim. — This claim is situate on the opposite side of Wairoe Stream from the Prospectors' claim, and is about 30 chains up a small creek leading into tha Stream. The reef here is about 15ft. wide, which can be traced in a northerly direction for about half a mile, and in a southerly direction for a mile. Very little work was done at the time of my visit, but from what could be seen from the character of the rock, there is only about 3ft. of it that will pay for working. This portion of the lode is of a soft friable character, having a reddish appearance, which is evidently owing to the oxide of iron. Several prospects were washed during my visit, which I estimate would yield at the rate of from 8dwt. to 10dwt, of gold per ton. The gold is found in a very finely divided state, and has a light colour, indicating that it is alloyed with silver to a considerable extent.

There are several quartz reefs in this district, but no prospecting of any note has been done to determine their value. The lodes, as far as proved yet, are of a payable character, if a plant for treating the ore properly were near the locality. The lodes, however, may be classed as containing ore of low grade.

Waihi District.

Very little mining has been carried on in this district during last year. The Martha Company still continue to work their mine, although the quartz is of very low grade; however, it is found that the mine will only pay the company by letting it on tribute. The reef is about 30ft. in thickness, but only a very small portion of this contains sufficient gold to pay for working. During last year 1,414 tons of quartz were crushed, which yielded 535oz. of gold.

Union Company.—The only operations carried on by this company during last year consisted in sinking a prospecting shaft 130ft. deep, to test the lode at a lower level. An adit-level was constructed from near the bottom of the shaft to the lodes, which were cut at 64ft. and 78ft. respectively from the shaft. The large influx of water when the main lode was struck prevented prospecting being carried any further. From what I could learn, the quality of the ore at the place where it was cut was not equal to that found on the top. This company's mine, together with the Rosemont and Winner Mines, have been purchased by an English company, and machinery for treating the ore is now in course of transit to the ground. Mr. J. W. Walker, the manager of the new company, has recently visited some of the mining centres in America to see the principle on which similar ores are treated there. From what I can learn, the treatment of ore will be by roasting, afterwards crushing it in a stone-breaker, and Globe crusher; thence to amal-amalgamating pans and settlers, where it will be chemically treated. The machinery for treating the ore has been imported from England and America, and the pumping-plant has been purchased from the Dart Company, at the Thames, and is now in course of transit to the mine.

Silverston Company.—This company has not done much work in its mine last year. A winze has been sunk to the depth of 60ft. on the reef, which is from 10ft. to 12ft. in thickness at the bottom, but only about 5ft. of the hanging-wall side of the lode has been taken out and sent to the crushing-battery. The quantity of water met with at the bottom of the winze prevented sinking operations from being carried on any further. It is said that this mine is likely to be purchased by a Sydney company, to whom it is at present under offer. The quantity of quartz crushed last year was 97 tons, which yielded 198oz. of gold.

Karangahake District.

The only mines in which work was being carried on at the time of my visit were the Mammoth, Woodstock, and Kenilworth. The operations in the other mines were suspended for a time.

Mammoth Mine.—This is owned by an English syndicate, who sent out a gentleman from England—Mr. Argill—to carry on prospecting operations to test the mine, previous to erecting machinery. The ground belonging to this syndicate is situated on the face of the range, on the westward side of the Woodstock Mine, and prospecting operations were being carried on at the time of my visit. This is the same ground where a rush took place in 1875. One of the old adit-levels was cleaned out and retimbered, and was being extended. Two quartz lodes were cut through, containing a little gold and silver, but they have a very broken appearance, and indicate that the whole face of the range here is only a portion of a large slip which has at one time come from the Karangahake Range. The character of the lodes and surrounding country rock in this adit-level gives one the impression that a permanent lode will not be found here. This syndicate have adopted a wise course, to prospect the ground first before going to any expense for machinery and plant. Recently I have heard that they have suspended operations.

Woodstock Mine.—This mine is let to a party of tributers, who are working on the lode, which is 6ft. in thickness. Stoping has been carried on from the adit-level to a height of 90ft., and the lode stoped out for a length of 25ft. During last year 312 tons of quartz have been crushed, which yielded 532oz. of gold, one parcel of 54 tons yielding 148oz. There is a large body of stone in this mine which contains sulphide of silver in combination with gold, but no process has yet been adopted here for the proper treatment of this class of ore.

Kenilworth Mine.—A few miners have been employed in this mine during the last year, but the quality of the ore is such that it cannot be successfully treated at any of the present crushing-plant in the colony. The lode in this mine is 3ft. in thickness, and contains chiefly silver ore. Two parcels of ore were sold at the mine, namely, 25 tons at £23 per ton, and 5 tons at £16 per ton, which were forwarded to Europe for treatment; 11½ tons were sold to Mr. W. Littlejohn, which he intends to treat with chemicals at the Ivanhoe Battery.

Several other mines have had a few men employed in them, but the work done is chiefly of a prospective character. There has been 70 tons of quartz crushed from the Monastery Mine, which yielded 160oz. bullion; 40 tons from the Diamond Mine, which yielded 139oz.; and 20 tons of ore from the Crown Mine, have been forwarded to Europe for treatment, but the returns have not yet come to hand. Railey's crushing-battery, from which so much was expected, and to which a tramway was constructed to connect it with the mines on the field, has turned out a failure; the whole plant was recently sold, being purchased by the mortgagees for £70. The tramway, when completed, was never used for the conveyance of quartz, as the battery since then has been standing idle. There have been about forty men employed in this district during the year.

Waitekauri and Owharoa Districts.

A few claims are still working in these districts, but there is nothing like the mining population that was employed here in former years. At Owharoa the principal work done has been in the Smile of Fortune and Me and Rowe Mines. From the former mine, 200 tons of quartz and mullock have been crushed, which yielded 340oz. of gold. The lode from which this was taken is about 6ft. in width

and is formed of mullock and small leaders or veins of quartz. In carrying on the construction of an adit near the surface, this lode was met with at 60ft. in from the mouth. It has now been opened out and a winze sunk for 50ft., which still shows the lode material to be of a payable character for working. In the Me and Rowe Mine a considerable amount of prospecting has been done, and a portion of the reef stoped out, but the stone is of very low grade, 60 tons being crushed for 7½oz. of gold.

At Waitekauri there are altogether about sixteen miners employed, chiefly in the old workings, near the surface, and from small leaders and veins, which are interstratified with the country rock. There has been 950 tons of quartz crushed last year from the Waitekauri Mine, which yielded 288oz. of gold; ½ ton from the Eclipse Mine yielded 22½oz.; 10½ tons from the Star of Hope gave 26½oz.; 150 tons from the Mangakura yielded 25½oz.; 65 tons from the Welcome gave 38oz.; and ½ ton from the Young New Zealand yielding 20½oz.: making a total of 1,176½ tons, which yielded 420oz. of gold.

Tui Creek District.

Champion Company.—About three years ago an auriferous and argentiferous lode was discovered near the saddle between the Waihou Valley and Waitawheta Creek, at an elevation of about 2,200ft. above sea-level. The outcrop near the saddle was prospected to some extent without any rich ore being found, and the lode was traced on the surface for about 30 chains in a southern direction, when it was found to contain rich ore, and on getting further southward a portion of the lode showed a large percentage of galena. The lode can be traced on the surface, and is from 10ft. to 12ft in width, containing ores of lead, zinc, mercury, silver, and gold; indeed, it is one of the most heterogenous lodes I have seen in the colony. The lode has been cut through in many places on the surface, and an adit has been constructed for 150ft., near the head of a creek which falls into the Waihou River. In this adit the reef has been partially cut through, showing it to be quite as wide as found at the surface, having seams of very rich ore containing silver combined with gold. There is about 2ft. of the hanging-wall side of the lode which contains a large percentage of galena, some of the assays showing about 70 per cent., and silver at the rate of from 10oz. to 15oz. per ton. At the time the La Monte furnace was at work at the Thames some of the galena ore was purchased for £22 10s. per ton. One hundred and fifty tons was shipped to England for treatment, which realised from £11 10s. to £12 10s. per ton.

The owners of the mine have entered into arrangements with Mr. Parkes (a gentleman who has recently come from England, and who treated successfully the ore sent Home), to examine the lode and nature of the ore, with the view of erecting works here to treat it in a similar manner. There is no doubt but this is one of the finest properties in the district, when a proper method of treating of the ore is adopted. There are three other reefs or lodes in the Champion Company's ground, which show good prospects of gold and silver. Owing to the large body of ore in all these lodes, and the situation of the mine, the stone can be broken out and transported to the plant for treatment at a very cheap rate. Between 500 and 600 tons are now laying at the mine ready to send for treatment when works are erected.

Te Aroha District.

When the quartz reefs on this field were first opened it was expected that they would, when properly developed, give employment to a large population for many years; and, indeed, there was never a new field that had a better opportunity of being properly tested than this one, inasmuch that as soon as it was opened Messrs. Firth and Clarke erected one of the finest stamping-batteries in the colony, and undertook to crush the quartz at 10s. per ton. In order to enable the miners and claim-holders to avail themselves of the crushing-plant, the Piako County Council, with a subsidy of £9,000 from the Government, constructed about three miles of tramway, at a cost of nearly £19,000, to connect the principal mines with the battery. When the battery and tramway were completed, every one was under the impression that the field, opened under such favourable auspices, would give good returns to those who invested their capital, and largely increase the revenue of the county, but these expectations were not realised. First one claim gave up, and then another. At the time of my visit, in January last, there was only one claim at work.

Nothwithstanding the gloomy aspect this field presents, I have still confidence that as soon as there is a plant on the field capable of treating the ore properly many of the mines now idle will be taken up again and worked with profit. Although the crushing-battery erected by Messrs. Firth and Clarke is one of the best in the colony at the present time, it is well known that not more than 50 per cent. of the bullion is obtained by the ordinary battery process, and in many instances the percentage saved is far below this. The gold on this field is extremely fine, and it occurs in bands in the stone being disseminated through these bands in very minute atoms. Not only is it always found in finely divided particles among the quartz, but it is also associated with silver and other minerals, some of which occur in such a form as to be very refractory to treat. Indeed, there is very little free-milling ore to be found on the field.

To show the value of some of the ore from this field, when the New Find Company first commenced to work their mine the quartz gave 2oz. of gold to the ton by the ordinary battery process. The tailings were afterwards treated in berdans, and yielded almost a similar amount. They were ultimately treated in berdans a second time, and still paid for working. It will therefore be seen that a very small percentage of the bullion in the stone was obtained in the first process by the ordinary stamping-battery.

The *New Find Mine* was the only one at work at the time of my visit. It has recently been purchased from the original company by Messrs. Firth and Clarke, the proprietors of the Battery Company, for £2,000 in cash and the liabilities paid. The Battery Company have twenty-seven men employed on the mine and seven men on the tramway, the latter being leased from the county by the proprietors of the battery at a rental of £100 per annum, on condition that the charges for the

conveyance of quartz from the mines to the battery shall not exceed 2s. 6d. per truck, which is estimated to hold one ton and a third.

It may be said that the whole of the mines on the Te Aroha field are held by two companies, viz., the Battery Company and the New Era Company. The former company holds several mines, in addition to a special claim of 110 acres which was granted in March last year, on the understanding that a large company would be floated on the London market to work it. I learned when in Auckland that the terms on which a London syndicate offered to float the company could not be entertained by the Battery Company, as the large number of paid-up shares to be manipulated and the small amount of cash proposed to be given to Battery proprietors left them no option but to refuse the syndicate's offer.

There is no doubt encouragement should be given for the introduction of foreign capital to develop the mines, but if the introduction of capital is hampered with conditions—that is, if a half or a third of the capital is to be absorbed by giving it away to what is termed the promoters, in paid-up shares, for merely taking up ground and floating a company—the introduction of foreign capital under such auspices will be of very little advantage to the colony, as it will take a very rich mine to pay fair interest on the nominal capital of such a company.

Mining, like any other industry, requires to be carried on on strictly commercial principles, and not merely held as stock waiting until, what is termed by sharebrokers, a "boom" comes to dispose of the shares. This is one of the great evils in giving away a large number of paid-up shares in a company. Every effort is used by those holding them to raise the price of shares by merely making representations as to the ultimate value of the mine, and by this means dispose of their interest above its real value. In many of the mining companies formed in the colony the promoters have no intention of working the mine, their purpose being merely to make money by the sale of shares.

The proprietors of the Battery Company, now that they have mines of their own, which are capable of supplying the battery with quartz, do not intend to crush for the public. They have, since my former visit, made several alterations in the battery-house—namely, the berdans are now all shifted to the adjoining buildings, where there are now altogether fifty-two berdans erected, and the tailings from the stamping-battery are run into a shoot and carried away to be treated by the berdan-plant. In the same building where the berdans are placed there is also a revolving-furnace, erected on the White-Howell principle, which is capable of roasting about 8 tons of ore per day. The furnace is a cast-iron cylinder 4ft. in diameter inside and 24ft. long. This is set at an inclination of 8in. to 24ft., or 1 in 36, and revolves at the rate of four revolutions per minute. The inside of the cylinder is lined with fire-bricks, and it takes the ore twenty-one minutes from the time that it enters the upper end of the cylinder until it is discharged at the lower end. The furnace is fed by an elevator, which lifts the tailings from the level of the floor into a shoot leading into the furnace. The fire enters the discharge end of the cylinder, and the fumes from the roasted ore are passed through a series of condensing-chambers before reaching the chimney. When the ore is put into the cylinder in a very dry state a jet of steam is used in the condensing-chambers to assist in the condensation of the fumes, but if the ore or tailings be damp when fed into the cylinder, the moisture in them has the same effect on the condensation as a jet of steam.

From what I could learn from the manager, they have not yet got into the proper system of roasting, but more in the way of making experiments to get the best effects produced. As far as the experiments had been conducted, it was found that about ½ per cent. of salt and 5lb. of lime to the ton of roasted ore was the best mixture. They found a large percentage of salt carried away the gold. The manager showed me several tests he had made with the tailings since the revolving-furnace has been erected. It must be remembered that in using the word "ore" in this instance it means the tailings from the stamping-battery.

Experiments were made with these tailings, with the following results: 10 tons were treated raw in the berdans, and yielded 30 per cent. of their assay value; 10 tons were roasted in the revolving-cylinder without lime or salt, and yielded 46 per cent.; and 10 tons were roasted with lime and salt, and yielded 62 per cent of the assay value. This shows the difference between raw ore and ore roasted with lime and salt to be 32 per cent.; the roasted ore giving more than double the yield obtained from the treatment of the raw ore in berdans. In some of the returns got from roasted ore the manager informed me he got as much as 95 per cent. of its assay value.

The furnace requires about 2½ horse-power to work it, and it takes one-third of a ton of fire-wood to roast a ton of ore. The erection of this furnace is a step in the right direction for the proper treatment of the ores met with in this district, and it has been proved by actual demonstration that it is the means of a much larger percentage of the bullion in the ore being obtained. Still, it must be borne in mind that it has only yet been tried on the tailings coming from the stamping-battery, or after the ore has been partially treated. To get the full effect of roasting the ore, it will have to be crushed in a dry state before roasting, or in other words, so long as ores containing a large percentage of sulphur and arsenic are crushed in a wet state, these mineral products will carry away a large proportion of the bullion along with them. Hence, in order to get the full benefit of the roasting-furnace, the ore should be crushed dry and afterwards roasted before final treatment. It then becomes a question whether leaching or amalgamation is the most economical method of extracting the precious metals. One thing is certain, that the character of the gold in this district, being in so finely a divided state, is specially adapted for the lixiviation process.

Recently Messrs. Firth and Clark disposed of the greater part of their interest in the mines and battery to a gentleman who has been associated with the silver mines in New South Wales since they were first discovered, and who intends floating a large company to carry on operations on a more extensive scale.

New Era Company.—This company stands in the same position as it did at the end of the previous year. Mr. Ferguson, who went to England to float a company to work the mine on a large scale, is still at Home, and there is no word yet whether he is successful in his mission or not.

Waitoa New Find.—Considerable excitement was caused by Mr. J. B. Smith reporting the discovery of gold in a volcanic deposit—somewhat similar in character to that recently ejected from Rotomahana—which covers the surface of a large area in the Waihou Valley to a great depth. It is certainly a strange deposit in which to find a large percentage of gold; even scientific men like Captain Hutton, Mr. Pond, and Sir James Hector were for a time deceived. The samples of stuff sent for analysis contained gold and silver to such an extent as to make those who study the character of the rocks where the different metals are found suggest some theory to coincide with the circumstances. Sir James Hector thought that the gold might come from some large auriferous-quartz reef which at one time stood up on the plain and had become decomposed and washed away for a certain distance on each side, forming an auriferous deposit. A company was formed to work the ground, and 1,000 acres of freehold land purchased from the proprietor, Mr. J. B. Smith, and shares went up to double their nominal value. This, however, did not last long. Mr. Whitaker, of the Bank of New Zealand, Auckland, and Mr. Pond, analytical chemist, on examining the material through a microscope, observed the gold twisted in a spiral form as if it had been done by a file. Careful attention was then paid to the character of the stuff sent for assay, and it soon became apparent that the gold had been fraudulently mixed with the material. A small plant was erected on the ground to test the deposit on a large scale, but, as was anticipated, gold could not be found to pay for working, and I have since heard that operations are suspended.

MIDDLE ISLAND.

Reefton District.

Although this district has not produced so much gold last year as it did the previous one, yet the mining-claims appear to be in a more healthy condition. The gold-producing claims were formerly confined to a very few, but the discoveries made during last year show a new district between Oriental Creek and Merijig's that is likely to have several gold-producing claims. The Big River District also promises to turn out fairly, so that on the whole there is a prospect of a good return being obtained from the mines during the present year.

Keep-It-Dark Company.—This was formerly one of the best gold-producing mines in the district. During last year the second level was worked out, and stoping was commenced on No. 3 Level, which is 500ft. below the surface at the mouth of the shaft. The east and west lode was cut, but the north lode was not found until very recently. A new block of stone was struck, which was at the time taken for the north lode, but this block only went up a few feet above the level and wedged out. However, it forms a strong lode underfoot and is likely to prove a good find when the next level is opened out. During the year 1887 there was 7,726 tons of stone crushed, which yielded 3,392oz. of gold, representing a value of £13,248. The dividends paid last year amounted to £6,000. This makes the total amount of dividends paid by this company £88,166 13s. 4d. There are 20,000 shares in the company, of which 10s. per share is declared paid up, and 2s 7½d. per share actually paid in calls, the balance of uncalled capital amounting to £7,373. This mine has been working for the last fourteen years. During that time 88,589 tons of stone has been crushed, which yielded 48,869oz. of gold, representing a value of £189,933.

Wealth of Nations.—This company has been doing nothing but prospecting for the last two years. They have constructed an adit-level into the hill for 800ft., at the end of which a shaft is sunk to a depth of 200ft. below the adit-level, and another level opened out at the bottom of the shaft. A trace of a reef has been found, but nothing more. The company intend to follow up this trace to see if it will lead on to a body of stone. They have erected a battery of berdans, and are now treating their old tailings, which yield about 10dwt. of gold per ton. The winding from the shaft at the end of the adit-level is done by a reversible overshot water-wheel fixed outside the mouth of the adit-level, having the gear fixed inside at the mouth of the shaft, whereby the man can, by means of different levers and breaks, stop the cage at any point in the shaft at a moment's notice.

Nil Desperandum Company.—This company has been carrying on mining operations since April, 1877, and has spent £9,671 of its capital in opening out and prospecting the mine; having, during a period of eleven years, only paid £144 in dividends. During the last year, ending the 1st March, the expenditure of carrying on their operations was £3,055, while the value of gold obtained was only £1,035. The amount of calls paid during last year was £1,587. An adit has been constructed into the hill for 300ft., and at the end of this adit a shaft is being sunk to prospect the mine at a greater depth.

Pandora, Keep It Dark, and South Wealth of Nations Companies.—These three companies have combined to sink a shaft near the boundaries of their claims which all adjoin. This shaft is sunk to a depth of 280ft., and adit-levels opened out, one at 178ft., and another near the bottom of the shaft. The reef is about 2ft. 6in. in thickness, with well-defined walls, and shows gold in several places very freely. Before sinking the shaft a winze was sunk down to a depth of 176ft., 100ft. of which was on the reef, which averaged here from 12in. to 20in. in thickness. From this winze, 78 tons of stone were crushed, yielding 102oz. of gold, representing a value of £395, which was on an average 26dwt. of gold per ton. The shaft is sunk on the boundary of the Keep It Dark No. 2 and Pandora Companies mining leases, the South Wealth of Nations Company's ground being a little to one side of the shaft. The Pandora Company was formed in May, 1887, and from that date to the 21st of January last the expenditure on the mine and plant has been £1,644. The amount of calls paid is £1,281; in addition to this £295 was paid before registration; and the value of gold obtained £395. The South Wealth of Nations Company was formed in June, 1887, and since that date the amount of calls paid has been £750, and the expenditure £464. The ground held by the Keep It Dark No. 2 Company was prospected and partially worked on and near the surface two years ago, when a narrow quartz lode was discovered, containing

gold of a payable character, but no work of any consequence was done until a commencement was made to sink the shaft conjointly with the other companies. According to the statement of affairs published by the manager in the *New Zealand Gazette* No. 10, of the 9th February last, the company is formed in 24,000 shares, with a nominal capital of £12,000, and the value of scrip given to shareholders on which no cash was paid was 10s. This represents the whole nominal capital of the company is declared paid up. The statement is, to say the least of it, confused and misleading, and appears to be unreliable, inasmuch that the same statement shows in another place that the paid-up value of scrip given to shareholders is nil. "The Mining Companies Act, 1886," section 32, has evidently not been strictly complied with in this instance; and although the prospects of the mine look very promising, statements of this description have a bad effect on the mining industry, and tend to cause mining companies to be held in disrepute.

Inkerman Company.—This company was formed in 1876, and since that date has paid up £13,633 of its capital, which is £20,000. They erected a battery of thirty heads of stamps and several berdans to work a large auriferous-quartz lode, which was over 20ft. wide in places; but the stone proved of too low grade to pay. During last year prospecting operations were carried on, and now they have come on what is considered a payable lode, which is taken to be the same line of reef as that on which the Happy Valley, Sir Francis Drake, and Scotia Companies are working.

Globe Company.—This company was formed in 1882 with a capital of £18,000, of which £14,775 has been actually paid up. The company continued mining operations for about three years, but the reef they were then working was of too low grade to pay. Shares were offered for nothing to any one who would take them; but in September, 1886, a new lode was discovered, which promised to recoup the shareholders for the whole of the money they had invested. Since this discovery dividends to the amount of £9,450 have been paid.

This company have sunk a new shaft on the face of the hill to a depth of 117ft. below the level that has recently been stoped out, and the reef cut at this level, which looks very promising. The average thickness of the lode above the adit-level was about 10ft., and the stone averaged about 14dwt. of gold per ton. There is an aeriel tramway which conveys the quartz from the mine to the crushing-battery at the Inangahua River, a distance of 90 chains. The winding in the shaft is done from an overshot-wheel erected alongside the crushing-battery, the power being communicated by a steel-wire rope to the winding-gear at the shaft, which is about one mile and a half distant from the place where the water-wheel is erected. The winding-rope passes over a pulley about 12ft. in diameter, fixed on to an intermediate shaft, which works the winding-gear by means of pinions, clutches, and brakes.

Progress Company.—This company is working on the continuation of the new reef which the Globe Company discovered. Stoping out is being carried on from No. 1 Level, and another level is in course of construction from Devil's Creek. This company was formed in November, 1886, and since that date the capital actually paid up is £839, while dividends to the extent of £2,400 have been declared. This mine promises to be dividend paying for a considerable time.

Sir Francis Drake Company.—This company is working on what is considered as the continuation of the Inkerman Reef. The reef was found on the surface, and an adit-level has been driven in from the face of the hill for 60ft., and cut the reef, which was about 8ft. in thickness. At this place a winze was sunk for some distance on the reef, which showed a fair amount of gold in the stone. A lower level was then constructed, and the reef intersected at 250ft. from the mouth, showing fair prospects of gold. This company are so satisfied with the prospects of their mine that they are erecting a battery of ten heads of stamps to crush the stone. The company was formed in July last; but the statement of affairs published by the manager in the *Gazette* of the 9th February last is so confusing and misleading that it becomes a question whether this company has any available capital or not. The statement is certainly not strictly made in accordance with section 32 of "The Mining Companies Act, 1886."

Happy Valley Company.—This company was formed in 1882, and has been from time to time prospecting the ground adjoining the Sir Francis Drake Company's claim. They obtained some rich specimens from quartz leaders in a portion of the ground, but never found a payable reef until recently, when they commenced to sink on a large quartz lode, which was cropping out of the side of the creek, and in this reef they have got what is believed to be payable stone. The amount of capital paid up to the end of December last was £1,435.

Gallant Company.—This company is only recently formed, and has taken up ground on the north side of the Sir Francis Drake Company's boundary. The reef is exposed on the surface almost across this company's ground. It is 3ft. in thickness, and shows a fair prospect of gold in many places.

Scotia Company.—This company's ground is on the northern boundary of the Gallant claim. The company has only recently been formed, and the only work yet done is of a prospecting character. Adit-levels are being constructed into the face of the range, and I have recently been informed that they have cut the reef, which shows a little gold distributed through the stone.

Big River Extended Company.—This company was formed in 1882, and has principally been prospecting the ground ever since. The prospects of this mine heretofore have been of a variable character. Before the road from Reefton to this mine was completed it was looked on as one of the mos tpromising mines in the field, but as soon as a crushing-battery was erected it told a different tale. The reef that they had been prospecting and working on did not prove payable; but recently a shot of gold has been discovered which is likely to give good returns. This company has a nominal capital of £24,000, of which £12,000 is declared paid up, and £7,115 actually paid up in cash.

Venus Extended.—This company was formed in 1885 with a nominal capital of £24,000, of which £12,000 was declared paid up, £2,485 being actually paid up in cash. The total amount of dividends paid has been £2,100. The ground that this company holds was one of the first

mining leases granted in the Reefton District, but very little work was done except of a prospecting character. An adit-level was constructed into the hill for about 800ft. in length without finding any payable lode. After the present company took up the ground they extended this adit-level for 22ft., and cut through a reef 20in. in thickness, which showed gold pretty freely. The stone above this level is now stoped out, a lower adit-level constructed, and a commencement made to open out the stopes. This level is now connected with an uprise to the former level, and the stone, which is about 2ft. in thickness, promises to give fully better returns than it did on the upper level. The stone obtained from 105ft. of the uprise yielded 110oz. of gold. Previous to opening up this level 4,000 tons of quartz were crushed, which yielded 2,535oz. of gold, representing a value of £9,823. The mine is connected with a crushing-battery—which was purchased from the late Energetic Company—by an aeriel tramway. Everything is now in good working order, and the mine opened out, so that good returns may be expected during the present year.

Inglewood Extended Company.—This company was formed in 1885, and up to the 31st December last has expended £16,931, and obtained gold to the value of £11,030. During the last year they have been constructing an adit-level, which is now in for a distance of 1,352ft., and still requires to be extended for about 90ft. further before it will cut the reef. The amount of dead work yet to be done by this company before stoping out commences will yet take some months to complete.

Boatman's District.

Welcome Company.—This company was formed in 1875, and has been steadily at work since that date. The nominal capital of the company is £15,000, of which £7,500 is declared paid up, and £3,750 has been actually paid in cash. The total expenditure on plant, machinery, and carrying on mining operations, has been £133,961; while the value of the gold obtained amounts to £229,908, of which £110,250 was paid in dividends. During the last year this mine has not maintained its former reputation of being a steady dividend-paying mine; but a great deal of dead work had to be done in opening out a lower level, which is about 430ft. below the main adit-level coming in from the face of the hill. This No. 9, or lowest adit, was expected, according to survey, to cut the reef at 225ft. from the shaft, but failed to do so. A connection was then made with a winze, which was sunk down for 80ft. below No. 8 Level, and the reef opened out from this point 40ft. above the No. 9 Adit-level. The reef here is very small and broken, and, although carrying fair gold, is not of a payable character. There is still 80ft. of the lode overhead which may possibly pay for working, but no doubt a deal of prospecting will have to be done before this mine will pay as handsome dividends as formerly.

Hopeful Extended Company.—This company was formed in 1882, and since that date has expended in carrying on mining operations £8,152, the value of gold obtained being £5,744. The main lode, which paid the former company who held this ground so well, is almost worked out, and for the last two years the mine has been let on tribute. However, during last year the tributers had to give it up, as they could not make it pay.

Fiery Cross Company.—This company was formed in 1879, with a nominal subscribed capital of £20,600, of which £12,000 was declared paid up, and £8,600 actually paid in cash, £11,700 being declared in dividends. The shaft has now been sunk down to a depth of 600 feet, a new level constructed, and a commencement made to stope out the lode. There is a prospect of this being a dividend-paying company during the present year.

Just in Time Company.—This company was formed in 1872, and has been working the mine ever since that date. The nominal capital of the company is £28,000, of which £9,762 has been actually paid up, and £17,167 paid in dividends. This company, in conjunction with the Reform, sunk a shaft near the boundary of their claims, which adjoin each other. The shaft is sunk to a depth of 200ft., and the workings are carried on from the 85ft. level, and also from the level at the bottom of the shaft. The stone is of fair quality, and the reef averages about 2ft. in thickness.

Reform Company.—This company was formed in 1885, with a nominal capital of £12,000, of which amount £1,200 was declared paid up, and nearly £3,000 actually paid for plant and towards opening out the mine. The mine is let on tribute, but the stone has not proved of a payable character.

South Hopeful Company.—This company was formed in 1877, with a nominal capital of £20,000, of which £10,000 is declared paid up, and £3,470 actually paid in calls. The mine is situated on the south side of Boatman's Creek, and although prospecting has been carried on for a number of years, the company has not been successful in finding a payable lode until recently, when a lode was discovered a few feet on one side of the old main adit-level constructed several years ago for a short distance into the hill. A winze has been sunk on this lode for about 30ft., and the reef, which is about 12in. in thickness, shows a fair amount of gold.

Lone Star Company.—This company was formed in 1886, with a nominal capital of £24,000, of which £12,000 has been declared paid up, and calls paid to the extent of £852 to open up the mine. The total expenditure to the 15th September last was £876. An adit-level has been constructed into the hill for 230ft. with the object of cutting the reef, but this is now abandoned. Subsequently a trench has been cut on the surface and the reef discovered. A winze has been sunk on the lode to a depth of 83ft., and about 50 tons of quartz taken from it, which is estimated to yield 1½oz. of gold to the ton. A level has been constructed from the bottom of the winze for about 40ft., which shows the lode to average about 18in. in thickness. This company intends to construct an aeriel tramway from the mine to one of the crushing-batteries on Boatman's Creek.

Eureka Company.—This company was formed in 1883, with a nominal capital of £24,000, of which £12,000 is declared paid up, and £6,690 actually paid in calls to construct the inc lined tunnel and open out the mine. The company expect to get the continuation of the Welcome Reef in their ground, and have constructed in an inclined tunnel on a grade of 1 in 3 for over 2,000ft. without cutting any stone. An adit-level has been constructed for 600ft. from this inclined tunnel, and a deal of prospecting has been done, but, as yet, no payable body of stone has been met with.

Homeward Bound Company.—This company was formed in 1883 with a capital of £24,000, of which £12,000 is declared paid up, and £4,118 paid in calls to prospect and open out the mine. Some four years ago this company, in conjunction with six others, constructed a low-level tunnel, but were not successful in finding any payable stone. They are now sinking a shaft in this tunnel with the view of cutting the Welcome reef in their ground. It still seems a question of doubt whether the Welcome reef will go through this company's ground or the Eureka; but if it go through this company's ground, the shaft which is now down 120ft. will yet have to be sunk nearly another 500ft. before the reef will be cut. The winding is done by an engine driven by compressed air, which is supplied from the compressor fixed at the mouth of the tunnel

Specimen Hill United Company.—This company was formed in 1884, with a capital of £20,000, of which £10,000 is declared paid up, and about £6,500 paid in calls, which have been expended on plant and prospecting the mine. The lode of auriferous quartz that is found in this mine is of a very loose and broken character, and so far has not paid for working. Prospecting is still being carried on, but no stone of any account has yet been found.

Owen District

Gold has been obtained in the bed of the Owen River for many years, but it was not until about two years ago that auriferous-quartz reefs were discovered. Since then different mining companies have taken up ground and commenced to work the reefs. The mining companies that have done any work are the Enterprise, Zealandia, Golden Crown, Wakatu, and Bulmer Creek.

The Owen reefs are situated from seven to nine miles up the Owen River from the Nelson–Lyell Road. They occur in the form of segregated veins or lodes following the foliation of the surrounding strata. The claims that have been worked are those in which gold was discovered on the surface in the outcrop of the lode. The character of the lodes in the several claims are similar to each other. They contain a very large percentage of arsenic and sulphur; and, besides, the gold is alloyed with bismuth, which makes it difficult to save by the ordinary crushing-battery process. On the caps or outcrops of the lodes the pyrites found at greater depths are oxidized, and the result is that very good prospects can be got on the outcrops; but as soon as the sulphides appear, very little gold can be obtained. The bismuth also being alloyed with the gold, sickens the quicksilver and renders the present method of treatment almost useless. It would almost be impossible for more than one-fourth of the gold in the stone to be saved by the present process of treating this refractory ore.

Enterprise Company's Mine.—This company's ground is situated on the western side of the main branch of the Owen River, and about seven miles distant from the junction of the Owen and Buller Rivers. The outcrop of the reef is about 250ft. above the level of the river, on a narrow ridge, which has every appearance of being a portion of a large slip from the main range; but, be that as it may, the surrounding country is greatly broken and tossed about. A little to the northward and westward of this company's mine the granite makes its appearance, which possibly may account for the broken appearance of the surroundings. At the time when the granite was forced up it would naturally bend up and break the surrounding rock, so that slips would be very liable to take place. Where the reef crops out on the surface the gold is got in a free state. In all the pieces I broke no gold could be discerned; but when the veins in the stone containing the oxide of iron were crushed in a mortar a fair prospect could be obtained. The reef, when first found, was about 30ft. in width, having alternating bands of mullock and quartz; but, as previously stated, the reefs are merely segregated veins occurring in different portions of the ground. There are other lodes higher up the range which have never been thoroughly prospected, although all of them have been proved to contain gold.

On my first visit to this district, at the end of June last, from what I saw of the prospects on the cap of the reef they would average from 6dwt. to 10dwt. per ton; but at that time there was no work done to test it at any depth from the surface. On my visit in March last the mine presented quite a different appearance: levels have been constructed at different depths, and although there is a very large body of quartz, the amount of sulphur and arsenic in the stone renders it unfit to be treated by quicksilver in its raw state. Two levels have been constructed, and stoping out was commenced in the upper level; but in the lower level the reef was merely cut, and scarcely any prospect of gold was got in the stone.

This company has erected 10 heads of stamps and four berdans, which are driven by a Pelton hurdy-gurdy water-wheel; but the tailings from the stamps were considered of too poor a character to treat with the berdans; consequently these were not used. At the time of my visit 720 tons had been crushed, which yielded about 72oz. of retorted gold, or only about 2dwt. of gold per ton.

Wakatu Company's Mine.—This company's mine is situated about half a mile up the Bulmer Creek, and about two miles further up the Owen River than the Enterprise Company's workings. The quartz is of similar character to that found in the Enterprise Company's ground, being extremely friable and full of oxide of iron veins near the outcrop, but contains sulphur and arsenic as the reef goes down. There are three lodes or segregated veins in this company's workings only a short distance apart; but in constructing low adit-levels the stone either cuts out or gets very poor. This company has gone to considerable outlay and erected an aerial tramway to connect the mine with the public crushing-battery, and have everything in good working order; but the quality of the stone with the present method of treatment will never pay the expense of working the mine. At the time of my visit this company had been crushing stone for four weeks, and, on clearing up, it did not yield 4dwt. of gold per ton.

Bulmer Company's Mine.—This mine adjoins the Wakatu Company's ground on the upper side of the range. The lowest portion of the company's ground is about 2,000ft. above sea-level. Very little work has yet been done on this claim beyond fossicking on and near the surface; still, sufficient has been done to show that the character of the lodes and surrounding country is all of the same nature, and greatly broken up. There is about 100 tons of stone on the surface, stacked at different

places, which the company intend to crush at the public battery as soon as the Wakatu Company's stone is crushed; but from what I saw of the quartz nothing great may be expected from it.

Zealandia Company's Mine.—This company's workings are in a blind gully on the side of the range northwards of the main branch of the Owen River, and about half way between the Enterprise and Wakatu Company's ground. The reef was first discovered cropping out in the gully, and some fair specimens, containing gold, were obtained. The company then drove an adit-level about 80ft. under the outcrop without cutting the lode, thus showing that it had cut out in this short distance. Even were payable quartz found in this ground the company would have to go to considerable expense to construct a tramway round the sideling to the public crushing-battery before they could get their stone properly tested.

Golden Crown Company's Mine.—This mine is situated on the opposite side of the main branch of the Owen River from any of the other company's mines. The reef was discovered at a high elevation cropping out on the surface, and like all the other claims, the prospects from the outcrop were very promising, but on a lower level being constructed it was found that the lode or vein had pinched out. Very little work has been done in either this or the Zealandia Company's mine.

The quartz reefs or segregated veins of quartz occurring in this district contain a little gold, which near the outcrop is of a free character, being found in reddish veins or bands of decomposed iron pyrites; but on sinking down a short distance into the reef large quantities of sulphur and arsenic are met with, which, in their raw state, would so sicken the quicksilver that it would scarcely have any affinity for gold. From what is known here of the proper process to treat ore of this character it requires roasting before it can be successfully treated with mercury to save the gold it contains.

In this district assays require to be carefully made from time to time in order to know the quantity of gold that is in the stone; and having ascertained that, and the metals associated with the gold, the question is, what is the mode of treatment which will pay best for manipulating the ore? If it is low grade and refractory it will not pay the expense of working. The Owen District is one well deserving of being prospected, as it is one where silver ores might be found; but as far as the quartz reefs at present being worked are concerned, there is no hope of them paying working expenses with the present method of treatment. It is a field where no doubt a deal of prospecting will be carried on, but it is also one which the largest portion of the present mining population will leave for a time.

Since my visit to this district galena lodes have been found, some of which contain a fair percentage of silver, and a number of licensed holdings have been applied for along the line of these lodes with the view of working the galena only for the amount of silver it contains. These lodes occur near the junction of the limestone and slate, and extend through a belt of country between the Owen and Wangapeka. Galena was first found in the Wangapeka District in 1870. Specimens were forwarded to Nelson at that time for analysis, and found to contain such a percentage of silver that a company was formed to work the lode.

Mr. J. Parkes, of the Geological Department, examined this portion of the country last summer, and states that the work done by the company formed in Nelson in 1870 consisted of making two small excavations, one of which shows a quartz-lode about 14in. wide, containing small nests of galena and iron pyrites. The other excavation showed two well-defined leaders of quartz, the largest of which was about 6in. in width, and contained a small irregular seam of galena, sometimes pinching out to the thickness of a thread and afterwards widening out again.

The following is the result of several assays made at the Colonial Laboratory by Mr. Skey, showing the amount of silver per ton in the galena ore found in the Owen and Wangapeka Districts:—

Schedule of Ores from the Owen and Wangapeka, lately assayed for Silver.

Lot No.	Contributor.	Locality.	Silver per Ton. Oz.	dwt.	gr.
4820(1)	H. H. Travers	Wangapeka	8	10	20
4820(2)	"	"	221	4	11
4846	"	"	8	0	0
4914	J. Grimmond, M.H.R.	Owen	7	4	0
4906	J. Clark	"	13	12	0
4921	R. Reeves, M.H.R.	"	51	13	0
4895	C. Longhurst	"	50	6	0
4893	R. Reeves, M.M.R.	"	9	10	6
4910	H. Bannehr	"	14	2	0
4945(1)	T. Dwan	"	91	14	8
4945(2)	"	"	116	18	4

It has to be borne in mind that, although some of these assays show a fair percentage of silver in the ore, the veins of galena yet found are very narrow; and in choosing pieces for analysis, it is well known that nothing but the best samples are sent. It is, however, a formation where galena and silver ore are likely to be found; but there is nothing yet discovered that leads me to suppose any of the lodes can be worked at a profit.

Lyell District.

United Alpine Company.—This company was formed in 1883 with a nominal subscribed capital of £33,733, of which £16,000 is declared paid up, and £17,733 paid in calls, the company having paid £39,667 in dividends. The lode that is being blocked out from No. 6 Level has got very much broken up, and it contains a large amount of very low-grade ore. There was 2,837 tons of quartz taken out from this level from the 6th April to the 4th October last, which yielded 1,241oz. of gold, representing a value of £4,894; and during the month of October 515 tons were crushed, from which 670oz. of amalgam was obtained. This would be equal to about 220oz. of gold, or £853. This makes the total value of the gold £5,747, and the expenditure on the working of the mine during this period

was £6,025. Of this amount £669 was for the construction of No. 7 or a lower level, and £957 for electric and air-compressing machinery. Deducting the cost of the new level and the value of the new machinery—namely, £1,626 — it leaves the expenditure on mining operations at £4,399, which still shows that the stone from No. 6 Level can be worked at a small profit. The lower adit-level is now constructed for about 1,100ft., but it is expected to take yet about twelve months before it will strike the reef. A great delay has been occasioned in constructing this level, owing to the contract for the erection of the electrical machinery not being completed within the contract time; and even when it was erected the machinery would not drive the compressor, owing either to faulty construction, or the mechanician who had the superintendence of its erection not having sufficient knowledge to erect it properly, which has not only proved a great loss to this company, but has had a bad effect on the introduction of electric machinery being employed in connection with mining.

Tyrconnel Company.—This company was formed in 1882, with a nominal capital of £24,000, of which £12,000 is declared paid up, and about £2,000 paid in calls. The mine is let on tribute to a party of six men, who are working on a small leader or vein near the surface.

Lyell Creek Extended Company.—This company was formed in 1881, with a nominal capital of £24,000, of which £12,000 is declared paid up, and £6,663 paid in calls, which has been expended in constructing a low adit-level. This company are constructing a low adit-level to cut the Alpine reef. They are now in over 2,100ft., but some distance will yet have to be driven before the reef is cut.

The other companies at Lyell are merely prospecting, and some of them in the New Creek locality may be said to have ceased operations, as no work has been done for a considerable time.

Westport District.

Great Republic Company.—This company has been working for several years at Waimangaroa. There is no solid compact body of stone, but mere loose rubble blocks. Some of the lode stuff contains a fair percentage of gold, but no lode having a permanent appearance has yet been met with. However, this company have managed to pay £3,800 in dividends.

Mokihinui Company.—The whole of the quartz companies at the Mokihinui reefs have suspended operations, and the proprietors are trying to float a large company in London to work all the mines. The only company in this district that ever paid dividends was the Red Queen. This company paid £5,284 in calls, and declared dividends to the extent of £2,400. Taking the whole of the companies in this locality the total expenditure amounts to £10,823.

This is a district in which the reefs occur in segregated veins following the bedding or foliation of the strata, and in some of them the surrounding country rock is very hard, so that there is a great probability of the lodes pinching entirely out. It is a district where the indications are not favourable for the existence of permanent lodes.

Fairdown Gold-mining Company.—This company has taken up as a special claim containing fifty-three acres of ground on the Pakihi, at the foot of the Mount Rochfort Range, about seven miles from Westport, and is working it on the principle of what is known as Perry's hydraulic-sluicing process. The water is lifted out of the Fairdown and Wareatea Creeks, and conveyed down the range for 20 chains in wrought-iron pipes, the total head of water being 260ft. The first 17 chains of pipes are 15in., and the last 3 chains 10in. in diameter, made of 12 B.W.G. iron, single rivetted, in lengths of 17ft. 3in., each having a cast-iron flange on one end and a telescopic joint on the other. The latter joints are stepped into each other and held tightly together with two screw-bolts, which go through lugs of wrought iron rivetted to the pipe. The elevating-pipe is 15in. in diameter, and the total distance the material is lifted is about 36ft.

The ground is composed of beach-wash and black-sand leads, containing fine gold. It is evident that the ocean covered the whole of the Pakihi at one time, and that the waves have formed a beach at the foot of the mountain-range, which is now about two miles inland. This lead was partially worked about seventeen years ago, and some very rich patches of gold were got; but the ground became too deep and wet to work in the ordinary manner, the fall being too little to admit of a tail-race being constructed to sluice it. The company have done but little work yet, and the boxes which they have for washing are not suitable for saving the character of gold found in beach leads. The washing-boxes are 3ft. wide paved in the bottom, and set on an inclination or grade of 3ft. 6½in. to 100ft.; but the large body of water and material that is lifted into these boxes does not allow the fine scaly gold to settle in the bottom, but carries it away with the stream. However, I was informed that there was sufficient gold saved to show that the ground was payable for working. At the time of my visit there was not sufficient water in the creeks to carry on sluicing operations; but the company intended to commence working as soon as water was available.

The nozzle of the hydraulic-pipe which is used to sluice the material into the well is of new construction. There are three vanes or feathers projecting inside the taper pipe at equal distances round the circumference; each of these vanes project for about 1¾in. inside, and are about $\frac{3}{16}$in. in thickness. The brass mouthpiece is then screwed on, so that these vanes are not observed unless the nozzle is carefully examined. The improvement claimed for these vanes is that the water is delivered through the nozzle in a solid form. If this is accomplished it will be a valuable improvement, especially where there is cemented ground to be broken up, as the water striking the face and cemented material in a solid body will do considerably more work than when the water is broken, as is generally the case, destroying the effective force of the water.

Beach-workings.—There are several parties of miners at work on the beaches between Westport and Ngakawau, who are making fair wages. Near the mouth of the Waimangaroa River Messrs. Kincaid and McQueen, of Dunedin, and party have taken up ground and intend to work it by means of a dredge. They thoroughly prospected the ground by a series of bore-holes and were well satisfied with the prospects obtained. During the last year a rush took place near the mouth

of the Mokihinui River on the old lead, which was worked for a certain distance and then lost many years ago. This lead was again discovered, and some of the parties have got very fair claims. I was informed, when in this district, that there is a small quantity of osmiridium found along with the gold, but no samples of this were obtainable.

Charleston.—The alluvial workings at Charleston still continue to support a considerable population, but the ground is gradually getting worked out. However, now that the extension of the Argyle Water-race is completed there will be a considerable amount of new ground opened on the back lead, which it is considered will pay good wages for working. It is astonishing the amount of gold that is still found in the bed of the creek. People place wide boxes here, covering the bottom of them with cocoanut-matting, and allow the water and sediment that is flowing in the creek to pass over them. These require no attention beyond washing the matting occasionally. Some men make really good wages by this means. There are still a number of men working on the beach north of Charleston. The most of them have small areas of land cultivated, and when they cannot work profitably on the beach they employ the spare time on their land. Beach-workings require a man to be on the spot, as the action of the waves is continually shifting the sand every tide. One tide may cut away the light sand and material and leave the black iron-sand and gold in a thin layer on the surface, and the next tide may cover it entirely with a heavy deposit of worthless sand. If the men can get a few weeks' work when the beach is well cut away they can earn good wages, and sometimes get sufficient to keep them for twelve months.

Croninville.—There are a few claims here that give good returns, but the quantity of water that can be brought on to the field is very limited. There seems to be a large area of auriferous ground here if there was water available for working it.

Addison's Flat.—This place maintains its population, and is likely to do so yet for a considerable time. The workings are carried on here in a far more extensive manner than they were a few years ago, and some of the claims are paying very well for working. The general principle on which the claims are worked here is by having a drainage tail-race, which allows the drift to be washed in the bottom of the paddock, and the tailings hauled afterwards up an inclined tramway by means of a water-balance and stacked on the surface. Very rich gold was got here in the early days, and one of the rich leads got into deep, wet ground, which has never yet been worked. Many years ago a tail-race was constructed for a long distance to drain this ground, but after it was completed it was found to be several feet too shallow to be effective, and consequently the scheme was abandoned. Recently this ground has been again taken up, and from what I could learn when in this district, it is the intention to try to float a large company on the English market to work it. Several special claims have been granted last year on Addison's Flat, and the prospects of the place on the whole are very encouraging.

Kumara District.

This is the largest mining centre in the colony where hydraulic-sluicing operations have been carried on. It was first opened in 1876, but for several years, owing to the limited supply of water on the field, the workings were to a great extent confined to tunnelling, sinking, and driving; but on the completion of the water-supply and sludge-channel, which was constructed by Government, the claims were opened out in a face, and the whole of the fine material removed by water. The large stones of which the wash-drift is full are placed in trucks, and hauled up an incline by water-power, and stacked on the ground.

The places where fresh claims were opened out for the purpose of being worked on this principle are getting pretty well washed away, where they are in close proximity to the sludge-channel. However, there is a great deal of ground yet that will pay for working. Recently several claims have been opened out on a large flat known as Nardor Flat, which promises to give good returns. Some of these come close to the main Hokitika–Greymouth Road, between Kumara and the Teremakau Bridge ; indeed, the extent of auriferous-wash drifts in this district is not yet known.

During last year the settlers who have freehold land on the bank of the Teremakau River took steps to stop the miners from working, on the ground that the tailings from the claims were raising the bed of the river and damaging their lands. This now will be obviated by the river being declared a tailings-channel from the second day of August next.

There is no doubt there is a great deal of poor auriferous ground on this field, but there is also a large area that will pay well for working and take many years to work out. It is a field which gives employment to a large mining population, and, notwithstanding the cry of the unemployed, any one willing to work here can always earn sufficient for a livelihood ; indeed, it may truly be said that extreme poverty is unknown on any of the alluvial goldfields in the colony.

Waimea District.

This district still maintains a good population, and, although alluvial mining has been carried on here since 1865, there is still a great deal of auriferous ground that will pay small wages for working. The principal method of working here is by hydraulic sluicing, but in some instances tunnelling and driving is resorted too.

Wheel of Fortune Company.—This company was formed in 1886, with a subscribed capital of £5,052, of which £3,000 has been expended on opening up their claim and on machinery. Their claim, consisting of twenty-eight acres, is situate on Ballarat Hill, but it is too deep to work on the ordinary hydraulic system. A long tail-race tunnel from Waimea Creek has been constructed for the purpose of carrying away the tail- and drainage-water, but sufficient fall could not be obtained to use this tail-race to carry away the tailings. They have therefore adopted a new system of working. A paddock has been sunk to about a depth of about 20ft. into the reef below the wash-drift, and timbered up. At each side of this paddock large hoppers are constructed, having a door and chute at the bottom. The gravel and wash-drift are sluiced into these hoppers by a hydraulic nozzle. At one end of the hopper there is an outlet for the water, which is carried down in a wooden box into

the tunnel tail-race. When one hopper is full of tailings the water is cut off and turned into the other hopper, and while this hopper is being filled trucks are run in under the chute of the other, when the tailings fall into the truck, which is hauled up an incline by an overshot-wheel and dumped into a hopper on the top, being then carried away with water in the sluice boxes. The whole of the machinery-plant and gearing are substantially constructed, and show a good deal of ingenuity on part of the manager, Mr. Creber; still, when they come to work the deep ground which they expect to get, it is difficult to understand how the stuff is to be sluiced into these hoppers. At the present time the bottom of the wash-drift is high and allows a fall into the hoppers, and so long as this continues the arrangement may work satisfactorily.

Arahura District.

Humphrey's Gully Company.—This company has a special claim of 160 acres in the vicinity of Humphrey's Gully. The face of wash-drift they are working in at present is over 200ft. high, with a little gold all through it. The ground, however, is of a poor character, and unless it can be washed away in a wholesale manner it cannot be made to pay. The supply of water the company has at present is totally inadequate for working this class of ground. They have extended their head-race time after time to collect the water from several small creeks, but they will never get a proper supply of water until the head-race is extended to the Arahura River, which is estimated to cost £20,000.

The hydraulic-sluicing operations were carried on with wages-men up to November last, but since that date the claim has been let on tribute to a party of miners, who pay the company 66⅔ per cent. of the total yield of gold, the company supplying water and keeping the head-race in repair. The amount of gold obtained last year was 1,017oz. 8dwt., representing a value of £3,868 7s. 6d., and the value of tributes £16 8s. 6d., making the total income £3,884 16s. The expenditure of working the claim, was £2,724 11s. 1d. This left a profit of £1,160 4s. 11d., but, in addition to the actual expense of working, £785 18s. 11d. was spent in plant, &c., making the total expenditure £3,510 10s. This still leaves a profit of £374 6s., which shows that were there a good supply of water to carry on extensive sluicing operations, the ground would pay for working. However, the new arrangement made to let the mine on tribute will give the company about 50 per cent. of the total yield of gold as profit after paying the expenses of race, maintenance, and management. The company has now expended most of its available capital, and cannot at the present time extend the head-race to get a larger supply of water before the capital is either increased or the company reorganized. Unless this work is completed and a good supply of water obtained, the ground, which otherwise could be made to pay, will be of very little value to the company.

Parkes's Dredging Company.—This company has a dredging claim at the side of a small lagoon near the ocean beach, about one mile south of the mouth of the Arahura River. The plant consists of a small Wellman dredge, and embraces a centrifugal-pump with two branches of pipes at the suction end, and one pipe above the pump for discharging the dredged material and water into boxes, which are placed about 12ft. above the surface of the ground. On the ends of the suction-pipes can be placed, if required, a revolving-cutter for excavating the material, and there is a sleeve or nozzle over the end of each pipe. The object of this sleeve is to prevent the choking of the suction-pipe, when its end is down on the sand, by allowing the water to get into the pipe between the portion that is termed the sleeve and the pipe itself, the sleeve being merely a short piece of pipe about 2in. or 3in. larger in diameter than the suction-pipe, and made fast to the suction-pipe with studs and bolts. The suction-pipes have a universal joint, which admits of them being lowered, raised, or moved horizontally as the dredging proceeds. Whatever the length of the suction-pipe is, it can be made to describe a radius of about 180°. The ends of the suction-pipe are bent downwards when they are projecting horizontally, and have the appearance of huge elephants' trunks. They are held in position by light wooden derrick-cranes, which keep them suspended, and swing them about as required. The centrifugal-pump is driven by a small portable engine, 8 horse-power. The whole of the plant is erected on the surface of the ground, and, after dredging out one paddock, will have to be shifted before another can be commenced. In this respect it is not suitable for working the beach-leads in an economical manner. The whole of the machinery and plant requires to be placed on a punt, so that it can be moved about as the dredging proceeds.

The following is an extract from the *West Coast Times*, when this dredger first started work: "The gold-saving tables are 7ft. 6in. wide over all, and 24ft. long, but this is divided in three parts, forming, as it were, three tables or boxes, each 2ft. 6in. wide. The supply-pipe lands the dredged material and water into a hopper-box, which is 3ft. wide at the back end, and widens out to 7ft. 6in. at the front end, to correspond with the width of the tables. Where the tables and the hopper-box join small doors are placed in the hopper to regulate the quantity of sand put on to each table. The tables are in two sets of 12ft. each, in sheets of iron 6ft. long, the first sheets being perforated with holes $\frac{5}{16}$in. in diameter and about 1in. apart; the second length of sheets is plain. The object of this will be more clearly shown. These sheets of iron stand about 1½in. above the bottom of the table, which is covered with baize from end to end. The material and water coming from the hopper passes over the perforated plate, the fine stuff falls through the holes, and the stones and coarse material passes onwards over the sheet-iron false bottom. The plain sheet at the end of the perforated one is for the purpose of preventing any material falling on the baize so as to disturb the gold and prevent it from being saved. The second length of tables are exactly similar to the first, but they are placed so that the false iron bottom of the second set of tables come on a level with the main bottom of the first set. By this means all the fine material and sand goes on to perforated plate of the second, and again falls on to the baize on the bottom of the table. At the end of the tables there is a box converging from 10ft. to a width of 3ft., and from this the tailings are carried some distance in boxes and deposited.

The converging-box is covered with cocoanut-matting, and also the tail-box for the first 6ft. in length. The dredging is done by the centrifugal-pump, which is constructed so as to pass stones and sand that enters the suction-pipe without grinding or choking. The fan of the pump is 18in. in diameter, with three carved arms, with an increasing pitch, and 4½in. in width. The water and material enter the centre of the fan and passes out at the periphery. The fan is constructed very strong, so as to prevent any damage taking place from shocks by stones striking against it, or other substances passing through.

The pump is bolted down to a cast-iron bed, to which are also bolted the brackets holding the bearings in which the steel shaft of the pump runs. From the pump are two intermediate pipes running at right angles, each being connected to a wooden joint-stand, which also supports the universal joint and the mast used for raising, lowering, or adjusting the dredging-pipes. The universal joint to which the dredging-pipe is attached is so constructed that the pipe can be raised or lowered through an angle of 90°, and swung round through a semi-circle; or even, if required, through a whole circle, whilst the pump is working. This enables the dredger being worked over a large area without being moved.

The dredging-pipe, which is a rolled iron gas-pipe, is in suitable lengths, and bolted together by means of flanges having india-rubber washers between them. As the material can be raised from any depth below the surface of the water without requiring any extra power, the pipes are constructed so that successive lengths can be added till the required depth is reached. At the end of the dredging-pipe is a nozzle: this is, in reality, a cast-iron sleeve, affixed by set screws round the lower end of the dredging-pipe, sufficient space being allowed between it and the pipe to admit of water passing freely. The water rushing down the space between the pipe and nozzle loosens and tears up the ground, which is then sucked up with the water through the pipe into the pump, and then forced up to the hopper at the head of the washing-tables. By raising or lowering this nozzle the proportion of material to water can be regulated, and the choking of the pipes prevented. The diameter of the two dredging-pipes in 4in., and the nozzles are 9in. long, and the width between them and the pipes is 1in. There is also another form of nozzle used for hard ground. It is a rake with four arms, provided with strong steel teeth, fastened in the centre to a spindle, which passes up the pipes. This has a propeller attached to it, worked by the upward current of the water. Each line of pipes has a wooden crane provided for the purpose of raising, lowering, or swinging the pipes. The special features of the Wellman patent are the universal-joint, which allows all the ground being worked within the radius of the pipes; and the nozzle, which, from its construction, forces the water to enter the pipe from above, and thus prevents choking.

In order to start the pump it is necessary to fill it with water, and this is accomplished by means of a steam-ejector from the boiler. When the pump is full the engine is set in motion, and the water impelled by the curved blades of the runner up the delivery-pipe, and its place immediately supplied by the water and material constantly rushing up the dredging-pipes, which pass through the universal-joint; thence into the pump."

With regard to the ultimate success of these dredges I think there is little doubt; but the present one is a mere toy, and not suitable for dredging on the beaches. The principle is good, and alterations will no doubt be made that will make them suitable for the work they have to do. The centrifugal-pump requires to be longer, and the pipes should be at least from 10in. to 12in. in diameter, so that good-sized stones could be lifted. Also, all these description of dredges should be placed on a punt, so that they can be shifted about anywhere. If the pipes were sufficiently large, and plenty of motive-power to work the pump, there is no doubt it would lift a large quantity of material from a good depth; but after the sand is lifted there is another element to be provided for—that is, separating the rough shingle from the fine sand; if the whole of the coarse shingle and boulders which are lifted are allowed to pass over the tables where this fine beach gold is collected there will be a considerable loss of gold.

Mr. Brooke-Smith was landing a ball dredger at Hokitika during my visit there. His dredger is larger than Mr. Parkes's one, the latter being constructed on the Wellman principle. The pipes are made of steel, and each joint is faced on a turning-lathe. Mr. Brooke-Smith also has, in conjunction with his dredge, one of Preistman's grabs for lifting up stones. This will be required, for the 7in. pipes are not large enough to take up the coarse shingle and stones that are found in the ocean-beach wash. The pump and steam-engine and derrick-crane will be placed on a punt. The place where Mr. Brooke-Smith's company intends to commence dredging operations first is at the Five-mile Beach, below Okarito. This was in former years one of the richest beaches on the West Coast, and there is yet a considerable length of it that has never been worked below the surface.

To sum up the prospects of the dredging companies on these ocean-beaches, I think the present dredges will be a partial failure; they are not large enough, nor sufficiently powerful, nor have they any proper appliances for separating the coarse shingle from the fine sand before it goes over the washing-tables. They are, however, constructed on a good principle, and I have no doubt when they are improved to suit the work they have got to do, they will prove a success, especially in working ocean-beach leads; and will be the means of giving remunerative employment to a large population.

Totara District.

This is a district in which almost every class of mining is carried on, and it is the only place in the colony where there are any very deep alluvial leads of gold. The deep workings were carried on for a number of years, but the influx of water became too great for the machinery employed, and, in addition to this, the quantity of gold in the wash-drift became less as it got further into the flat. Hydraulic sluicing is carried on here to a considerable extent, and recently auriferous-quartz reefs have been discovered at Cedar Creek.

Ross United Company.—This company is now working the ground above the 100ft. level in Ross Flat by tributers. Those working from shafts pay the company 10 per cent. of the gross yield of the gold. The two elevator claims—one in Ross Flat and the other at Donoghue's—are worked also by tributers, who pay the company 35 per cent. of the gross yield. The total value of gold obtained from this company's ground last year was £6,171 14s. 6d.—namely, Ross elevator claim, £1,593 19s. 6d.; Donoghue's £1,724 16s. 6d.; from deep workings previous to stoppage, £753 13s. 6d.; and from tributers working from shafts above the 100ft. level, £2,099 5s. The total received from tributers last year was £1,327 0s. 6d.: this, added to the value of the gold taken from the deep workings, and £183 4s., makes the total income from this company's mine last year £2,263 18s.; while the actual expenditure in carrying on operations was, exclusive of general management, directors' fees, &c., £1,961 11s. 10d. The company intend to work the deep levels again as soon as they have machinery that is capable of overcoming the water; but as the whole of the capital is now called up they cannot undertake new works which are estimated to cost about £20,000—that is, to erect more powerful pumping-machinery, and bring in an increased water-supply from the Totara and Mikonui Rivers. Negotiations are in train for obtaining the additional capital by either reorganizing the company or issuing preference shares, but so far nothing has been done.

Mont d'Or Company.—This company was formed in 1882, with a capital of £12,000, of which £10,899 has been paid up. The company has been carrying on hydraulic-sluicing operations continuously. It took a long time to get the claim in working order, and to construct a head-race to bring in a water-supply. This claim has been worked since 1875, but at that time it was held by private individuals. The money shown as capital paid represents the total expenditure since the claim was first taken up. Of late years this claim has given the shareholders very good returns, and is likely to continue to do so for some years. The total amount of dividends paid up to the end of last year was £8,400.

Mount Greenland Company.—This company was formed in 1878, with a capital of £10,000, the whole of which is paid up. Their ground adjoins the Mount d'Or claim, and they have still a large area of auriferous drift to wash. This claim was first taken up about 1873, and a co-operative company formed—one half-paying in and the other half working-shareholders. They constructed a water-race at a high elevation from small creeks leading from Mount Greenland to the Mikonui River, and also a dam on a flat ridge near the head of the Sandinavian Creek. The ground at present worked by the company is upwards of 200ft. in depth, but the limited supply of water at their command makes but little impression on it for twelve months' work. Dividends to the amount of £7,260 have been paid up to the end of last year.

Cedar Creek Reefs.—Auriferous quartz was found in the bed of Cedar Creek about three years ago, and a rush for ground set in; but after prospecting for some time all the claims were abandoned. During last year prospecting was carried on by the William Tell Company, when a payable lode was discovered in an adit-level 57ft. below the cap of the reef, where it was originally found in the bed of the creek. The adit was carried on for 229ft. on the course of the lode; about 200ft. of this was found to contain sufficient gold to pay for working. At the easterly end of this lode the quartz almost pinches out; but on the western end the reef is about 4ft. wide, with gold fairly distributed through the stone.

A winze has been sunk on the lode for 76ft., at about 84ft. distant from the western end of the adit. There was about 50ft. of water in this winze at the time of my visit, so that I could not see the stone in the bottom, but the portion of the lode in the winze I could examine showed gold freely. The lode, however, is a little broken in the winze in one place; but it is said to be more compact near the bottom. To take this lode on the whole, as far as I could examine it, it is likely to yield about 1oz. of gold to the ton, and it varies from 1ft. to 5ft. in thickness. Another adit level, 86ft. lower than the present workings, is in course of construction; 154ft. of it was completed at the time of my visit, and it was expected to go another 250ft. before it cut the reef. When this adit cuts the lode far more will be learned as to its quality and permanency. About 200ft. below this level a low-level tunnel or adit was constructed with subsidy from this department for a distance of 1,000ft. This adit goes through a country in which auriferous lodes are likely to be found. A block of stone or reef was cut through at about 800ft. from the mouth, but there is very little gold to be found in it. Several small leaders have been cut through further in, which contain a little gold. The appearance of the country rock at the extreme end of this adit leads me to think that another quartz lode will be cut at no great distance. I have not seen any true lodes in this locality; the reefs are all in the form of segregated veins.

Swiss Republic Company.—This company's ground adjoins the William Tell, and has a parallel reef running through it. Operations at the present time are confined to prospecting the reef at the side of Cedar Creek, which shows on the outcrop a width of 3ft. A little gold is found in the stone, but I should not deem it at present payable for working. There is no prospecting being done of any account on this reef, and therefore nothing can be said as to the probabilities of finding a payable lode.

Since the discovery of payable stone in the William Tell Company's ground, licensed holdings have been applied for and granted for a considerable area of country; and I was informed very good specimens can be got from the lodes passing through several claims. These quartz reefs will yet take a considerable time before they are developed, as there is no road yet constructed whereby machinery can be brought on the ground.

Maerewhenua District.

This is a district where there is a considerable area of auriferous ground that would pay for working by hydraulic sluicing if there was a good supply of water, but there is very little water available at the present time. Several small water-races are constructed, but if the water in the whole of them were put together it would only be sufficient for carrying on hydraulic-sluicing operations on an extensive scale for about two claims.

The ground in this district is similar to that at Tinker's, Vinegar Hill, St. Bathan's, and Mount Burster, being what is known as the old quartz drift-wash. The only exception from this is some ground that has been worked on the eastern side of Pringle's Gully, which is more of a river deposit. The only portion yet worked is the shallow ground, as there is not sufficient water to work the deep ground, and more especially as the top stuff, which is cemented sand, contains little gold, and is not only hard to break down, but requires a good pressure on a hydraulic nozzle to break it up.

The chief gold-bearing stratum underlies a band of greensand, which is apparently a marine deposit, as it is full of shark's teeth and marine shells, and underneath the gold-bearing stratum is the old quartz wash-drift cemented together, which also contains a little gold; but the scarcity of water does not admit of any but the best of the ground being worked. From what I could learn from the miners working on this field some of the claims will give as much as half an ounce of gold per man a day if they can get one and a half sluice-heads of water. This, however, may be taken for what it is worth, as some parties dispose of water at 20s. to 30s. a sluice-head per week, and if the ground were really very rich it would pay the proprietors of those water-races better to work ground themselves on a systematic principle rather than sell water at so low a rate.

The ground on the western side of the Maerewhenua River is said to be the most extensive and also the richest, and the miners are extremely desirous of constructing a head-race from the Otekaike Creek, above its junction with Dansie's Creek. This, however, would not only be an expensive race to construct, but also a difficult one to maintain, as the side of the range, where a ditch would have to be constructed, is, in many places, a steep rock sideling, and in others old slips that have come from the ranges.

The great drawback to the development of this field for mining is that the most of the land is alienated from the Crown, and the proprietors hold riparian rights. No doubt if a large supply of water was brought on to this field the tailings would not only cover the flat land, but also, in course of time, fill up the bed of the Maerewhenua River to such an extent that it would damage the low-lying land along its banks. From the amount of gold duty the Waitaka County receives the annual yield of gold from this field must be about 1,121oz. The most of the miners have a few cattle and small plots of land, on which they work when there is no water available.

Tuapeka District.

Blue Spur and Gabriel's Gully Consolidated Company.—This is a new company formed recently in London, and has purchased all the mining properties at the Blue Spur, together with all machinery, plant, tools, buildings, water-races, and dams that formerly belonged to the Fidelity, North of Ireland, Morrison's, Perseverance, Great Extended, Otago and Nelson Cement-crushing Companies; also the Gabriel's Gully Sluicing Company, and two water-race companies.

During the last ten years the value of gold obtained by these companies is said to have amounted to £570,000, and during this period they are said to have paid £187,000 in dividends. The area of ground now held by the new company is fifty-four acres of cement workings on the Blue Spur, and twenty-six acres in the bed of Gabriel's Gully, making a total of eighty acres. In treating of the value of gold that has been actually obtained in alluvial workings it must be borne in mind that this is no criterion as to future yields, and especially in the cement workings, which were opened in 1862, and have been worked ever since by different methods. The best of the ground is all taken out, and it is only by an improved method of treating the cement that the portion which is now left can be made to give fair returns after deducting working-expenses.

The ground in the bed of Gabriel's Gully is perhaps the most valuable portion of the company's property, although it is principally tailings which have accumulated from the different claims since this gully was first opened. In the early days the ground was rich, and the same care was not then bestowed on saving the gold as now. This is the ground where the new company intend to concentrate all their operations at first before they commence to erect machinery for dealing with the cement. Being now the owners of all the water-rights and supplies that command the Blue Spur and Gabriel's Gully, they intend to open out the bed of the gully so that they can have either four or five hydraulic elevating nozzles at work, and thereby utilise the whole of their water-supply in working the low ground in the gully in the first instance, in order that when they commence to work the cement the tailings can be deposited on worked-out ground.

The new company took possession of their property on the 10th April last, and since then have commenced to put the water-races in proper repair; also the underground tail-race down the bed of Gabriel's Gully, which has collapsed at the upper end. No definite plan is yet laid down for working the cement, as it will take several years to work out the ground in the bed of the gully. It is estimated that the total quantity of water available in all the company's head-races is sixty-two sluice-heads. Mr. J. C. Brown, M.H.R. is chairman of directors for New Zealand, and Mr. H. C. Clayton has been appointed manager.

Other Claims.—A good many small parties of Europeans and Chinese are still engaged in the old workings all over the district, which continue to make, on the average, small wages.

Waipori District.

There are about forty miners in this district working in quartz and two hundred and fifty in alluvial mining, ninety of the latter being Chinese. The old O P Q Quartz claim is again taken up, and between 700 and 800 tons crushed from it, the parcels yielding from 3dwt. to 14dwt. per ton. The total quantity of quartz crushed in this district during the last year is about 1,000 tons, and the amount of gold from this is about 350oz., or an average of 7dwt. per ton.

A prospecting area of 1,500 acres has been granted on Waipori Flat, and arrangements are made to sink three shafts with iron cylinders by the pneumatic process.

The antimony reef is again taken up, and prospecting operations are being carried on. Recently several tons of the ore have been forwarded to London to be tested, with the view of forming a large company to work it. The lode has been traced for a distance of 1,500ft. from the old workings.

ROXBURGH DISTRICT.

The principal workings here are on the banks of the Clutha River, and a few parties are also dredging its bed. There is a large flat on the opposite side of the river from the Township of Roxburgh, where seven frontage mining-claims have been worked for the last eighteen years, from which a large amount of gold has been obtained. The owners of these claims—Waigh and party, Anderson and party, Carlow and party, Coulter, Leary, Pelford, and Houghton and party—have all arranged to put the whole of their claims into a large company, and bring in a large water-supply to work them on a different principle. The method on which some of the claims have been worked is draining the ground with Californian pumps worked by overshot water-wheels, the wash-drift being then hauled up an incline on trucks. They now propose to work the deep ground on the hydraulic elevating principle, after sluicing off all the top stuff down to such a level as the river will admit. To get a sufficient quantity of water to work the ground on this principle a high-level water-race will have to be constructed from the Teviot River; and it is also proposed, if they are successful in floating the company, to construct a dam near the head of the Teviot, at Dismal Swamp, for the purpose of storing water to work with during dry seasons.

Some idea may be formed of the value of the ground in this locality when it is stated that two of the claims mentioned last year produced 2,300oz. of gold; and, from what I could learn, equally as good ground is likely to extend back into the flat. Indeed, from the appearance of this flat, it is likely that good runs of gold-bearing wash will be got, here and there, all the way back to the foot of the terrace, for there is no doubt the river has been flowing all over here at one time. Only the easily-worked portions of the Clutha Valley have yet been touched. Rich leads will yet be found in many of the flats all along the side of the river, and I do not know of any place better worth prospecting than this flat and Miller's Flat; but the latter flat would require a large capital to carry on extensive mining operations successfully.

White Reef Company.—This company's ground is situate on the face of the Old Man Range, about two miles from the main road, between Roxburgh and Alexandra. Ground-sluicing was carried on here for several years before any attempt was made to prospect for a quartz reef, and the whole of the gold found showed that it had travelled no distance, as it was porous, with sharp edges with small pieces of quartz attached. This company was formed in 1883, with a capital of £10,000, of which £2,363 has been paid up in calls, and dividends to the extent of £250 have been paid. The reef was traced into the hill from the surface, but, after getting in a little way with an adit-level, the ground was so broken and tossed about that the course of the reef was not followed. The adit-level was extended first in one direction and then in another, following the most tortuous course possible. Hundreds of pounds have been wasted here owing to men controlling the workings of the mine who had little or no knowledge of the system of carrying on quartz-mining operations. This adit is now constructed for 650ft. and the lode is partially stoped out for 520ft. in length. The lode is from 1ft. to 4ft. in thickness, but it can scarcely be termed a quartz reef; there is very little solid stone. The lode chiefly consists of quartz gravel, and, judging from a small handful of this lode material I saw washed, it should give very good returns for working. The last crushing yielded at the rate of 25dwt. per ton. There is a crushing-battery of five heads of stamps, driven by a turbine water-wheel, erected near the mouth of the adit-level. To carry on this mine with success a good deal of expenditure is required to put it in order. The whole of the workings are merely of a prospecting nature, which will absorb a great deal of the gold in expenses which really ought to go towards paying dividends to the shareholders.

CROMWELL DISTRICT.

The principal gold-workings in this district are at Bannockburn, where the claims are all worked by hydraulic sluicing. The Pipeclay Gully Sludge-channel being now completed, it is the means of a great deal of ground being worked that otherwise could not; but from what I learned from the miners who are working it the ground is, as a rule, very poor—the average earnings would not exceed £2 a week per man. The miners pay 6d. a day of eight hours for every sluice-head of water they let into the sludge-channel. This, together with whatever gold the channel may save, is the only revenue that the Channel Company receive. The channel has not yet been cleaned up, so that they have no idea of what amount of gold will be got. At the time of my visit there were six claims tailing into this channel, and three more getting ready to do so.

There are five parties working on the fall into Smith's Gully, but from what I could learn none of them are making large wages. It is considered by some of the miners here that if a sludge-channel were constructed up Smith's Gully there is a great deal of ground in that locality which would be worked; but to construct a channel up this gully would be a heavy undertaking.

Cromwell Quartz Company.—An English syndicate has arranged to spend a certain amount of money on prospecting this mine, and if payable quartz is found to float a large company on the English market. The mine has been at a standstill for a considerable time, but a commencement is now being made to resume operations—to sink the shaft to a depth of 600ft. At the time of my visit to this district, pumping-machinery was in course of transit to the mine. When this is erected sinking of the shaft will be continued.

Mount Criffel.—There are two water-races now constructed and about ten sluice-heads of water brought on to the field, which enables some of the claims to give good returns. About sixty men were employed last season, and the amount of gold obtained about 1,200oz. A rush has taken place at Fat Boys, between Mount Pisa and Criffel, and some gold has been got leading into deep ground. A party of miners are testing the deep ground by boring, and are now down to a depth of 100ft. without getting either bottom or any auriferous wash-drift.

ALEXANDRA DISTRICT.

There is very little mining carried on here, with the exception of some parties who are working on the banks of the river and also engaged in dredging operations. The Wellman dredger has been

constructed for some months, but the dredging-pipes with which it was fitted up were far too small to be of any use for lifting material on a large scale. New pipes, 12in. in diameter, are being fitted on to the dredger, and when this is done a start will be made.

At the time of my visit the punt and whole of the machinery had sunk in the river; but this was during a flood, the punt being anchored near the bank. When the water is low the dredger will be resting high and dry on a bank of shingle. The principle of this dredge is fully described when dealing with a dredger of similar character, erected on the ocean-beach, near Arahura, on the West Coast, the only difference being that the whole of the machinery is in this instance placed on a punt instead of being erected on land. From the description given and plans shown to me by Mr. Wellman there is little doubt but this dredge will work the bed of the river successfully—that is, if the centrifugal-pump is large enough for the 12in. dredging-pipes, and also if the engine is sufficiently powerful to work the pump.

The steam-dredge constructed by Messrs. Kincaid and McQueen, of Dunedin, is at work about a mile and a half above Alexandra, and from what I could learn the ground it is working is payable.

Arrow District.

Macetown.—There are three quartz companies working in this district—namely, the Premier, Tipperary, and Sunrise. The latter company are working a quartz lode at Advance Peak, and have now commenced to crush some of the stone, which is believed to be payable for working.

Premier Company.—This company are carrying on mining operations from a winze sunk down on the lode for 90ft. below the main level. The lode is from 18in. to 4ft. in thickness, and has been proved payable for a length of 460ft. along its course. The mining operations are, however, carried on in such a manner that the proper safety of the workmen employed is disregarded, and nothing but rich stone will pay for taking out. The average yield of gold from this mine last year was 14dwt. per ton. This ought to give good returns to the shareholders if the mine was worked in a proper systematic manner; but the whole system of working is from hand to mouth; make-shifts of every description are employed; and what ought to be a good property is rendered almost valueless for want of the mine being opened out in a proper manner. This company was formed in 1880 with a capital of £6,000, of which £3,000 is declared paid up, and £3,000 has been paid in calls. During the time the company have been carrying on operations £1,800 has been paid in dividends.

Tipperary Company.—This company's mine is not looking so bright at present. The stone appears to get poorer as it goes down. Still, the country rock is of a soft character, and the walls of the lode are well defined. But there is some probability of another shot of gold being got at a greater depth. This company was formed in 1883, with a nominal capital of £12,000, of which £120 has actually been paid up, £13,500 having been paid in dividends. They were working at the time of my visit on the No. 7 Level, which is 330ft. below the level of the lowest drainage adit. There is a block of stone here about 90ft. long and 70ft. high yet to stope out, but when this is taken out prospecting will have to be carried on to test the lode at greater depths, or prove whether other shoots of gold exist along the course.

Sunrise Company.—This is a company who have opened out a quartz reef near Advance Peak, from which 200 tons of quartz was crushed last year, yielding 102oz. of gold.

There are a few parties working alluvial ground in the district and making fair wages, the season having been exceptionally good for supplying water to work the claim.

Skipper's District.

The quartz workings in this district do not present a hopeful aspect. For some time to come prospecting operations will have to be carried on before any future finds of large extent may be expected.

Phœnix Company.—This company, whose mine looked remarkably well on my former visit, has worked out the whole of the blocks of stone that were known to be payable, and are now merely prospecting. There are eight men employed in what was formerly known as the British-American ground, which is at 600ft. higher elevation than the levels on which the company have recently been working. Gold has been struck in a reef in this ground, but the large influx of water prevented a winze being sunk on the lode. An adit-level, about 60ft. below where the gold was struck, is in course of construction, and the company expects to get some payable stone from this quarter. There are also four men prospecting in the main level, with the view of cutting the northern lode to see if the gold continues in it; but no great returns may reasonably be expected from this mine for a considerable time.

During the past year 2,500 tons of quartz have been crushed, but the average yield of gold was very small; some of the quartz going as low as 3dwt. of gold per ton. This company has now all the modern appliances for working a mine systematically, and for reducing the quartz, but is still behindhand in the principle of saving the gold. This appears to occupy a secondary place in milling operations, while it really ought to be the principal.

This company has, however, succeeded in perfecting the electrical machinery to such an extent that the dynamos, when driven at a speed of 800 revolutions per minute, now register 40 amperes, whereas, at the time of my former visit they only registered 15 amperes, when the two dynamos were working conjointly, and the electro-motive force registered is now 1,200 volts. The work done by the two dynamos is as follows: They work thirty heads of stamps, ten of which are 800lb. each, and twenty are 650lb. each, lifting seventy-six times per minute, having a drop of 7in. This requires about 30-horse power. They also drive an air-compressor and stone-breaker, which are calculated to require 20-horse power. Therefore, the total power given by the dynamos is equal to 50-horse. The power required to work the dynamos is obtained from two hurdy-gurdy Pelton water-wheels, working under a head of 165ft., the nozzles supplying water to the wheels being

2¼in. in diameter. Two of these nozzles with the head mentioned would discharge about 330 cubic feet of water per minute, and allowing that these wheels give 80 per cent. the power of the water, then the two dynamos required 82½-horse power to generate an electro-motive force capable of doing the work of 50-horse power. This is equal to the dynamos giving 60 per cent. of the power employed to drive them.

The power of the dynamos was increased by having new laminated armatures put on. These new armatures reduce the heat that was formerly generated with solid armatures, and turned it into electro-motive force; hence a greater amount of power now generated by the dynamos than was the case when they were first erected. This is worth knowing to any one who may make use of electrical machinery for mining, that the loss of power is not now so great as when the principle of driving a crushing-battery by electricity was first tested.

Phœnix Extended Company.—This company have sunk a shaft on the side of the creek, on the boundary of the Phœnix Company's ground, to a depth of 150ft., and have driven an adit-level from the bottom in a southerly direction to cut the south main lode that comes through the Phœnix Company's claim, but at the time of my visit they had not reached the distance at which they expected to find the lode. On sinking the shaft, two distinct lodes were passed through, but neither of them contained sufficient gold to pay for working. The shaft is 10ft. long by 3ft. 6in. wide, divided into three compartments—namely, two for winding, and one ladder shaft. The winding at the present time is done by a horse-whim, but if gold is struck it is the intention of the company to erect proper poppet-heads and winding-machinery. At the time of my visit there were six men employed.

Maori Point Company's Mine.—This mine is situated about two miles and a half below Maori Point, and about a hundred yards on the upper side of the road leading from Skipper's to Queenstown. The reef was first discovered in a small creek, where the water had laid bare the stone and showed a few specks of gold here and there. On the strength of this discovery, a crushing-battery of ten heads of stamps was erected. About 400 tons of stone were crushed, which yielded, on an average, 2½dwt. of gold per ton. Two low-level adits have been constructed, and only a trace of a quartz lode found in each of them. The company has let the mine on tribute, but from what I have seen there is little possibility of tributers continuing long at work in this mine. Indeed, the prospects of the mine never justified the erection of crushing-machinery, and its erection reflects very little credit on the judgment of those who were connected with its management and direction at the time. There were at the time of my visit six tributers, who have undertaken to pay 10 per cent. of the gold they obtain to the company.

Gallant Tipperary Mine.—This mine is situated on the southern side of the Shotover River, about a mile above the junction of the Skipper's Creek. It was known in former times as the Nugget, but on remodelling the company it got its present name. There is an adit-level driven into the range for about 1,500ft. before it cuts the reef, where the present shot of gold was found. The length of the shot of gold is from 100ft. to 120ft., and the reef is from 2ft. to 5ft. in thickness, which yields about 16dwt. of gold per ton. The reef has been stoped out for 80ft., and there is still about 200ft. of backs to work. There were ten men employed in the mine at the time of my visit. The workings are carried on in a haphazard manner, having little regard to the safety of the workmen employed in the mine.

Alluvial mining in the Shotover and Skipper's District is being carried on energetically; some of the claims are paying very well, especially Davis's claim on Pleasant Terrace and Johnston's and Aspinal's claims, at the junction of Skipper's Creek and the Shotover River. These claims have given very good returns during last year. There is still a large amount of alluvial ground in this district that would pay if a good supply of water could be brought on to the terraces at a sufficient elevation. This, however, is very limited at the present time, but I was told that a company has been formed to construct a water-race from Skipper's Creek to work the terraces below Aspinal's claim, and if this work is carried out I have no doubt that a deal of gold will be obtained. Any water-race having a good supply, and brought in at a high elevation, will be costly to construct; but unless this is done, the large quantity of auriferous drift in the terraces will never be advantageously or profitably worked, as the present water-supply is confined to the snow-water coming down the gullies from the mountains, and only lasts for a short season of the year. This season has been exceptionally wet, and has given an impetus to alluvial mining all over the district.

The large amount of gold obtained from the beds of Skipper's Creek and the Shotover River in the early days indicates that it came from slips off the sides of the mountain, and was deposited in the bed of the river by the light material being washed away, on the same principle as ground-sluicing is now carried on, but on a far more gigantic scale; and the stones and shingles carried down by the force of the water have worn away a narrow deep channel in the rock. It is also evident from the large amount of river-drift on some of these terraces that the Shotover River flowed at a much higher elevation at one time than it now does. Even the loose material from slips which has never been affected by the river contains a large percentage of gold, which will be some day worked profitably when water is brought to bear on it. The more I see of this district the more I am convinced there is yet a very extensive field for hydraulic-sluicing operations; but the great difficulty is obtaining a sufficient supply of water. The steep and mountainous nature of the country—in many places consisting of vertical rocky cliffs—renders a large water-supply a very costly undertaking; but the land is practically of no value except for mining and the gold that it contains, and every encouragement should be given to those undertaking the construction of a water-supply by granting large areas of ground as special claims at a cheap rental.

The time has gone by when individual miners can take up ordinary claims and work them profitably. Capital and labour must in the future go hand in hand to carry on mining on a systematic and intelligent basis. Companies with large capital only can cope with the difficulties that stand in the way of carrying on mining on commercial principles; and when sufficient attention has been given to this industry, and mining companies established on a proper footing, they will give

employment to a large population, and tend to relieve the depression under which the colony is now suffering.

Head of Lake Wakatipu.—The reefs at the head of the lake are doing very little. The Invincible Company's mine, which paid well when first opened out, is now let on tribute; the company cannot make it pay by employing wages-men. Whether the tributers will do better remains yet to be seen; but the way in which this mine was worked at the time of my former visit to this district was such that nothing but rich lode stuff would pay the expense of working. The company was formed in 1880, with a capital of £21,000, of which £14,000 is declared paid up, and £2,666 paid in calls. The amount of dividends declared has been £4,025.

Black's District.

Green's Reef Company.—This company has now commenced operations, and intend to bring in a water-supply from Muddy Creek to work machinery for crushing the deposit. They propose to convey the water across the Manuherikia River, at the Gorge above the station, in wrought-iron pipes. The deposit which this company intend to work cannot be termed a quartz reef; it is merely a deposit of decomposed schist in very fine foliated layers, and interstratified with thin string-like veins of quartz running across the foliations in all directions. It is in these fine quartz seams that the gold is found. The deposit is about 30ft. wide, with a moderately hard schist wall on one side, and hard chlorite schist on the other. A small cut has been made, and the stuff taken out and washed in a long-tom and sluice-box, and the quartz taken out and stacked, to be hereafter put through a crushing-machine. The manager informed me that the company intend to work this deposit by putting the whole of it through a cyclone crushing-mill, which is going to be erected on the ground, and which will crush about 400 tons per week. As this will be the first of these mills in this colony, a description of it will not be out of place.

This machine is known in America as Wall's Crushing-rolls. It differs from the ordinary crushing-rolls in common use chiefly in the novel construction and arrangement of the crushing-faces, which consist of parallel corrugations extending across the faces of the shells, either parallel or inclined to their axis, the corrugations being rounded or curved with such proportions that, when intermeshed or rotated, any portion of the surface of each will press equally upon the counterparts of the opposite roll, and being held firmly in position by suitable steel gear, skipping of the crushing-faces upon each other, or upon the material to be crushed, is rendered impossible. A description of this machine was given in the *Mining and Scientific Press*, of the 4th February last.

It will be seen from the annexed plan that the meeting- or crushing-faces present at all times overlapping curved surfaces, between which the material is firmly held, and crushed by almost direct pressure, thus absolutely avoiding the grinding or uneven rapid wear of the face of the shell, and the consequent destruction of the ores by the production of refractory slimes, such as result to a disastrous degree from the constant grinding or rubbing to which all material is subjected in being reduced by common plain-faced roll attrition-mills and similar devices in common use.

For pan- or plate-amalgamation three pairs of these rolls will give a greater daily product than a crushing-battery of forty stamps, and they do not require more than one-fifth of the motive-power to work them, while the cost in the original outlay is not more than one-fifth the price of a forty-head battery; also the cost of tear and wear is but a mere fraction compared with that of stamps.

These rolls are coming into use in the Australian Colonies. Two sets have been sent to the Mount Perry Gold-mine, Queensland, which has similar ore to that found in the Mount Morgan Mine, near Rockhampton; one set has been purchased by the Australian Smelting and Reduction Company, Dry Creek, South Australia; one set for the Broken Hill Company, Silverton; and two sets for the Barrier Ranges Concentrating Company, New South Wales. Annexed is an illustration showing the principle of these rolls.

I have no doubt rolls of this description are a great improvement on the old-fashioned stamp-mills; but it is very questionable if they are the best description of machine to treat the whole of the material from the deposit found in the Green's Reef Company's ground. The soft slimy nature of the deposit will cause it to adhere to the rolls if crushed dry, and if water is used the amount of mud will be so great that it will carry the fine gold away with it. The deposit is one which could be sluiced down into a puddling paddock on the flat, and in this paddock the material could be broken up by having two hydraulic nozzles playing on it in opposite directions to each other; and when the whole of the soft decomposed schist was broken up into slime the muddy water could be gradually let away by having slip-boards in a sluice to draw it off, until nothing but the clean gravel remained in the paddocks. This system is adopted by Mr. John Ewing, at St. Bathan's, to puddle thick bands of stiff clay, and proves very effectual at a small cost. After the material is puddled and the slime all run off, the gravel can be removed from the paddock and put through the crusher.

Corrigall's Reef.—This reef is again taken up by Mr. Green, who has been prospecting it for a considerable time, and discovered what he believes to be payable stone. He has lately purchased a crushing-battery of five heads of stamps that was at the Carrick Range, and is removing it to Black's to work this reef.

Ida Valley.—The deep lead at Ida Valley has been taken up as a special claim of fifty acres, and negotiations are going on with some gentlemen in London to float a large company, giving the present proprietors £4,000 either in paid-up shares in the new company or in cash for the property. The depth of the ground is about 200ft., and in this there is 21ft. of drift to go through. Several other claims are taken up there with the expectation of this company being floated.

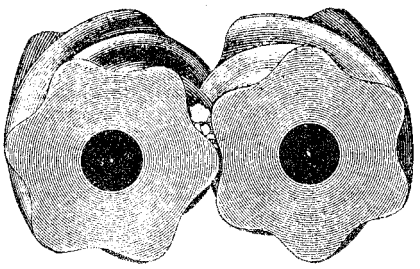


Fig. 2.—THE WALL ROLLS.

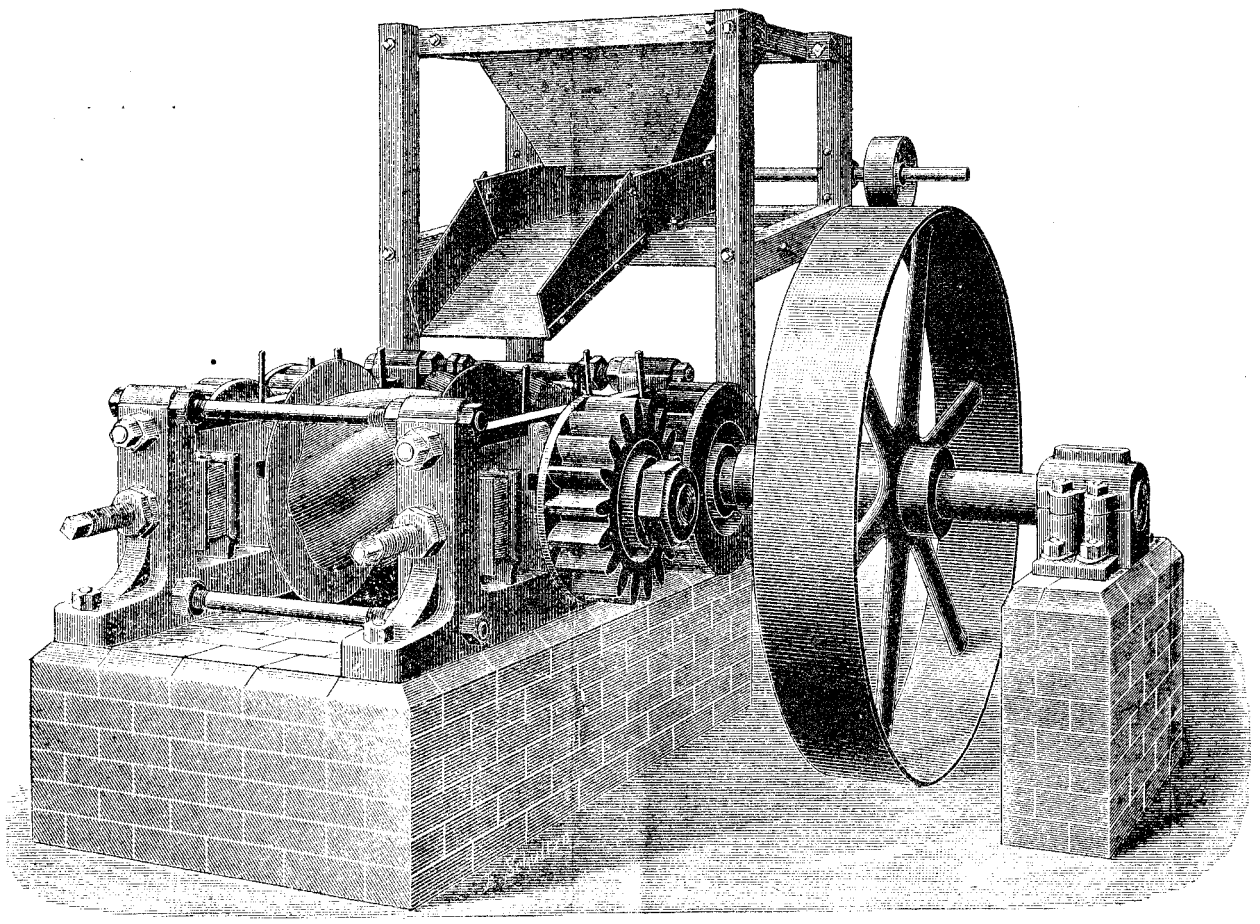


Fig. 1.—THE CYCLONE QUARTZ CRUSHER.

To Illustrate Report of
H. A. Gordon Inspecting Engineer.

Tinker's District.

Mountain Race Company.—This company has not been so successful as in former years. They have been working what is termed the old decomposed granite deposit, which rests at a high angle against the side of the range. Gold was discovered in this deposit a few years ago, but has never been worked to any extent. They got about 400oz. of gold during last year.

Symes and Party.—This party of miners has been working on the same run of ground as the Mountain Race Company, and obtained 200oz. of gold during the year.

J. Ewing Claim.—This is a claim between Symes and party and the Mountain Race Company's ground. It was taken up by a miner named Fogarty, but no work has yet been done on the claim. Recently Mr. Ewing purchased the claim, and is now constructing a high-level water-race from Thompson's Creek to work the ground.

Undaunted Company.—This company has worked about an acre of ground, from which they obtained about 3,000oz. of gold, 800oz. being obtained last year. I am informed that shares in this company have recently been sold as high as £2,000.

Matakinui Company.—This company has been engaged for the last fifteen months in bringing up a tail-race to work a deep run of ground where the Undaunted Company have recently been getting so much gold. This is now almost completed, and they expect to get good returns during the ensuing year. They have the best water-supply in this district, and have a special claim of twenty-five acres.

Reid and Party.—This party obtained 500oz. of gold for their year's work, which left them £1,100 profit.

Several small parties are at work in this district, and all making fair wages. Although this is only a small field, it contains as rich alluvial auriferous ground as any in the colony.

St. Bathan's District.

Vinegar Flat.—There are a few parties here doing very well. Watson and Thomas's claim pays about £8 a week per man. This is worked by a deep tail-race constructed up the flat. The value of this claim can be better realised when it is known that the yield of gold per acre is about 1,200oz. Davis and party's claim pays about £5 a week, and Morgan and party's about £4 a week, per man. The claims on the hill facing Vinegar Flat are doing very little, owing chiefly to the pottering system in which they are being worked. The ground requires to be washed away in a wholesale systematic manner before the claims will be made to give fair returns.

Vinegar Hill.—The only party working on Vinegar Hill is John Ewing, who has been employing, on an average, nine wages-men throughout the year. He is one of the most energetic and enterprising men that follows up mining in the colony. He sometimes purchases mining properties, and gives a high price for the same, when the original proprietors could not make them pay expenses. This means that his whole mind is given to the most economical method whereby a large quantity of ground can be worked with little labour. A few years ago he purchased a mining-claim at St. Bathan's for £1,100, which almost ruined the original proprietors in working it, and after spending an additional £1,600 in plant, &c., he very soon got back the whole of his money. This same claim paid him last year a clear profit of £2,000. Mining is like every other industry: it requires skill and forethought, and a thorough knowledge of the system of working that is proposed to be introduced. And to any one who makes mining his special study, and has a thorough knowledge of the particular branch he wishes to engage in, there is not a safer investment in the colony; but those who enter into it blindfold and in a haphazard manner, are pretty certain to come to grief. It is the same with any other industry. Mining is not the only one whereby people lose their money. At Vinegar Hill Mr. Ewing was washing up at the time of my visit, and from the appearance of the gold in the boxes it is likely to give handsome returns. He was formerly working in deep, heavy ground, but some two years ago he purchased the adjoining claim, where the workings were shallow, for £2,000, and has since chiefly confined his operations to this ground, only working the deep faces in wet weather, when there was a plentiful supply of water.

St. Bathan's.—There are a few of the claims still being worked on the level of the old tailing-channel, and some of them paying very well, but the best portion of the ground is below this level, and will have to be worked from the new tailings- or sludge-channel, which is estimated to take about three years yet to complete.

Muddy Creek.—The construction of the Muddy Creek sludge-channel has been the means of the ground being worked to an extra depth of 45ft. The Scandinavian Company, which was one of the companies that constructed this channel, is now washing up after fifteen months' work, and the appearance of gold is so promising that shares have gone up from £9 to £20 each, and no sellers can be got at the latter figure. The United M. and E. Company, who are part proprietors in the same channel, have, during last year's work, been able to pay off liabilities amounting to £2,000, and declared dividends to the extent of £720. About twelve parties of miners who purchased water from these companies are also working into this channel, and doing very well. The Otago Company are also working into this channel; but although they have a water-supply of their own, consisting of about eight sluice-heads, they have not, as yet, been very successful with their venture. The Dunstan Creek Water-race Company have been constructing a tail-race for the last two years, and are now doing fairly well. Eagle and Gray have been working ground here for the last twenty-four years which has paid them well all the time.

Blackstone Hill.—About twelve months ago there was a rush to a piece of ground situated near the foot of the range on the western side of the direct road from Hill's Creek to Black's, where about 400oz. of gold was obtained. There are still four parties at work here doing fairly well by sluicing the ground.

Rough Ridge.

Gimmerburn.—A company with a capital of £7,000 has been formed to construct dams for the storage of water on the Rough Ridge, and to work ground that has been held for the last twenty-four years and is known as the Garibaldi claim, which could not be worked for the want of water. Tenders have been accepted for the construction of the first dam.

Great Eastern Company.—This company was formed some time ago, and took up ground formerly held and worked by the Homeward Bound Company. After carrying on prospecting operations for some time they discovered a shot of gold in the lode, and since October last 820oz. of gold has been obtained, representing a value of about £3,000. This has enabled them to pay a dividend of £200, or one-third of the paid-up capital of the company. The total quantity of quartz crushed was 400 tons. This gives an average yield of 2oz. 1dwt. of gold per ton. One parcel of 100 tons gave at the rate of 3oz. of gold per ton. It is said that there are four different lodes running through this company's ground. The main one, on which the company are working, is highly mineralised, containing a large percentage of iron-pyrites, with zinc-blende through the stone. In such stone as this it is impossible to save anything like a fair percentage of the gold by the ordinary crushing-battery process. The large amount of sulphur in the pyrites will carry away a great deal of the fine gold with the water which will not even be found in the tailings. According to assays made by Professor Black of the tailings it showed that the loss was equal to about 2oz. of gold per ton.

This company and the Progress Company, whose ground adjoins, have arranged to place their properties in the London market, for which they want £50,000, part to be taken in fully paid-up shares in the new company and part in cash. From the Progress Company's mine 80 tons was crushed and yielded at the rate of 1oz. 17dwt. of gold per ton. The lode is from 18in. to 2ft. wide.

Although these companies have, at the present time, a good prospect of a shot of payable stone, the value set upon the properties seems to be exceedingly high. We want outside capital to develop the quartz-mines in the colony; but we also wish to make certain that the properties placed in the English market will pay a good return for the money invested; and unless companies are floated on such a basis as will admit of this being done, we may never expect to find capitalists willing to embark their money in mining ventures here. A few companies may be floated on a fictitious basis, and a few individuals make money by them, but the ultimate result will be ruinous to the mining industry in the colony. Careful investigations should be made by mining experts of good standing having a knowledge of the auriferous lodes occuring in different parts in this colony, and the value of the properties offered to outside capitalists should be ascertained by them. If this were done there would be a far greater guarantee that the ventures offered would be payable undertakings.

Serpentine.—The Golden Globe Company are constructing a low-level adit on a lode about 280ft. below the place where auriferous quartz was worked on the surface. The adit is now constructed for 900ft. In this distance several shots of gold have been passed through, aggregating about 100ft. in length, and, according to the prospects that are got in these shots, the quartz is estimated to yield from 10dwt. to 2oz. of gold per ton. Turnbull and party sunk a shaft on this lode for 40ft. from the surface, but at that depth the amount of water there was to contend with prevented sinking operations from being continued. From this shaft some stone was obtained which yielded 4oz. of gold per ton.

Mount Ida District.

Naseby.—The whole of the auriferous workings here are carried on by hydraulic sluicing. The old ground on the Naseby side of Hogburn is getting pretty well worked out. Attention is now given to the ground in the vicinity of Spec. and Home Gullies. At the latter place there are a few very good claims, but, with the exception of a few parties who are using iron piping, thereby utilising the whole available head of water, the ground is being worked in such a primitive manner that it would have to be very rich to pay. I observed some of the claims were worked by men picking down the face, and then running the stuff away afterwards with water. In close proximity to this a head of 100ft. could be obtained if pipes were carried up to the water-race, which would do three times the amount of work with far less labour.

A company or party of miners have taken up a claim in the bed of the Hogburn, directly above the place where the road crosses from Naseby to Kyeburn, and are working it on the hydraulic-elevating principle; it is said to give good returns for the labour and capital expended.

Hyde.—The alluvial drift-wash terraces in the vicinity of Hyde are pretty well worked out, as far as they will pay, and attention is now being given to the discovery of quartz reefs in this neighbourhood. A large quartz lode was discovered in June last at the Mareburn, and known as the Mareburn Reef. The prospectors—McAuley, McNally, and party—have obtained, from trial crushing, nearly 2oz. of gold per ton. The reef is about 5ft. wide, and it has been traced for a distance of nearly two miles from the prospectors' claim; in this distance it crops out on the surface for about five hundred yards. The reef has been cut through in several places, and auriferous stone found distributed through the whole width of the lode. This promises to be a valuable discovery; the extent and width of the lode showing that it is one well worthy of being prospected, and in which good shots of gold are likely to be found. It need not be expected that the lode will carry payable auriferous stone continuous for the whole length; but it is likely to have several runs or ledges carrying payable stone. As the alluvial ground gets worked out, no doubt more attention will be given to the discovery of auriferous lodes, which are really the permanent mines of the colony.

COPPER-MINING.

During last year a discovery was made of a lode containing copper-ore in the Woodville District, at Maharahara. This lode is situate on the eastern slopes of the Ruahine Range about thirteen miles from Woodville, and near the head of the western branch of the Manga-atu Creek, about 2,200ft. above sea-level. The lode or block of ore that crops out on the surface consist chiefly of red-chert rock and hæmatite, intersected here and there with a little green carbonate of copper or malachite, chrysocolla, and chalcopyrite or copper-pyrites.

The lode, where it crops out on the surface, is about 12ft. in thickness; but, as there had been scarcely any work done on it at the time of my visit in November last, it is difficult to state definitely what the real thickness of the lode is, or whether it is only a slip from the main range. On examining the lode along its course it seems greatly broken up, and in the bed of the creek a large quantity of this lode-material is found, showing that a slip has taken place at some time and covered the side of the range with isolated blocks of lode-stuff in this manner. Before anything can be known definitely whether the outcrop on the surface is portion of a slip or not, an adit will have to be constructed some distance below the outcrop, and the lode, if it then continue to go down, will thus be cut through and determined.

The presence of copper in this lode of ironstone is a good indication that a fair percentage of copper-ore will be found at a good depth. In Cornwall the whole of the copper-lodes contain a very large proportion of gossan on the outcrop; and after going down 200ft. and 300ft. the gossan is replaced by copper-ores. Indeed, it is seldom that a payable copper-lode in Cornwall is found within 150ft. of the surface. The great indication there being gossan on the outcrop.

The side of the range where the out-crop of this lode occurs is very steep, and the apparent dip or inclination of the lode is in the same direction as the inclination of the surface, so that an adit-level could be constructed at a very small outlay to test this lode at a depth of, say, 200ft. below the outcrop. Unless a rich lode of copper-ore were found in this locality, it would not pay for working at the present low value of copper. There is, however, richer ore to be found in isolated blocks in the western branch of the Manga-atu Creek than what I could find in the lode, or even would expect to find near the surface. Where those blocks came from had not been discovered at the time of my visit to the district.

MINING COMPANIES.

The following is a list of the companies who published a statement of affairs in compliance with "The Mining Companies Act, 1886":—

Auckland District.

Name of Company.	Date of Registration.	Number of Shares.	Number of Shares allotted.	Nominal Capital.	Subscribed Capital.	Value of Scrip given to Shareholders.	Amount of Cash actually paid up.	Amount paid up per Share, including Scrip given to Shareholders.	Number of Shares forfeited.	Arrears of Calls.	Amount of Dividends paid.
				£	£ s. d.	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Tokatea	Sept. 30, 1869 ..	20,000	18,000	100,000	90,500 0 0	80,000 0 0	9,615 0 0	4 19 6	..	750 0 0	63,625 0 0
Success	Sept. 7, 1880 ..	11,000	9,000	11,000	9,000 0 0	..	1,647 14 0	0 3 10	908	77 6 0	1,575 0 0
Cambria	Jan. 4, 1884 ..	44,700	44,700	44,700	31,862 15 0	12,857 5 0	1,181 5 0	*0 5 9	388	..	77,122 10 0
Devon	Jan. 19, 1885 ..	15,000	15,000	15,000	15,000 0 0	..	1,335 9 3	0 2 0	6,755	204 14 6	..
New Alburnia	Sept. 10, 1885 ..	20,000	20,000	10,000	1,000 0 0	1,000 0 0	1,000 0 0	0 1 0	..	..	493 15 0
New Prince Imperial	Jan. 23, 1882 ..	18,000	18,000	18,000	18,000 0 0	..	900 0 0	0 1 0	454	..	60,732 6 0
Josephine	Jan. 6, 1887 ..	27,000	27,000	13,500	..	13,500 0 0	320 0 0	..	..	..	..
Oriental	Aug. 22, 1883 ..	30,000	26,546	30,000	26,546 0 0	..	2,001 7 3	0 1 9	14,600	79 5 6	..
New Eureka	Nov. 13, 1882 ..	18,000	18,000	18,000	16,800 0 0	75 0 0	1,976 11 6	0 2 6	1,672	34 7 3	..
Geraldine	Feb. 13, 1880 ..	1,200	1,200	12,000	12,000 0 0	..	118 0 0	0 2 0	..	2 0 0	..
Moanatairi	Sept. 19, 1868 ..	13,500	13,485	135,000	3,310 15 0	..	3,310 15 0	0 5 0	242	60 10 0	121,365 0 0
New Manakau	Feb. 10, 1883 ..	30,000	30,000	30,000	1,500 0 0	..	1,500 0 0	0 1 0	..	..	..
Diamond	Oct. 19, 1885 ..	30,000	29,000	15,000	15,000 0 0	†14,500 0 0	362 10 0	0 19 3	1,590	..	..
Adeline	Nov. 27, 1885 ..	20,000	17,000	10,000	..	†10,000 0 0	83 6 8	0 11 10	1,800	..	2,500 0 0
Dubbo	Jan. 4, 1884 ..	50,000	33,192	25,000	..	300 0 0	283 17 4	0 0 2	16,808	70 0 8	..
New Fearnought	July 22, 1886 ..	50,000	40,000	25,000	..	36 0 0	254 2 6	0 0 2	13,750	32 5 10	..
Silverton	Feb. 4, 1886 ..	24,000	24,000	12,000	271 10 0	..	271 10 0	0 0 3	20	28 10 0	600 0 0
Woodstock	Dec. 9, 1885 ..	36,000	36,000	36,000	2,352 10 0	18,000 0 0	2,352 10 0	0 11 5	16,800	137 1 8	..
Rose	Jan. 20, 1886 ..	20,000	19,500	10,000	719 14 1	..	719 14 1	0 0 10	8,500	92 15 11	..
Totals	..	478,400	439,623	570,200	243,863 4 1	150,262 5 0	29,233 12 7	..	84,287	1,568 17 4	328,013 11 0

* Nominally. † By labour.

Reefton District.

Lyell Creek Extended	May 25, 1881 ..	48,000	48,000	24,000	24,000 0 0	..	6,718 11 6	0 2 9	..	81 6 8	..
Big River Extended	Jan. 21, 1882 ..	24,000	24,000	24,000	24,000 0 0	..	7,115 0 11	0 5 11	..	84 19 1	..
Hopeful Extended	June 12, 1882 ..	24,750	24,750	24,750	24,750 0 0	..	2,010 18 9	0 1 7½	..	..	..
Progress	Nov. 26, 1886 ..	24,000	24,000	12,000	12,000 0 0	..	839 5 8	0 0 9	..	60 14 4	2,400 0 0
Lord Edward	Nov. 3, 1883 ..	24,000	24,000	24,000	24,000 0 0	..	436 1 0	0 0 5½	1,584	102 18 5	..
Specimen Hill United	June 10, 1884 ..	20,000	20,000	20,000	20,000 0 0	..	6,810 3 11	0 6 10	..	23 2 9	..
Phœnix Extended	Nov. 7, 1879 ..	16,000	16,000	16,000	16,000 0 0	..	6,127 17 6	0 7 8	465	38 15 9	1,200 0 0
Pandora	May 2, 1887 ..	24,000	24,000	6,000	6,000 0 0	..	956 8 4	0 0 10	..	43 11 8	..
South Wealth of Nations	June 15, 1887 ..	24,000	24,000	12,000	12,000 0 0	..	705 6 8	0 0 8	..	94 13 4	..
Welcome	Aug. 20, 1875 ..	15,000	15,000	15,000	15,000 0 0	..	3,750 0 0	0 5 0	..	..	110,250 0 0
Lone Star	Nov. 15, 1886 ..	24,000	24,000	24,000	24,000 0 0	..	1,263 17 10	0 1 2	950	136 2 2	..
Caledonian Extended	April 17, 1880 ..	20,000	20,000	20,000	20,000 0 0	..	5,668 5 2	0 5 9	571	..	..
Walhalla Extended	Sept. 22, 1883 ..	24,000	19,400	24,000	12,000 0 0	..	1,089 12 6	0 1 0	..	110 7 6	..
Inkerman	Feb. 9, 1876 ..	20,000	20,000	20,000	20,000 0 0	..	13,633 9 8	0 13 5	..	100 3 2	..
South Hopeful	Nov. 23, 1877 ..	36,000	36,000	36,000	36,000 0 0	4,000 0 0	3,469 10 4	0 2 0	6,001	62 9 6	..
Just in Time	Oct. 9, 1872 ..	28,000	28,000	28,000	28,000 0 0	..	9,762 1 4	0 7 0	..	..	17,166 13 4
Inangahua Low-level Tunnel	Oct. 18, 1880 ..	24,000	24,000	12,000	12,000 0 0	..	4,375 12 4	0 3 9	600	52 2 7	..

Globe	Aug. 8, 1882	36,000	36,000	18,000	18,000	0 0	..	14,775	0 0	0 8 2½	5,450	..	9,450	0 0
Eureka Extended	Aug. 13, 1883	24,000	24,000	24,000	24,000	0 0	12,000 0 0	8,689	18 3	0 7 4	200	110 1 9	..	
Larnach	Oct. 7, 1885	24,000	24,000	24,000	24,000	0 0	..	850	0 0	0 0 8½	2,000	..	..	
Keep it Dark	Mar. 2, 1874	20,000	20,000	20,000	20,000	0 0	10,000 0 0	2,625	0 0	0 2 7½	..	..	88,166	13 4
No. 2 South Keep it Dark	June 10, 1887	24,000	24,000	12,000	12,000	0 0	6,000 0 0	556	7 6	0 11 10	5,675	..	..	
Sir Francis Drake	July 10, 1887	24,000	24,000	12,000	12,000	0 0	6,000 0 0	210	0 0	0 10 10½	..	212 15 0	..	
General Gordon	June 18, 1887	24,000	24,000	12,000	12,000	0 0	..	356	5 0	0 0 4	750	43 15 0	..	
Rainy Creek	Feb. 22, 1882	24,000	24,000	12,000	12,000	0 0	..	7,100	0 0	0 5 11	8,600	13 9 2	..	
United Devonshire	Jan. 18, 1887	30,000	30,000	6,000	6,000	0 0	..	376	10 7	0 0 3½	9,193	5 4 2	..	
Devon	June 19, 1885	15,000	15,000	15,000	15,000	0 0	..	1,335	9 3	0 2 6	6,755	204 14 6	..	
Wealth of Nations Extended	April 12, 1882	32,500	32,500	32,500	32,500	0 0	..	31,443	15 0	0 19 4½	4,297	..	..	
Fiery Cross	Sept. 27, 1879	24,000	24,000	24,000	20,600	0 0	12,000 0 0	8,600	0 0	0 17 2	..	..	11,700	0 0
Homeward Bound	Sept. 3, 1883	24,000	24,000	24,000	24,000	0 0	12,000 0 0	4,118	0 4	0 13 7	..	181 19 8	..	
Venus Extended	Aug. 21, 1885	24,000	24,000	24,000	24,000	0 0	12,000 0 0	2,485	0 0	0 12 3	..	215 0 0	2,100	0 0
Nil Desperandum	April 5, 1877	23,000	23,000	23,000	23,000	0 0	11,500 0 0	9,670	19 5	0 18 7	500	199 17 3	143	15 0
Happy Valley	June 22, 1882	24,000	24,000	24,000	24,000	0 0	12,000 0 0	1,434	14 9	0 11 2½	750	15 5 3	..	
Bannockburn	April 3, 1884	24,000	24,000	24,000	24,000	0 0	12,000 0 0	216	2 5½	0 10 4	4,934	33 17 6½	..	
Reform	June 22, 1885	24,000	24,000	12,000	12,000	0 0	..	2,698	3 2	0 2 3	..	42 12 10	..	
Suez	Dec. 23, 1886	24,000	24,000	12,000	12,000	0 0	..	109	9 7	0 0 1½	..	40 10 5	..	
Golden Point	Nov. 16, 1878	24,000	24,000	24,000	24,000	0 0	12,000 0 0	7,000	0 0	0 15 10	5,785	11 17 9	189	14 10
Orlando	Nov. 2, 1877	16,000	16,000	16,000	16,000	0 0	..	956	10 5	0 1 2	500	176 16 3	..	
Eclipse	July 28, 1882	24,000	24,000	24,000	24,000	0 0	12,000 0 0	898	6 9	0 10 9	..	1 13 3	..	
North Venus	Nov. 23, 1886	24,000	24,000	24,000	24,000	0 0	12,000 0 0	183	6 8	0 10 2	..	16 13 4	..	
Dauntless Extended	Aug. 21, 1887	24,000	24,000	24,000	24,000	0 0	12,000 0 0	3,250	0 0	0 15 6	..	..	100	0 0
Totals	..	1,000,250	995,650	808,250	792,850	0 0	157,500 0 0	184,671	12 6	..	65,560	2,517 10 1	242,866	16 6

Mokihinui District.

Red Queen	Nov. 4, 1882	48,000	48,000	48,000	29,700	0 0	..	5,284	7 5	0 2 4½	6,180	515 12 7	2,400	0 0
Mokihinui	May 20, 1883	24,000	24,000	24,000	2,650	0 0	..	2,474	12 5	0 2 2½	2,714	175 7 7	..	
Southern Light	Jan. 5, 1885	25,000	25,000	25,000	13,912	10 0	..	953	13 1	0 1 2	4,153	458 16 11	..	
Nile	June 27, 1885	24,000	24,000	24,000	13,100	0 0	..	887	2 8	0 0 11	8,350	217 17 4	..	
South Pacific	Oct. 26, 1882	36,000	26,336	36,000	26,336	0 0	18,000 0 0	1,222	16 9½	0 10 10½	8,024	2 7 0½	..	
Totals	..	157,000	147,336	157,000	85,698	10 0	18,000 0 0	10,822	12 4½	..	29,421	1,370 1 5½	2,400	0 0

Westland District.

Mount Greenland	Nov. 26, 1878	2,400	2,400	12,000	10,000	0 0	..	10,000	0 0	4 3 4	..	..	7,260	0 0
Wheel of Fortune	July 15, 1886	6,000	5,052	6,000	5,052	0 0	..	2,779	4 6	0 11 0	..	..	..	
Mont D'Or	July 25, 1882	12,000	12,000	12,000	12,000	0 0	..	10,799	14 0	0 18 0	..	142 17 6	8,400	0 0
William Tell	June, 1884	24,000	24,000	24,000	24,000	0 0	12,000 0 0	1,725	12 1	0 11 8½	308	206 1 5	..	
Christchurch	Aug. 28, 1885	26,000	25,640	26,000	26,000	0 0	10,500 0 0	3,484	6 3	0 10 10	360	6 16 8	..	
Kumara Long Tunnel	May 16, 1882	16,000	16,000	16,000	8,000	0 0	..	7,433	6 8	0 9 3½	3,440	..	700	0 0
Totals	..	86,400	85,092	96,000	85,052	0 0	22,500 0 0	36,222	3 6	..	4,108	355 15 7	16,360	0 0

Otago District.

Name of Company.	Date of Registration.	Number of Shares.	Number of Shares allotted.	Nominal Capital.	Subscribed Capital.	Value of Scrip given to Shareholders.	Amount of Cash actually paid up.	Amount paid up per Share, including Scrip given to Shareholders.	Number of Shares forfeited.	Arrears of Calls.	Amount of Dividends paid.
					£ s. d.	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Garibaldi	Dec. 16, 1880 ..	17,000	17,000	4,250	4,250 0 0	..	991 13 4	0 1 2	..	27 3 9	212 10 0
White's Reef	Nov. 13, 1883 ..	10,000	10,000	10,000	10,000 0 0	3,000 0 0	2,537 10 0	0 7 3	..	..	250 0 0
Queen Victoria	Nov. 13, 1882 ..	20,000	20,000	10,000	10,000 0 0	..	458 0 0	0 0 11	..	8 6 8	..
Cromwell Gold-dredging Company ..	Jan. 2, 1885 ..	50	33	600	396 0 0	..	126 0 0	9 0 0	..	151 0 0	..
Old issue	..	56	50	1,400	1,250 0 0	..	1,238 0 0	25 0 0	..	12 0 0	..
New Pipe-clay Channel	Mar. 2, 1885 ..	50	50	1,000	1,000 0 0	..	757 2 6	18 0 0	..	142 17 6	..
St. Bathan's Water-race	Aug., 1875 ..	48	48	9,600	7,233 0 0	..	2,538 14 0	50 10 0	..	..	..
Maryborough	Feb. 10, 1881 ..	19,200	19,200	19,200	19,200 0 0	..	840 0 0	0 15 0	1,739	18 15 0	1,440 0 0
Dunedin No. 2 Gold-dredging Company	Aug. 29, 1887 ..	3,000	3,000	3,000	3,000 0 0	..	1,500 0 0	0 10 0	..	..	..
St. Bathan's Channel	Dec. 1, 1881 ..	27	27	3,780	3,780 0 0	..	3,303 13 9	125 0 0	..	71 6 3	..
Phœnix Water-race	Oct. 12, 1867 ..	1,000	1,000	1,500	1,500 0 0	..	1,500 0 0	1 10 0	..	..	5,176 0 0
Blue Spur and Gabriel's Gully ..	Oct. 30, 1879 ..	30,000	29,490	30,000	8,742 1 0	..	4,347 0 0	0 3 2	..	104 8 0	311 1 9
Tipperary	Mar. 8, 1883 ..	12,000	12,000	12,000	12,000 0 0	..	120 0 0	*0 5 0	..	..	13,500 0 0
Enterprise Water-race	Feb. 7, 1867 ..	16	16	4,800	4,800 0 0	4,800 0 0	..	†300 0 0	..	..	..
Undaunted	Mar., 1878 ..	120	120	9,600	9,600 0 0	..	9,600 0 0	full	..	..	1,475 0 0
Hydraulic	Nov. 10, 1885 ..	1,000	1,000	1,000	1,000 0 0	500 0 0	500 0 0	1 0 0	..	..	..
Premier	Aug. 4, 1880 ..	12,000	12,000	6,000	6,000 0 0	3,000 0 0	3,000 0 0	0 5 0	..	..	1,800 0 0
Invincible	Sept. 28, 1880 ..	21,000	21,000	21,000	21,000 0 0	14,000 0 0	2,665 11 8	*0 6 6	..	..	4,025 0 0
Wetherstone's Cement	Sept. 16, 1878 ..	8,000	8,000	8,000	6,400 0 0	..	6,400 0 0	0 16 0	..	146 17 6	2,966 13 4
Dunedin Gold-dredging Company ..	Sept. 1, 1881 ..	240	240	7,200	5,520 0 0	..	5,520 0 0	23 0 0	..	..	3,000 0 0
Otago Central	Oct. 13, 1884 ..	10,000	9,119	5,000	4,559 10 0	4,559 10 0	1,818 11 9	†0 7 0	3,835	101 9 10	..
Progress	Sept. 29, 1886 ..	10,800	10,800	5,400	5,400 0 0	5,400 0 0	2,069 5 9	0 4 2	2,645	135 9 2	..
Golden Gully	Jan. 12, 1887 ..	72,000	49,370	18,000	12,342 10 0	7,342 10 0	204 0 8	/10 on 29,370 1/6 on 20,000	2,510	36 13 8	..
Totals	..	247,607	223,563	192,330	158,973 1 0	42,602 0 0	52,035 3 5	..	10,729	956 7 4	34,156 5 1

* Nominally. † By labour.

The following table will show the average results of these companies in the several districts since the companies were formed.

Name of District.	Amount of Capital paid up.	Dividends paid.	Loss on Working.	Profit on Working.
	£	£	£	£
Auckland	29,234	328,014	...	298,780
Reefton	184,672	242,867	...	58,195
Mokihinui	10,823	2,400	8,423	...
Westland	36,222	7,960	28,262	...
Otago	52,035	34,156	17,879	...
Totals	312,986	615,397	...	302,411

This shows that there has been a profit on the working of the mining companies at Auckland and Reefton of £356,975, and a loss in the Mokihinui, Westland, and Otago Districts of £54,564; but, to take the whole of the colony, the profit has been £302,411. This, however, does not show the whole of the mining companies, as a large number of them did not publish a statement of their affairs, as required by Act.

CASSEL'S CHLORINATION PROCESS.

This is a process whereby auriferous ores can be successfully worked by a cheap method. It was patented about two years ago by Henry Renner Cassel, of London. A working model is now on exhibition at Mr. Hayes's shop, Lambton Quay. From what I have seen of the process it seems specially adapted for auriferous ores, but the patentees would require to introduce a full-sized machine before much can be said respecting it. The principle, however, seems to be correct, and deserves a fair and impartial trial.

The invention proposes to treat metalliferous ores, especially auriferous compounds, by electrolysis, in a machine where chlorine and oxygen are generated, where the metals are dissolved at the positive pole, thence deposited at the negative pole.

The most powerful solvent which can be produced on a large scale for gold and most other metals is chlorine, and this can be easily generated by electrolysing a solution of common salt. The chlorine and oxygen are set free at the anode, and if this pole be of metal it will be readily dissolved, and the dissolved metal will be carried over to be deposited at the cathode; but, if the anode be composed of carbon, any particle of metal coming in contact with the same during electrolysis will also be readily dissolved.

Gold ores containing antimony, sulphur, arsenic, tellurium, bismuth, and many other compounds are termed "refractory ores," commonly designated "pyrites." Their treatment offers great difficulty, and hitherto it has always been necessary to roast or calcine them in order to oxidize the sulphur, arsenic, antimony, &c., and so set the gold free. This becomes unnecessary in this process, as the nascent chlorine and oxygen are the means of oxidizing the pyrites, and setting the gold free, which is then converted into chloride of gold. The gold is deposited at the cathode in the form of black slime.

Mr. Cassel gives the following description of his machine:—

"Fig. 1 is a side elevation of the machine, complete.
"Fig. 2 is an end view.
"Fig. 3 is a transverse section.
"Fig. 4 is a section through the shaft, showing the holes and internal screw.

"*a* is a drum, made of wood or other suitable material, and, if it be of metal, must be thoroughly insulated inside. This drum contains a number of carbon rods or plates as anodes; indeed, the inside thereof may be completely lined with carbon or plumbago, and he prefers to arrange the carbons inside the drum horizontally, as indicated by *b*, in Fig. 3; and, to prevent a leakage at the protruding ends, rubber-solution, marine glue, or other compound, may be used. The ends of the carbon are rendered metallic either by depositing suitable metal thereon, or by wires, soldering, or otherwise. These carbons are connected with each other by a band or rod of metal, *c*, Figs. 1 and 2, which is soldered or screwed to the protruding ends of the carbons, *b*. One or more rows of carbons may be introduced into the drum, and these must then be suitably connected. The drum may be of any desired dimensions, and, if large, the carbons may be introduced into both ends. The drum is mounted on a hollow shaft, *d*, of copper, iron, or other suitable material. In that portion of the shaft within the drum a number of holes are bored, *e*, of any desirable size (Fig. 4), due regard being given to the strength of the shaft. After well insulating the outer surface of the shaft, asbestos-cloth is fastened around it to cover the holes, and, if desired, also all those parts outside the shaft exposed to the solution in the drum. It is desirable to make the asbestos adhere to the shaft by means of rubber-solution, marine glue, or otherwise. Instead of using asbestos-cloth, slag-wool, or both, may be used, or any other suitable material, through which the current passes, but which prevents any of the crushed ore from doing so. The drum is fixed on the shaft in any suitable manner, and to prevent leakage rubber or other washers may be used. The ends of the asbestos are fastened under the flanges against the sides of the drum, or they may be fastened on the shaft by means of hard-rubber rings, or otherwise. The ends of the hollow shaft pass through stuffing-boxes, *f*, in metal standards or tanks, *g*. On the drum is fixed a cog-wheel, *h*, with which gears a pinion, *i*, and driven by a pulley, *k*. Inside the shaft is arranged an archimedean screw, *l*,

(Fig. 4), for the purpose of causing the solution to circulate when the drum is revolving, and also for removing into one or both standards any slime that has gathered in the shaft. The screw may be the same length as the shaft, or it may be only such length as may be desired to accomplish the object for which it is intended. Both tanks are connected with each other by a pipe, *m*, to enable the solution to circulate freely. The anode, as indicated by *b* (Figs. 2 and 3), consists of a number of carbons arranged in the drum in one or more rows. Carbons are used for the reason that metals would be immediately attacked and dissolved by the chlorine. The current is conveyed to the carbons by means of brushes, *n*, or by rollers. The brushes or rollers bear upon the metal rods or band, *c*, and are fastened in brackets, *o*, to standards, *g*, care being taken to properly insulate them, and they are connected at *p* with one pole of the source of electricity by wire, *q*, while the other pole is connected with the shaft or standards themselves at *r*, so that both shaft and standards form the negative pole in the machine. Upon the drum being set in motion and the current switched on, the current is conveyed by wire, *q*, to the brushes, *m*, bearing upon the band, *c*, to the carbons, *b*, forming the anode; then through the electrolyte to the shaft, *d*, and the standards, *g*, and back to the battery or source of electricity. The electrolyte is common salt water, such as sea-water. The drum is charged with the ore through the opening, *s*, which is provided with means of tight shutting, a rubber ring being inserted to prevent leakage. The metals in the pulverised ore are constantly thrown against the anodes when the drum is revolving, and these form frequently part of the anode itself, and thereby are brought into most intimate contact with the nascent chlorine and oxygen generated at the positive pole, and are readily dissolved. The metals in solution are deposited electrolytically in the shaft—this being the negative pole—as a black slime, and are then conveyed into the tanks by the archimedean screw, where they can then be easily collected and smelted.

"The shaft may be made stationary, and the drum caused to revolve thereon, but it is preferable to cause the shaft also to revolve, to insure the delivery of the slimes into the tank. Several of these machines may be placed in the circuit. The passing of the shaft through the interior of the drum may be dispensed with in the manner shown in Figs. 5, 6, and 7. In these figures *a* is the drum containing the carbons, as before described, and having a large opening, *t*, on each side (Fig. 6). This opening may be of any convenient size, and the larger it is the less the resistance will be. This opening is entirely covered with asbestos-cloth, and to each side of the drum is fastened the flange of shaft, *d*, *d*—which is made well- or funnel-shaped, as shown—by means of screws, or in any other suitable manner, care being taken to prevent leakage of current and solution; and this shaft passes, as before, through stuffing-boxes, *f*, in tanks, *g*. Upon the drum being charged and set in motion, the current, as in the former case, enters the drum through the carbons, and leaves it again through the bell-shaped shaft-ends, the asbestos dividing the two poles. The chloride of gold is deposited in the shaft and in the tanks, all of which form the negative pole. Hydrogen is generated from the decomposition of the water at the negative pole; and to allow this to escape, and further to prevent polarisation, and also to allow any slimes which may accumulate to be withdrawn, openings, provided with valves, *w*, are arranged in the bell, which, on reaching a certain point, are opened automatically to allow the escape of hydrogen, and on passing a given point again they are automatically closed. Instead of the bell-shaped ends terminating through the stuffing-boxes in the standard-tanks, the drum may be provided on each side with a large iron cap, serving as a cathode, asbestos being fastened between the iron and the drum to separate the carbons from the iron, which latter forms the negative pole. The drum may then rest upon wheels, and suitable gearing provided by which it can be revolved. Of course, proper means must be applied to allow the hydrogen to escape."

Only a small working model is yet exhibited, and there may be many small points that will have to be considered when a machine is constructed to work upon a large scale; but as far as I have examined this machine it appears to be well suited for the extraction of gold from the ores. Annexed are plans showing the principle of the machine, which will make the foregoing description more clearly understood.

TREATMENT OF SILVER-ORES.

Seeing that there is a very large percentage of silver in some of the quartz lodes in the North Island, especially in the Marototo, Whangamata, Waihi, and Karangahake Districts, and that no proper process has yet been adopted for the treatment of the ores, it may be interesting to those who are engaged in this class of mining to give a description of one of the successful processes adopted in mining districts in America. The following is an extract from a paper read before the American Institute of Mining Engineers, by C. A. Stetefeldt, and published in their transactions in 1886, which process seems to be applicable to some of the ores found in the Marototo and Karangahake districts.

"*Russell's Process for the Lixiviation of Silver-ores.*

"All silver-ores that do not carry a large percentage of lead or copper can be treated by Russell's process with success and economy. It is not meant that from all ores containing considerable quantities of lead and copper a high percentage of silver can be extracted by this process. Such ores, however, will, in many localities, be reduced to better advantage by smelting. In case lead-bearing ores are suitable for concentration, it may be profitable to concentrate them by Krom's dry system, obtaining a smelting product high in lead, and to lixiviate the tailings and the dust. This plan has been adopted in a mill recently erected in Cortez District, Nevada.

"The dry system of concentration deserves the preference, because it delivers the tailings and the dust in a condition ready for chloridizing-roasting. In wet concentration the drying of the tailings would be expensive, and there would be a considerable loss of silver in the sluice.

FIG.1.

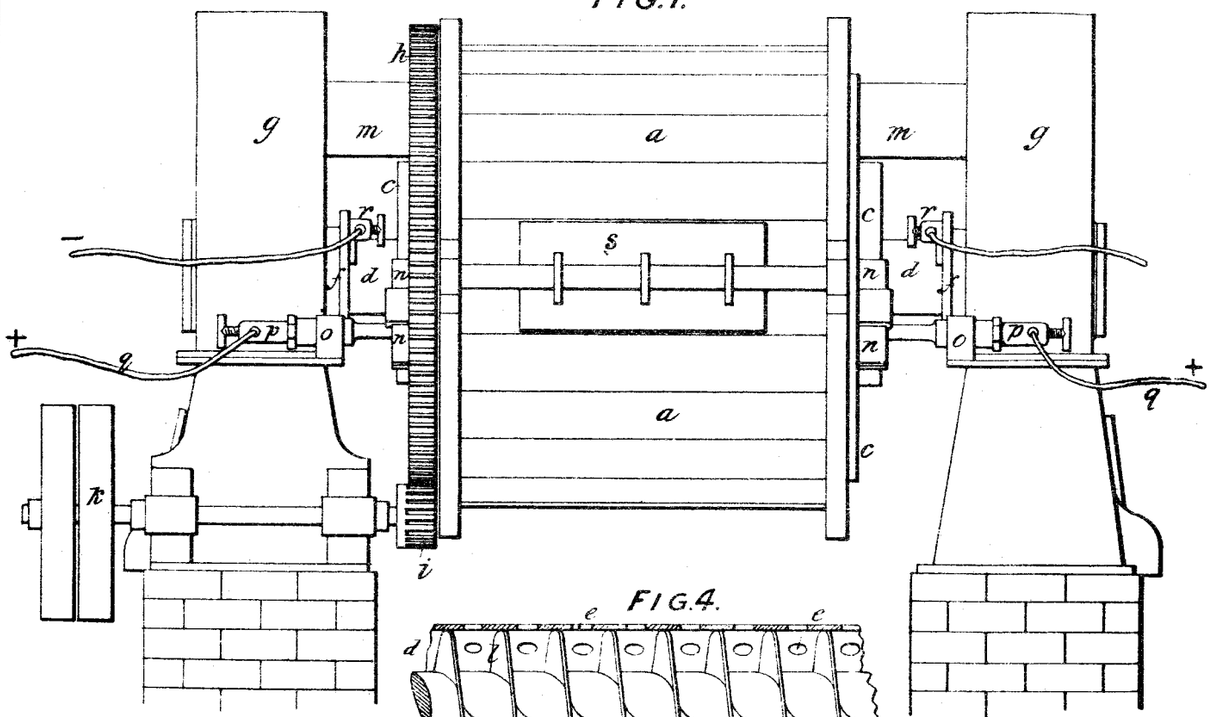


FIG.4.

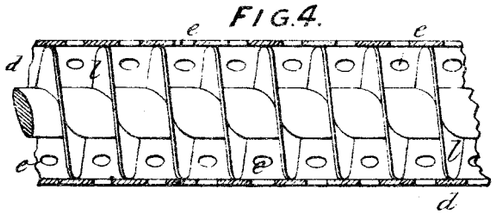


FIG.5.

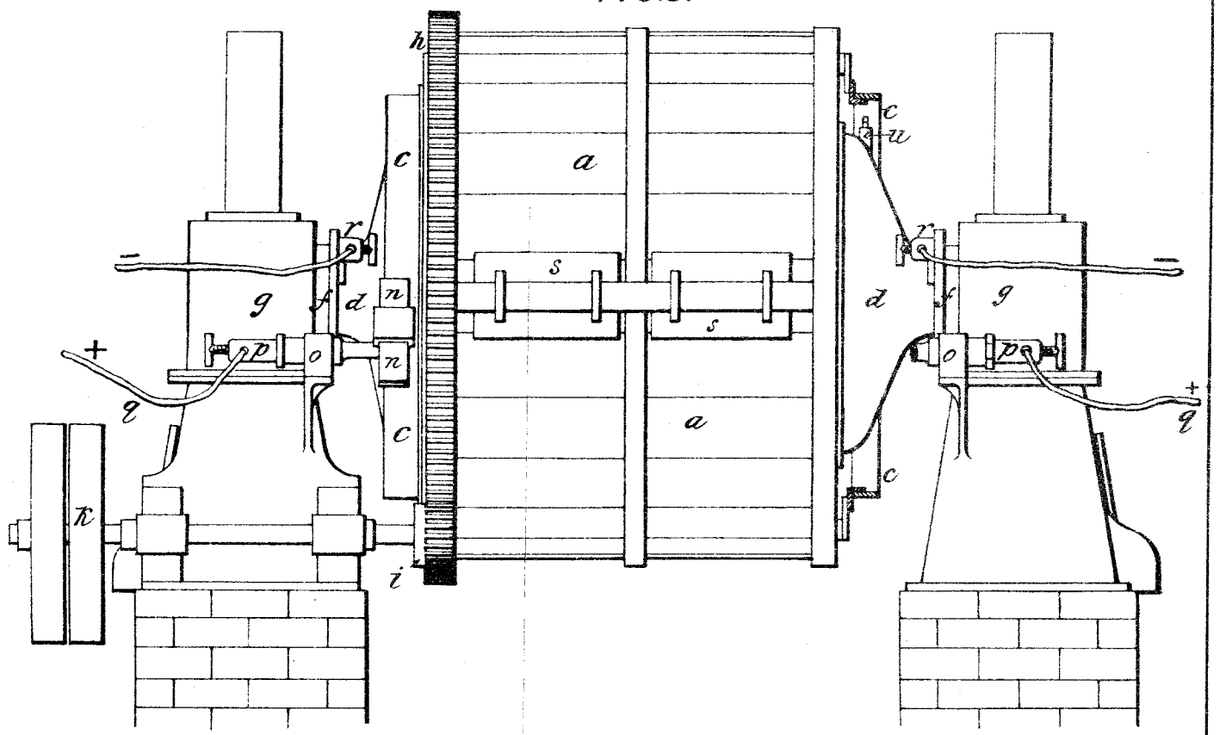


FIG.2

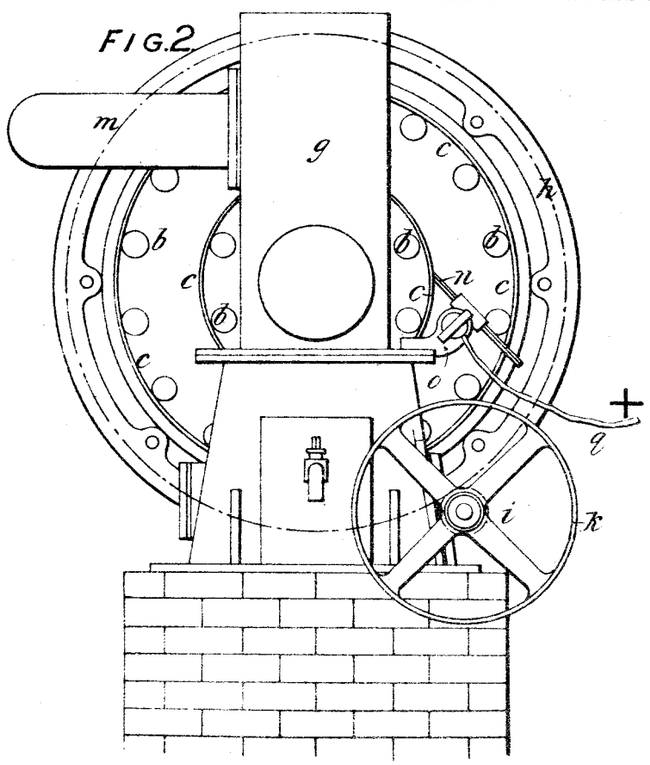


FIG.3.

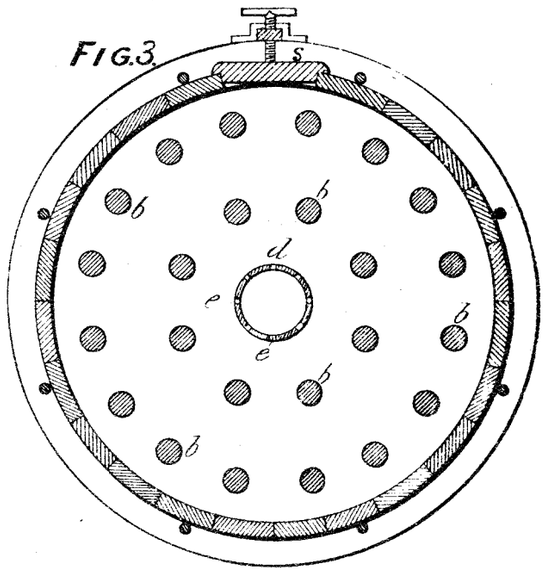


FIG.6.

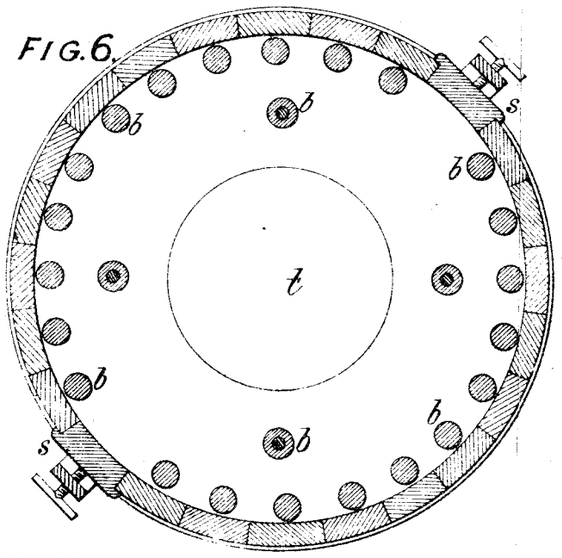
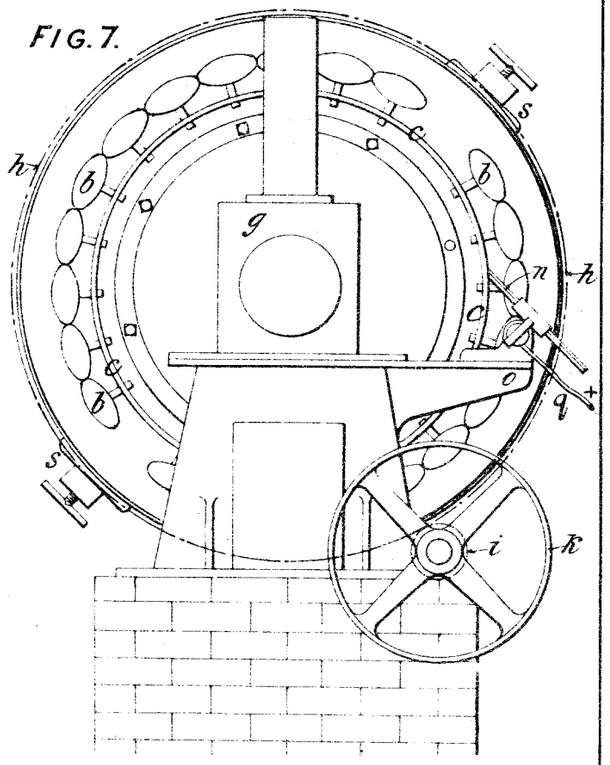


FIG.7.



PLAN SHEWING

CASSEL'S CHLORINATING PROCESS

To Illustrate Report of H.A. Gordon, Inspecting Engineer.

Oxidized ores containing silver-chloride and lead minerals may be lixiviated after crushing, and the tailings may be concentrated for lead. In this case wet concentration would be the most suitable. This has been done at the Old Telegraph Mine, Utah, but the preference to dry concentration is given in all cases which require that concentration should precede lixiviation.

"The Russell process is also adopted to the treatment of tailings resulting from ores which have been worked either by the old lixiviation process or by amalgamation. Whether it is most profitable to lixiviate an ore raw, or after chloridizing-roasting must be determined in each case by actual experiment. Should an ore be deficient in sulphurets, it may become necessary to mix it with pyritic-ores, in order to obtain high chlorination in roasting. Oxidized ores containing manganese may be entirely free from sulphurets, and give high chlorinations in roasting without the admixture of pyritic-ores.

"The operations preceding the lixiviation process—namely, crushing, or crushing and roasting the ore—do not concern us here, since they are almost identically the same as those preceding the well-known treatment by amalgamation. It is necessary to say, however, that in every instance the crushing should be done dry, even in case the ore is lixiviated raw. The size and number of the screen through which the crushed ore should be made to pass, in order to lixiviate with most economical results, can only be determined by a practical test in each individual case, since it depends on the character of the ore. A No. 10 wire-screen may generally be considered the limit of coarseness. In most cases a No. 16 or 20 screen will be used to best advantage, especially if the ore has to be roasted, and a screen of No. 30 mesh will rarely be needed. These numbers represent the number of meshes per linear inch.

"In roasting ores, those furnaces should be used in which the dust collected in the chamber is well chloridized. The Stetefeldt furnace is known to give the most perfect results in that respect. In case the dust remains raw, the proportion of silver extracted is not only diminished for chemical reasons, but the mechanical difficulties in lixiviating fine material are also increased in proportion to the imperfection of its roasting. In the following it is proposed to treat in detail the plant, the chemicals and solutions, and the manipulations peculiar to the Russell process:—

"*The Plant.*—Although the Russell process does not differ materially from that used in the old lixiviation process, it is essential to describe what has been approved by the latest practical experience. The plant consists of lixiviation-vats; tanks for storage and manufacture of solutions, and for the precipitation of metals, pipes, injectors, and pumps for conveying solutions; a filter-press, for collecting precipitates and a refinery for the treatment of the sulphides.

"*Lixiviation-vats, Storage-tanks, &c.*—Dimensions to be recommended for lixiviation-vats, and suitable in most cases, are: Inside diameter, 14ft.; inside height, 6ft. 6in. if the tailings are removed by sluicing, and 5ft. if they are shovelled; thickness of staves and battens, 3in. The sides are made straight, and the best material for their construction found in America is Californian white cedar. The staves should be ordered cut to sweep of vat and 9in. longer than the inside height, but not gained for the bottom. The latter should be without dowle-pins, and cut to a diameter 2in. greater than that of the finished vat. The gaining of the staves 1in. deep is done by hand, leaving a chime of 6in. below the bottom. The bottom pieces are grooved and joined by a tongue $\frac{5}{8}$in. by 1$\frac{1}{2}$in. All joints of staves and bottom must be filled with precision, and are finally put together with a thick coat of white-lead. These precautions are imperative to obtain air-tight vats, so that the Korting ejectors may be used with effect. There are five hoops to each vat, made of 1in. round iron with screwed ends, which pass through cast-iron lugs and are tightened by hexagonal nuts.

"In constructing the storage-tanks for solution, the precipitating-tanks, and the sumps for the filter-press and pump, the directions given above should also be followed. The exact dimensions of these tanks are not of much importance, but the following recommendations are made: Storage- and precipitating-tanks, 10ft. in diameter and 8ft. 6in. high inside; tank for extra solution should be about 500 cubic feet capacity, and sumps for filter-press and pump about 250 cubic feet of capacity each; but the filter-press sump should not be deeper than 4ft.

"*Tank for Sodium-sulphide and Soda-ash.*—The tanks for the manufacture and the storage of the sodium-sulphide solution are made of $\frac{3}{16}$in. boiler-plate. The manufacturing-tank may be 6ft. high by 3ft. 6in. in diameter. The dimensions of the storage-tanks are not essential, but they should have a capacity of about 90 to 100 cubic feet in each. The same also applies to the soda-ash tanks.

"*Filter-press and Pumps.*—For filter-press, Johnson's, of 15in. diameter, is recommended, with twenty-four chambers, six 2in. distance-rings, and one dummy-plate. The chambers are of cast iron, and covered with asphaltum varnish. The force-pump attached to the filter-press should be of iron, lined with hard lead. The brass pump ordinarily sold with a 15in. press is too light and small, and the brass wears out in contact with the solution. The pump for raising the solution into the storage-tank is a plunger pump made of iron and lined with hard lead. Its capacity should be larger than the maximum quantity of solution circulated, so that the pump may not need to run continuously, and time may be left for repairs.

"*Pipes, Valves, and Troughs.*—Hard rubber is the best and, in the end, the cheapest material for all pipes, valves, and cocks that convey or come in contact with the lixiviation solution, and lead is the next best material. Iron or brass valves become useless very soon; but iron pipes may be protected by dipping them into hot asphaltum varnish. For sodium-sulphide and ash-solutions iron pipes are generally used. Troughs for conveying and distributing solutions are made of wood, and painted inside and outside with asphaltum varnish.

"*Korting Injector.*—The modification of the Korting injector, which acts in this case as an ejector, and is attached to the vats to hasten the filtering in lixiviation, is known as the acid siphon-pump. It is lead-lined, and provided with a platinum steam-nozzle. Size 1 is to be used.

"*Fitting up the Lixiviating Plant.*—Each of the storage-tanks and the extra-solution tank are provided, for heating the lixiviation solutions, with a coil of 1in. lead-pipe about 70ft. long, placed 3in. or 4in. above the bottom and connected with a steam-pipe. The storage-tanks are connected

with each other, and with a 3in. pipe running over the lixiviation-vats, and the valves are so arranged that each tank can be used separately.

"The discharge-pipe of the lixiviation-vats is 1½in. in diameter, made of lead or hard rubber, and inserted in the centre of the bottom. It is secured by a threaded cast-iron flange bolted to the outside. The bolts holding the flange pass through the bottom, the heads being countersunk in the wood and bedded in white-lead. This pipe, slightly inclined, is connected with the Korting injector, which discharges into the double distributing-trough (one portion is for solution, and the other for wash-water) standing above the precipitating-tanks. A short piece of rubber-hose is attached to the end of the discharge-pipe, so that the liquor can easily be turned from one portion of the distributing-trough to the other. Near the discharge end of the pipe there is a valve, and between it and the Korting injector a T joint receives the pipe for circulating the extra solution, whereby the latter is returned to the vat if the valve is closed, and the injector is in operation. The false bottoms for the filter and the latter itself are prepared as follows: Wooden slats, 1½in. high and 1in. wide, and separated 1in. from each other, are fastened to the bottom of the vat by iron screws, bedded in thick white-lead. The side of the slats next the bottom is cut out in several places ½in. deep and 3in. wide, so that a passage for the solution is established everywhere. Between the ends of the slats and the staves of the vat a clear space of 1½in. wide is left all round. A strip of wood, 1½in. high and 1in. wide, previously cut by a saw in many places and well soaked in water, so that it will bend easily, is now fastened round the slats, leaving an annular space between the strip and the staves. One thickness of stiff matting, covering the slats and circular strip but not the annular space, forms the foundation for the filter-cloth proper. The latter is of No. 10 canvas duck, cut to a diameter of 6in. greater than the diameter of the vat, so that the ends can be pressed into the annular space described above, and kept in position by forcing down a ½in. rope. The sluice-gate is fastened to the vat by iron belts bedded in white-lead, having its bottom about ¼in. below the surface of the filter. The gate proper is covered with rubber, which protects the iron, and at the same time forms a gasket. The cast-iron frame is protected with asphaltum varnish. The sodium-sulphide manufacturing-tank is provided with a steam-pipe reaching close to the bottom.

"The precipitating-tanks have two outlets. A short piece of 3in. pipe with valve passing through the stave close to the bottom discharges the sulphide into a trough leading to the filter-press sump. The clear solution is drawn by a swing-pipe, 2½in. in diameter, standing inside the tank. This pipe has a joint formed by two elbows and a nipple; one of the elbows is attached to a short piece of pipe passing through the stave 4in. above the bottom of the tank, and discharges into a trough leading to the solution-pump. The filter-press sump is provided with a false bottom, sloping to the outlet, which communicates with the filter-press pump. All vats should be painted outside with white-lead or asphaltum varnish.

"The number of lixiviation-vats, of dimensions given above, necessary for works of stated capacity will vary with the time of leaching or the number of tons of ore in rotation and with the weight of the ore per cubic foot, which can easily be determined for any mill after preliminary tests have been made with the ore to be treated. A mill of 50 to 100 tons daily capacity will always require two storage-tanks, one extra-solution tank, two sumps, one tank for manufacturing sodium-sulphide, two tanks for storage solution of the latter, one tank for purifying soda-ash (provided pure soda cannot be obtained), two storage-tanks for soda solution, one filter-press, one solution pump, and the necessary number of Korting injectors. There should be from two to three tanks for precipitating lead and two to four tanks for precipitating the sulphides. Properly constructed tanks should also be provided for extracting copper and silver from the first wash-water. It is hardly necessary to mention that in special cases a portion of this plant may not be required.

"*Plant for the Treatment of Sulphides.*—It is not the intention to go into a description of the plant required for the treatment of sulphides for two reasons. First, because the lixiviation process proper ends with the production of the sulphides as they leave the filter-press; and, second, because neither the treatment proposed has, so far, been practically applied, nor has this been done by any other new method. A plant for this purpose should always be adapted to local circumstances, and its designing must be left to the discretion of an experienced metallurgist.

"*Arrangement of the Lixiviation Plant.*—The lixiviation-plant, and, in fact, the whole mill should be planned and arranged by an experienced metallurgist, not by a millwright or a foundry-draughtsman, who turn out mills after a fashion of their own, and without the least knowledge of any essential requirements. However, it is necessary to draw attention to some of the important points which should not be neglected. For charging the ore a slightly-inclined car-track should be constructed, passing over the lixiviation-vats and connected with a track leading to the cooling-floor or to the line for raw ore. All other arrangements with conveyers, elevators, and ore-hoppers above the vats, as they exist in some mills, are severely condemned. The lixiviation-vats should not be placed on a solid floor, but should rest upon joists, so that the bottom may be exposed and accessible in case of leakage. Between the joists and the solid floor below sufficient working room must be left. The same applies to the setting up of all other wooden tanks for the storage solutions. The top of the precipitating-tanks should be about 3ft. below the bottom of the lixiviation-vats. If lead is to be precipitated separately and the grade of the mill-site does not permit the placing of the silver precipitating-tanks below those of lead all the precipitating-tanks are placed on the same level, and the solution, after precipitation of the lead, is transferred to the silver precipitating-tanks by Korting injectors. The filter-press and solution-pump stand above their respective sumps; but the pump filling the filter-press is placed on a level with the bottom of the sump from which the sulphides are drawn, because, on account of the weight and thickness of the sulphide slimes, this pump has not much suction-power. The refinery for the sulphides is best located in a building by itself, separated from the mill. Finally, abundance of room about the apparatus and well lighted and ventilated buildings are most desirable features.

"*The Chemicals and Solutions.*—The chemicals used are sodium-hyposulphite or the commercial hyposulphite of soda, copper-sulphate or bluestone, caustic soda, sulphur, sulphuric acid, and sodium-carbonate or soda-ash.

"*Sodium-hyposulphite.*—This is packed in barrels, and does not decompose in contact with the atmosphere. If imported in large lots from England it costs in New York ¾d. a pound. If bought from dealers the price asked is 1⅛d. per pound in New York, 1¼d. in St. Louis, and 1½d. in San Francisco.

"*Caustic Soda.*—Only a high-grade article should be ordered of 70 to 76 per cent. It is principally imported from England, put up in sheet-iron drums, holding 600lb. to 700lb. It should not be left exposed to the air after the drum has been opened as it absorbs carbonic acid. The price in New York is 1¼d. per pound for 60 per cent. Hence 74 per cent. caustic soda would cost 1½d. per pound.

"*Sodium-carbonate.*—It is most economical to buy the pure alkali of 58 per cent., made by the Solway or ammonia process. This alkali is in the form of white powder, and is so pure that it contains 98·7 per cent. of sodium-carbonate, the remainder being principally sodium-chloride and sulphate and 0·25 per cent. moisture. On account of the entire absence of sodium-sulphide and caustic soda (which are always found in the ordinary soda-ash) the solution for the precipitation of lead does not require purification.

"*Copper-sulphate.*—Price is 2⅛d. per pound in New York, 2d. in Omaha, 2½d. in St. Louis and San Francisco.

"*Sulphur.*—It is immaterial whether the sulphur is crude or refined or flowers of sulphur. Lump sulphur should be pulverized so as to pass through a No. 10 screen before using it in the preparation of sodium-sulphide. It is more convenient to buy the sulphur already pulverized. Price in New York of refined sulphur in rolls is 1¼d. per pound.

"*Sulphuric Acid.*—Off 66° Beaume is best transported in sheet-iron tanks, which hold about 1,700lb. If shipped in this way it is much less than in glass carboys, the cost of such tanks being 26s. each; price in New York, ¾d. per pound.

"*Solutions: The ordinary Stock Solution.*—This is made by dissolving a proper quantity of sodium-hyposulphite in a measured quantity of water in the storage-tanks. To hasten the solution steam may be passed through the lead pipe-coil. As the weight of a cubic foot of water is 62½lb., this number of pounds of sodium-hyposulphite added to 100 cubic feet of water will produce a solution of 1 per cent. concentration, and so on. Practical experience has demonstrated that it is not economical to work with a solution of higher concentration than 2 per cent., even if high-grade ores have to be treated. In that case increased volume of solution is made to do the work. With low-grade ores a solution of 1 per cent., and even less, concentration may be most profitable. In starting new works it is best to begin with 2 per cent. solution, and then diminish its concentration according to circumstances. The strength of the solution after continued use changes, and in most cases it becomes weaker. The weakening is caused as follows:—

"(1.) By admixture of some wash-water which may precede and always follows the solution.

"(2.) By a condensation of steam from the Korting injectors.

"(3.) By a decomposition of hyposulpite through atmospheric influences.

"(4.) By a decomposition of sodium-hyposulphite withcopper sulphate in making the extra solution. For each 1lb. of copper sulphate thus consumed 1lb. of sodium-hyposulphite is destroyed.

"On the other hand the solution gains strength by evaporation, but principally in precipitating the sulphides of silver, copper, and lead (provided the lead has not been previously eliminated by sodium-carbonate) with sodium-sulphide, which always contains a large amount of hyposulphite. The more silver, lead, and especially copper precipitated, the larger will be the quantity of hyposulphite added to the solution, so that cases may exist where all the loss in hyposulphite is not only compensated, but the solution may even increase in strength.

"After the most advantageous concentration of the solution has been determined by experience, it should be maintained by constant addition of sodium-hyposulphite. This is best done by making the extra solution, as will be shown later on. The concentration of a solution of hyposulphite after it has been in use cannot be estimated, even approximately, by its specific gravity, for reason that will soon become apparent. Hence a chemical test is the only one on which reliance can be placed. One method is to ascertain how much silver-chloride will be dissolved by a certain number of cubic centimeters of the solution, and to compare the result with a scale that has been prepared for this purpose. Preference, however, should be given to the volumetric assay, which is based on the fact that a solution of iodine in potassium iodide in contact with sodium-hyposulphite changes the latter to sodium-titrathoniate, while the iodine combines with sodium to sodium-iodide. The end of the reaction is indicated by the blue colour of starch which has been added to the hyposulphite solution. The details of this can be found in any book on analytical chemistry. The original stock solution is subjected to other changes outside those mentioned above in conseqnence of a gradual accumulation of sodium-chloride, sulphate, and titrathoniate. It can easily be seen whence these salts are derived. Sodium-chloride and titrathoniate do absolutely no harm. Sodium-sulphate diminishes the solvent energy of the solution only slightly. Calcium-salts are introduced if gypsum is present in raw ore, or if calcium-sulphate or caustic lime exist in roasted ore. In case the lead is precipitated by soda, the calcium is also precipitated, and no calcium-salts can exist in the solution. The concentration of the solution in these salts, however, does not go on indefinitely, but reaches a maximum and then remains stationary. It can easily be seen that this effect is produced by the wash-water, which either precedes or follows the lixiviation solution. In this operation both a loss and a dilution of the lixiviation solution takes place.

"There is, however, another change in the condition of the stock solution that is of great importance—namely, its assuming a caustic solution. Silver-ores only that carry a comparatively large percentage of antimonial and arsenical compounds may be benefited by treatment with a

caustic solution. Whenever the stock solution shows the presence of caustics it must be neutralised with sulphuric acid. The latter, Mr. Russell states, is not diluted, but added in concentrated form while stirring the solution. The consumption of sulphuric acid per ton may be from $\frac{1}{4}$lb. to $\frac{3}{4}$lb. It seems most convenient to add the sulphuric acid to a caustic stock solution in the silver precipitating-tanks immediately after the precipitation of the sulphides has been finished. The reaction of the solution on litmus-paper should be closely observed, so that not more acid is consumed than is absolutely necessary. Copper-sulphate also neutralises the caustic; hence an extra solution will have to assume a caustic reaction, and can be made from a caustic ordinary solution. In fact, ordinary solution having an acid reaction should not be used in the preparation of extra solution, because the latter is then more liable to decompose. On account of the greater cost of copper-sulphate, preference should be given to the use of sulphuric acid for neutralising a caustic stock solution.

"It is evident that the amount of stock solution kept in hand and in circulation should be reduced to a minimum. The quantity of stock solution required for works of given daily capacity depends upon the time of leaching with extra and ordinary solution, and upon the volume of the solution necessary to saturate a ton of ore. This will be made clear by example. Suppose the daily capacity is 80 tons—1 ton requires 9 cubic feet of solution for saturation; the time of leaching with extra solution is six hours. In that case 100 tons of ore are constantly under treatment, and this requires 900 cubic feet of solution for saturation. Besides, a certain quantity of the solution stands above the charge in the vats—say, 150 cubic feet—and one precipitating-tank is full and settling, and the second one is half filled—say, 750 cubic feet for both—then there is a certain accumulative solution in the sump for the pump and filter-press—say, 250 cubic feet. Finally, we must have sufficient solution in the storage-tanks to make a charge of extra solution of about 300 cubic feet; and, in addition to that, we should have not less than 300 cubic feet to supply the lixiviation-vats. This would give a total of 2,400 cubic feet. That works of large capacity require comparatively less stock solution than those of smaller capacity can easily be seen. In most cases the best results are obtained in lixiviating with an ordinary solution heated from 90° to 125° Fahrenheit.

"*Extra Solution.*—This is not kept in stock, but is made up in charges as needed, and is then immediately used. It decomposes much more quickly than ordinary solution, and is converted into the latter before leaving the precipitating-tanks. As a rule, the quantity of extra solution made and used is just sufficient to saturate the ore. The only exception to this rule occurs in the lixiviation of roasted ores containing caustic lime, as will be shown later on. The extra solution for raw ore is made as follows: The necessary amount of copper-sulphate put into a box with holes placed above the extra-solution tank is dissolved by ordinary solution turned on from the storage-tank. Before this is done, however, the tank below is filled with about two-thirds of the required amount of ordinary solution. In this way the strong copper solution meets at once a sufficient amount of sodium-hyposulphite to prevent the precipitation of a canary-yellow salt of cupreous-hyposulphite.

"As already stated above, it is not judicious to use an acid stock solution in preparing the extra solution, because cupreous-hyposulphite decomposes more quickly upon heating in the presence of an acid than if the solution is neutral. If the extra solution is to be used warm the ordinary solution is previously heated in the storage-tank, or in the extra tank itself. In case the stock solution needs strengthening a proper amount of sodium-hyposulphite is put into a box over the extra-solution tank and dissolved prior to the copper-sulphate. The introduction of fresh hyposulphite is most judicious at this stage of the process, by reason of the decomposition of sodium-hyposulphite with copper-sulphate, as already referred to, as the fourth cause of weakening the stock solution. It is evident that the extra solution, by passing the precipitating-tank, must produce an ordinary solution of less concentration than the stock solution possessed from which it was made, unless a fresh supply of hyposulphite has been added. Of course, a part of the hyposulphite lost in the manufacture of the extra solution is replaced by the hyposulphite entering with the sodium-sulphide in precipitating the copper and silver.

"The consumption of copper-sulphate for the extra solution is generally calculated for a ton of ore and varies between $2\frac{3}{4}$lb. and 7lb. As it takes from 7 to 10 cubic feet of solution to saturate 1 ton of ore, and not more than this quantity of extra solution is generally needed, its concentration in copper sulphate may vary between $\frac{6}{10}$ and $\frac{1}{10}$ per cent. Only, if caustic lime is present in roasted ore weaker but larger volumes of extra solution of $\frac{4}{10}$ to $\frac{1}{10}$ per cent. concentration are used. Since the effect of the extra solution depends, in a certain measure, more upon its concentration than its quantity it is apparent that the consumption of copper-sulphate per ton of ore is affected by the specific gravity of the ore, or by the quantity of solution necessary to saturate a ton of ore. Hence roasted ores, on an average, require more copper-sulphate than raw ores, although, in the latter case, the extra solution may have to perform more work than in the former.

"After the most advantageous quantity of copper-sulphate required per ton of ore has been determined by experience, another point should not be neglected in the preparation of the extra solution. It has been demonstrated that those extra solutions are the most effective in which the relation between the quantity of copper-sulphate and sodium-hyposulphite is as 1 to a fraction above 2—we will say, for the sake of safety, as 1 to $2\frac{1}{4}$. An excess of copper causes the formation of an insoluble cupreous-hyposulphite salt, which will only dissolve upon more sodium-hyposulphite. An excess of sodium-hyposulphite in the extra solution, while it diminishes its efficiency upon metallic silver, silver-sulphide, and certain silver minerals, does not act as injuriously as an excess of copper. Especially if the extra solution is used on raw ores prior to the ordinary solution, and these ores carry a fair percentage of the silver in the form of chloride, an excess of sodium-hyposulphite is beneficial for the more rapid extraction of the silver-chloride. From this it follows that in making the extra solution the strength of the stock solution should be approximately known, and that if it is deficient in sodium-hyposulphite a proper amount of the latter should be added. To illustrate this: Suppose that ore is treated which requires 8 cubic feet of solution to saturate 1 ton;

that the normal concentration of the stock solution is 1½ per cent. in hyposulphite; that 5lb. of copper-sulphate is needed per ton of ore. The 8 cubic feet of stock solution would represent only 7½lb. of hyposulphite: hence not less than 3¾lb. of sodium-hyposulphite should be added to each 5lb. of copper-sulphate in 8 cubic feet of solution in order to produce a normal extra solution. Off the 11¼lb. sodium-hyposulphite now contained in 8 cubic feet of solution 5lb. will be destroyed by the copper-sulphate, leaving 6¼lb. intact. After precipitating the extra solution an ordinary solution of 1¼ per cent. concentration would result. As there is, however, a considerable gain in hypophosphite from the sodium-sulphide the solution will be much stronger than 1¼ per cent., and will probably exceed the original stock solution in concentration. In case the extra solution is preceded by ordinary solution, which is always done in treating roasting ore without caustic lime, and sometimes in treating raw ore, it can be made in the lixiviation-vat itself, on the top of the ore, by stopping the leaching as soon as the liquid has sunk to the surface of the ore. The copper-sulphate is now dissolved, if necessary, with the addition of hyposulphite, and under the same precautions as stated before, by filling the space above the ore about 12in. deep with solution. As this volume is not sufficient to saturate the total amount of ore in the vat the extra solution has to be made in several charges in succession. This method, in the cases specified, is always used and recommended by Mr. Russell. The extra solution is, in most cases, used to best advantage at a temperature of from 90° to 100° Farenheit. If circulated by the Korting injector it is more or less heated thereby.

"*The Sodium-carbonate Solution.*—If pure soda, manufactured by the ammonia process, has been bought this solution does not require purification. It is made by dissolving the soda in hyposulphite stock solution in preference to water, so that in precipitating the lead the concentration of the stock solution in hyposulphite is not diminished. It is recommended to dissolve on each cubic foot of stock solution from 12lb. to 16lb. of soda directly in the storage-tank. In case ordinary soda-ash is at hand it must be purified with copper-sulphate. In this case it is imperative to dissolve soda-ash and hyposulphite-solution. If copper-sulphate solution is carefully added whilst stirring until a black precipitate ceases to appear generally not more than 1lb. of copper-sulphate is consumed to purify 100lb. of soda-ash. The clear solution is drawn into the storage-tanks. Caustic soda is also removed from the solution by copper-sulphate.

"*Sodium-sulphide Solution.*—In order to attain a sodium-sulphide of maximum precipitating-power, the following *modus operandi* should be strictly followed: The whole contents of a drum of caustic soda, 600lb. to 700lb., are broken up into lumps, which should not exceed 5lb. or 6lb. in weight, and which are placed into the iron tank previously described. About 3 to 3¾ cubic feet of water are added, provided dry steam of high pressure is supplied; but less water is used if the steam is not dry and of low pressure. Steam is now turned on, and the tank covered to avoid the spattering of the lye. The dissolving of the caustic soda takes from two to three hours, and at the end of the operation sufficient steam should be admitted to raise the temperature of the lye to not less than 200° Fahrenheit. The condensed steam increases the volume of solution. Its total volume should finally be such that it measures as many cubic feet as there were pounds of caustic soda charged divided by 62½. In other words, one cubic foot of lye should hold 62½lb. of caustic soda. Now pulverized sulphur two-thirds of the weight of the caustic soda is added, a shovelful at the time under stirring. The temperature of the mass rises; it boils and foams, swelling to several times its original volume, while the chemical reaction takes place. If the process is conducted according to the directions given above the sulphur will dissolve rapidly and completely. Should the lye have been either much less concentrated or of lower temperature than previously stated the solution of sulphur will not be complete. In this case the lye has to be boiled with steam for three or four hours. The precipitating coefficient of the finished product is, however, thereby diminished. The sodium-sulphide solution thus obtained is so concentrated that it should solidify upon cooling. It is diluted with hyposulphite stock solution in preference to water, and then transferred to the storage-tanks. The dilution is carried to such an extent that the total volume of the solution measures as many cubic feet as there has been pounds of caustic soda divided by eight.

"The silver precipitating coefficients for caustic soda and sulphur vary according to the proportion of these reagents, and therefore influenced by other circumstances. The highest precipitating coefficient obtainable for caustic soda is 2·3, and for sulphur 4—that is to say, 1 part of caustic soda or sulphur will precipitate 2·3 and 4 parts of silver respectively.

"*Manipulation.—General Rules for Handling the Lixiviation Solutions.*—Before entering into a detailed description of the modifications in lixiviation necessary in special cases, it is best to establish general rules that must be followed under all circumstances, and without which the best results and the greatest economy cannot be reached. The first step to be taken is to ascertain the weight of the ore per cubic foot and the amount of solution required for 1 ton of the ore. From these figures the number of tons of the charge in the lixiviation-vats and the number of cubic feet of solution necessary for saturating the ore are calculated. One cubic foot of dry ore (these ores are generally oxidized, and without any large percentage of sulphurets) weighs from 75lb. to 100lb., and the weight of 1 cubic foot of dry roasted ore is from 55lb. to 90lb. It takes from 7 to 9 cubic feet of solution to saturate 1 ton of raw ore and from 8 to 10 cubic feet for roasted ore.

"All roasted ores are first treated with water, called the first wash-water. Whether the first wash-water is followed by ordinary or by extra solution, it is imperative, at the end of this operation, to stop the discharge of the liquor as soon as the water has sunk to the surface of the ore. The space above the surface of the ore is now filled with solution, and leaching is commenced and continued until a quantity of solution, sufficient to saturate the charge, has been supplied. Now the discharge of the liquid is turned into the precipitating-tank. At the end of leaching with hyposulphite the second wash-water follows the lixiviation solution. Here, again, leaching is stopped as soon as the solutions sink to the surface of the ore. A quantity of water is now turned on sufficient to saturate the charge, and as soon as the liquor sinks to the surface of the ore discharging into the precipitating- tank is stopped, and the wash-water is allowed to run to waste, or it is left in the

charge, as will be seen later on. In applying the extra solution to roasted or raw ore after treatment with ordinary solution, and in the minimum quantity, namely, just sufficient to saturate the charge, the same *modus operandi* as previously described is adopted, in order to replace the ordinary solution. As soon as this is accomplished, the discharge of the solution from the lixiviation-vat is stopped, and, as will be afterwards explained, circulation of the extra solution is commenced. But outside of these measurements, which are absolutely necessary, it is recommended to measure all the wash-water and lixiviation solution consumed, so that only a fixed quantity, established by experience, is passed through the charge. This can be accomplished by applying the solution in charges measured in the lixiviation-vat itself. The space above the ore—say, 12in. deep—is filled with solution. The discharge at the bottom of the vat having been stopped, leaching is now resumed, and continued until the solution has sunk to the surface of the ore. At this moment the discharge is stopped again, and a fresh quantity of solution put on, and so on. This method is somewhat tedious on account of the frequent interruptions of the process; but it is the only one to be recommended.

"The facility with which a solution filters through the charge depends upon various conditions. With raw ore, a large percentage of slimes acts injuriously, especially if they consist of clay and talc. The roasting of such material has a beneficial effect. Well roasted ores generally leach freely, even if in a fine condition. This difficulty may become serious in case of raw tailings, which are mostly treated in the form of slime.

"By the Korting injector attached to the discharge-pipe of the lixiviation-vats, a vacuum below the filter can be produced, and the solution forced through with considerable speed. This method is the most simple and effective of all for that purpose, and the only one to be recommended. The introduction of the Korting injector is one of the greatest improvements that has been made in lixiviation from a mechanical standpoint. Through the same injector the circulation of the extra solution becomes possible. By circulation is meant the drawing of the solution from the bottom of the lixiviation-vat, and retaining it in the same vat, so that it filters through the ore continuously.

"The rate of leaching or the volume of solution that filters through the charge in a given time is very valuable. Mr. Russell states that the most advantageous rate of leaching is as fast as possible; but if it is from 6in. to 8in. per hour he rather prefers to have it at that rate, instead of accelerating it to 12in. or 14in. by using the Korting injector. Roasted ores containing caustic lime should be leached rapidly.

"Another precaution in lixiviation should not be neglected. In introducing water or solution into the vat the force of the current should be broken by directing it against a piece of matting, or by running it through the copper-sulphate box, in case the extra solution is made in the lixiviation-vat, so that the even surface of the ore is not disturbed.

"*Charging Lixiviation-vat with Ore.*—After the vat is charged the surface of the ore should be levelled. Upon application of the first wash-water to roasted ore or lixiviation solution to raw ore the charge sinks more or less. This shrinkage is from 10 to 18 per cent. for raw ore, and from 12 to 24 per cent. for roasted ore. For this reason the vats should be filled to such a height that after the settlings of the charge has taken place a space of about 12in., rather more than less, is left free above the ore. This is easily accomplished after a few trials. A vat 14ft. by 6ft. 6in., as formerly described, will hold from 38 to 48 tons of raw ore, or from 27 to 38 tons of roasted ore.

"*Treatment of Roasted Ores.*—The first wash-water: The quantity of this varies between 20 and 80 cubic feet per ton of ore; the time of leaching from one hour and a half to four hours. It is generally used cold, but with warm water the operation is accomplished sooner. The soluble salts removed by the first wash-water are principally sodium-sulphate and chloride; besides these there may be the soluble sulphate and chlorides of copper, zinc, manganese, alumina, iron, and calcium, also antimonial and arsenical salts, and caustic lime. Should lead-chloride be present in the roasted ore, it will be changed to sulphate in contact with sulphate solution. Lead-sulphate, however, is somewhat soluble in a concentrated sodium-sulphate and chloride. So are cupreous-chloride and silver-chloride. The leaching with water is suspended, and the liquor ceases to give a perceptible reaction with sodium-sulphide. The first portion of more concentrated wash-water may hold sufficient copper and silver to be worth saving, and in this case is collected in a separate tank. Cement silver can be precipitated from it by copper, and the copper subsequently by iron. Warming and the addition of sulphuric acid hasten the reaction.

"Silver-chloride, cupreous-chloride, lead-sulphate, and antimonial salts are in part precipitated from the concentrated wash-water by diluting it. Should the ore contain caustic lime the wash-water, provided the solution shows a caustic reaction, will be free from copper, but may hold considerable silver. In this case the silver is best precipitated with scrap-iron after the caustic lime has been neutralised with suphuric acid, and a surplus of acid has been added besides. The reaction is hastened by treating the solution with steam. At Lake Valley, New Mexico, a precipitation of the cement silver was accomplished in twelve hours, and 1½ to 4oz. of silver per ton of ore was saved, with an expenditure of 2lb. of sulphuric acid. Complete statistics regarding this question are not yet at hand.

"It has been recommended in certain cases to introduce the wash-water below the filter, and force it up through the ore until it reaches several inches above the charge; then fill up the vat from above and reverse the current. Precipitation of silver-chloride, &c., takes place as already explained, and these salts are caught in the charge. It is also claimed that the subsequent filtering of the solution is more rapid. This may be due to the removal of fine ore particles from the filter through the upper current of the water.

"*The Lixiviation.*—Under this head we have to consider the following cases:—

"(*a.*) The roasted ore does not contain caustic lime. The order in which the solutions are applied in this case is one-half of the ordinary solution; then the extra solution, followed by the other half of the ordinary solution. The volume of the ordinary solution varies 20 to 120 cubic feet per ton of ore; the time of leaching with it from twelve to thirty hours. The extra solution is

circulated from four to six hours. Both solutions are generally used warm. After the treatment with water has been finished, and the wash-water has nearly been replaced by a measured quantity of ordinary solution, the liquid running from the lixiviation-vats should be closely watched for the appearance of the ordinary solution by testing it with sodium-sulphide. As soon as a perceptible reaction takes place the solution is turned into the precipitating-tank. Leaching is now continued until the first half of the ordinary solution has passed through the charge. Then the extra solution is applied in the manner previously described, only with the following modification: The quantity of the extra solution prepared should be from 5 to 8 or even 10 per cent. less than is required to saturate the charge. The object of this precaution is to avoid waste in any extra solution by running it into the precipitating tanks before the cupreous-hyposulphite has done its work on the ore, which would easily occur if the volume of the extra solution were either the exact amount needed to saturate the charge or in excess of it. After the extra solution has circulated a sufficient time it is replaced with ordinary solution, and leaching with the latter is recommended, and continued in the usual way.

"(*b.*) The roasted ore contains an appreciable percentage of caustic lime. In this case the treatment is modified as follows: A large volume of extra solution precedes the ordinary, and the former is not circulated, but applied like the latter. The volume of the extra solution varies between 18 and 40 cubic feet per ton of ore, and that of the ordinary solution between 30 and 90 cubic feet. Both solutions are used cold. Practical experience has demonstrated that if roasted ore containing an appreciable percentage of caustic lime are treated with ordinary solutions after the first wash-water the result is very disastrous, and that the damage done is only partially made good by subsequently leaching with extra solution. But if the extra solution is applied at once the cupreous-hyposulphite neutralises and counteracts the deleterious effects of the caustic lime, and leaves the silver in a soluble form. The extra solution is put on in several charges, commencing with one of $\frac{4}{10}$ per cent. concentration in copper-sulphate, and followed by others of less concentration, the last one only containing $\frac{1}{10}$ per cent. of copper-sulphate. Before the extra solution follows the first wash-water it has been found beneficial to impregnate the ore with a small quantity of strong copper-sulphate solution. It can easily be seen that the first portion of the extra solution replacing the wash-water now becomes more or less diluted in contact with water. This dilution may be so considerable that an insufficient quantity of copper is present to protect the silver from the deleterious influence of the caustic lime. The *modus operandi* is as follows: About 1lb. of copper-sulphate per ton of ore is dissolved in such a volume of water that it will fill the lixiviation-vats to a depth of not less than 1in. and not more than 2in.

"As soon as the first wash-water has sunk to the surface of the ore, leaching is suspended and the copper solution is put in. The latter is made to sink a little below the surface of the ore before the extra solution is run on the charge, and leaching is started again. When the extra solution has replaced the wash-water the discharged liquor is turned into the precipitating-tank, and leaching with extra solution is continued. How the ordinary solution is to be applied after leaching with extra solution has been completed needs no further explanation. The second wash-water, as soon as the extraction of the silver is completed, is in order. Its quantity is from 7 to 10 cubic feet per ton of ore. The time of this operation varies between an hour and a half and two hours and a half. After the ordinary solution has been replaced by the wash-water the latter is allowed to run to waste if the tailings are to be shovelled out; but remains in the charge if the tailings are to be removed by sluicing.

"*Discharging the Tailings.*—The tailings are now sampled with a long butter-tester if they are removed by sluicing, or a sample is taken from each car if the tailings have to be shovelled out. The quantity of water required for sluicing is about 12 cubic feet per ton of ore. Hence it will be possible in most cases to resort to sluicing if ores are treated raw. Should water be scarce in working roasted ores, the first wash-water after silver and copper have been precipitated from it may be pumped to a tank and used for sluicing. This method of removing tailings will, under all circumstances, be cheaper and more convenient than shovelling.

"*Treatment of Raw Ores.*—Raw ores require no first wash-water. The order in which the solutions are applied is, in most instances, extra solution followed by ordinary. In some instances, but not frequently, the extra solution is both preceded and followed by ordinary. In the latter case the operation is the same as already described for roasted ore without caustic lime. The extra solution is always circulated. If leaching is commenced with extra solution its volume should be sufficient to cover the charge after circulation has been started. Should the extra solution made in the extra tank fall short of its required volume, enough of ordinary solution is added. The time of circulating the extra solution is from four to six hours. The volume of ordinary solution varies between 20 and 90 cubic feet, and the time of leaching between twelve and thirty hours. Both solutions are generally used warm. What has been said in the former paragraph about the second water and the discharging of the tailings holds good here also.

"Mr. Russell conducted several interesting experiments in reference to the treatment of raw ores and ores subjected to an oxidizing roasting. The samples experimented on were obtained from the Sombeerete District and vicinity, Zacatecas, Mexico. These experiments showed the remarkable effect produced by treating the ore with an aqueous solution of copper-sulphate prior to the application of the lixiviation solution,—

"(1.) Experiments with ores that had been roasted without salt in a reverberatory furnace for two hours at a low heat:—

"Value of ore, 24·9oz. silver per ton.

"Value of tailings, 14·58oz., after lixiviation with ordinary solution.

"Value of tailings, 7·5oz., after lixiviation with ordinary and extra solution.

"Value of tailings, 2·6oz., after first using copper solutions and then adding sodium-hyposulphite.

" (2.) Experiments with samples of raw ore tailings after treatment:—

Value of Raw Ore.	Ordinary Solution.	Extra Solution.	Copper-sulphate Solution, and then adding Sodium-hyposulphite.
13·4oz. ...	12·9oz. ...	10·2oz. ...	7·0oz.
18·2oz. ...	15·3oz. ...	12·4oz. ...	7·0oz.
16·3oz. ...	16·2oz. ...	10·4oz. ...	7·8oz.

" (3.) Experiments with samples of raw ore treated at present by the Patio process:—

" Value of raw ore, 12·15oz. silver per ton.

" Tailings, 7·5oz., after treatment with ordinary solution.

" Tailings, 4·62oz., after treatment with extra solution.

" Tailings, 2·85oz., after treatment with copper-sulphate solution and then adding sodium-sulphite.

" There is also a marked difference in treating ores that have been roasted with salt, as the following experiment will show:—

" (4.) Experiments with ores that have been roasted with salt and were treated by barrel amalgamation, extracting about 65 per cent. of the silver.

" Value of ore, 14·3oz. silver per ton.

" Tailings, 4·86oz., after lixiviation with ordinary solution.

" Tailings, 4·86oz., after lixiviation with extra solution.

" Tailings, 2·19oz., after treatment with copper-sulphate solution and then adding sodium-hyposulphite.

" All these experiments were laboratory tests only, but there is no doubt but the results will be practically the same on a large scale. For quantities of chemicals and the *modus operandi* used in these tests see 'Laboratory Work.'

" *Constitution of Lixiviation Solution before Precipitation.*—The lixiviation solution may hold outside of silver and gold the following elements that play an important part in precipitation—namely, copper, lead, antimony, arsenic, and calcium. Neither iron, zinc, nor manganese, can be present if the first wash-water has been properly applied.

" Copper is derived from the extra solution from cupreous-chloride in roasted ores and from copper-carbonate in raw ores. Lead is introduced through lead-sulphate in raw and roasted ores. Antimony and arsenic are derived from antimoniates and arseniates in roasted ores. Calcium comes from calcium-sulphate, and caustic lime from roasted ores, and gypsum in raw ores. Although the quantity of the loose metals in the lixiviation solution rarely exceeds a few pounds per ton of ore, the value of the precipitated sulphides in precious metals may nevertheless be therefore diminished to a considerable extent.

" *Precipitation of Lead.*—The precipitation of lead with sodium-carbonate solution is very easily effected, and the precipitate settles in a short time. The necessary stirring is done with a piece of hard wood. Care should be taken not to add an excess of soda. Although the presence of the reagent in the hyposulphite solution is not injurious to the extraction of the silver in lixiviation, it can easily be seen that should it become necessary to neutralise any caustic soda in the solution, the consumption of sulphuric acid would be increased by neutralising sodium-carbonate also. The clear solution is decanted into the silver precipitating-tank, while the lead-carbonate is allowed to accumulate from several charges before it is taken to the filter-press. The lead-carbonate is very pure, containing no other base metals, and assays only from $\frac{1}{2}$oz. to $\frac{3}{4}$oz. of silver to the ton. Should lime be present in the solution, the precipitate will be contaminated by calcium-carbonate. In practice, less than 1lb. of soda is consumed in precipitating 1lb. of lead, or 1$\frac{1}{3}$lb. of lead-carbonate.

" Although lead-sulphate is more easily soluble in warm than in cold hyposulphite solution, and although the concentration of the latter increases its solvent energy for lead, the differences in the amount of lead dissolved are practically not very great, whether the solution has been used warm or cold, or whether it has been somewhat more or less concentrated. Neither does a large amount of lead-sulphate in the ore affect a final result materially, since it is by no means all dissolved. The amount of lead that finds its way into the lixiviation solution rarely exceeds 5lb. per ton of ore. Of course it is, as a rule, desirable to reduce the quantity of lead dissolved as much as possible without diminishing the extraction of the silver. The separate precipitation of the lead as carbonate from the lixiviation solution is always a matter of economy, and may be even a source of profit, provided the amount realised from the sale of the lead-carbonate exceeds the cost of the soda consumed. That the precipitation of lead with soda is always economical can easily be seen, since the lead would have to be precipitated otherwise with sodium-sulphide, a reagent much more costly than soda. Besides this, the amount realised from the sale of the lead-carbonate is a clear gain.

" *The Precipitation of Silver.*—This part of the process is very easily executed. It is hardly necessary to mention that the solution should be well stirred with a piece of hard wood while sodium-sulphide is added, and that this reagent should not be used in excess. In case this has been done by inadvertence, more fresh lixiviation solution from one of the vats must be added. Hence the precipitating-tanks should not be filled too much. It is far better to leave a slight quantity of silver in the solution, and not precipitate the last trace of it.

" If the solution contains lime which has not been previously parted by soda, the precipitation of lead having been found necessary, an insoluble calcium-monosulphide may be precipitated, and may contaminate the precious sulphides. In this case, however, the light yellow calcium-sulphide does not appear until all the sulphides of silver, gold, and copper have fallen out. In order to recognise the end of the reaction with more accuracy, it is to be recommended to take a test-tube full of clean solution; precipitate the lime first with soda, and then add sodium-sulphide; the reaction is then not obscured by the yellow calcium-monosulphide.

"After settling of the sulphides has taken place, the clear solution is decanted into the pump-sump and the sulphides are drawn into the filter-press sump. The consumption of sodium-sulphide per ton of ore is very variable, and depends principally on the amount of copper which has been precipitated with the silver.

"*Sulphides.*—Directions for handling the sulphides in the filter-press are furnished by the manufacturers of the machine. For reasons already stated, it is not the intention to discuss at present the various methods that may be used for converting the sulphides into bullion. In case the sulphides are sold to smelting-works, they should be roasted in a reverberatory furnace previous to their shipment. This roasting need not be a dead roast, and is principally intended to oxidize the free sulphur, a considerable percentage of which is mixed with the sulphides.

"*Laboratory Work.*—In a lixiviating-mill the following determinations should be made every day:—

"(1.) Pulp assay of ore and salt mixture.
"(2.) Determination of the percentage of the salt in the pulp.
"(3.) From these data the value of the ore is calculated.
"(4.) Determination of the percentage of soluble salts in roasted ore.
"(5.) From these data the value of roasted ore, minus the soluble salts, is calculated.
"(6.) Pulp assay of the roasted ore.
"(7.) Assay of tailings.
"(8.) In comparing the value of tailings with the value of roasted ore, minus the soluble salts, the percentage of silver left in the tailings is calculated.
"(9.) Lixiviation tests of roasted ore with ordinary solutions.
"(10.) Lixiviation tests of roasted ore with extra solutions.

"The result of No. 9 shows to what perfection the roasting has been carried, and that of No. 10 show what results may be expected in lixiviating on a large scale. By comparing No. 9 with No. 10 we learn how much the extraction of the silver will be benefited by the use of Russell's process. If the ore is treated raw most of these determinations are not required.

"In regard to the lixiviation tests it is advisable to adopt some definite practice. The following are recommended by Mr. Russell: The results of these tests, Mr. Russell says, will correspond with careful work on a large scale within $\frac{1}{2}$oz. to $\frac{3}{4}$oz. of silver per ton of ore. In order to avoid the weighing of the reagents a 20-per-cent. copper-sulphate solution and a 5-per-cent. sodium-hypo-sulphate solution are prepared; 100c.c. of the former would contain 20gr. of copper-sulphate, and 100c.c. of the latter would contain 5gr. of sodium-hyposulphite. A pipette holding 20c.c., and a measure for 300c.c. should be at hand. The quantity of hyposulphite solution used is always 300c.c., and that of copper-sulphate 20c.c. In preparing the extra solution the copper solution is added to the hyposulphite solution in a beaker. The following rules are also observed in any instance: The reagents are applied cold to the ore in a beaker, which is then heated, with occasional stirring, upon a moderately hot sand-bath until the solution reaches the temperature of 125° to 130° Fahr. The beaker is then removed, the ore allowed to settle, and the solution is decanted upon a filter, to which, at the end of the operation, all the ore is transferred. After washing with the warm water the filter is put into a drying-chamber, and its contents are finally assayed. If the ore has been roasted it is generally first treated with 300c.c. of warm water. The wash-water is decanted upon the filter, leaving the ore in the beaker, and the lixiviation solutions are then applied. How the lixiviation test with ordinary solution alone is to be made requires no further explanation.

"Mr. Russell uses the following three methods in making lixiviation tests with extra solution, each of which may be preceeded by a leaching of the sample with water, in case the ore has been roasted:—

"*(a.)* The sample is treated with extra solution only.

"*(b.)* The sample is treated as follows: Add 20c.c. copper solution, and heat to 100° to 125° Fahr.; leave for five minutes, and then add 300c.c. hyposulphite solution, and heat to 125° to 130° Fahr.; decant upon the filter, and wash out, &c.

"*(c.)* The sample is treated with ordinary solution; decanted and heated with extra solution.

"For raw ores, method (*c*) is most frequently used; (*a*) often gives as good results; (*b*) is rarely used. Roasted ores are generally first leached with water; and only if not much salt has been used in roasting, and the sample only contains a small amount of soluble base metal salts, this operation may be dispensed with.

"For ore roasted without caustic lime, method (*c*) is most frequently used, but (*a*) may give as good results.

"If the roasted ore contains caustic lime, method (*b*) alone is used. Silver in the wash-water is determined by precipitating a measured quantity with sodium-sulphate, and assaying the precipitate."

VALUE OF WORKS CONSTRUCTED.

The total value of works in progress and constructed by this department since the votes we e placed under the control of the Hon. the Minister of Mines, including roads and other works for the development of the mining industry, either by way of subsidy or otherwise, has been as follows :—

Nature of Work.	Total Cost of Construction, or Amount authorised 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 Years 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, subsidised by Mines Department	52,841 17 0	21,844 16 7	10,207 15 9
Works undertaken by prospecting associations, subsidised by Mines Department	13,216 13 4	3,350 0 0	3,400 0 0
Construction of drainage- and sludge-channels, subsidised by Mines Department	5,750 0 0	2,468 15 4	781 4 8
	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, subsidised by Mines Department	13,566 14 1	6,293 16 6	12,739 17 6
Roads to mines, other than gold, subsidised by Mines Department	4,594 10 0	111 19 0	2,888 1 0
Works undertaken by prospecting associations, subsidised by Mines Department	850 0 0	108 0 0	3,692 0 0
Construction of drainage- and sludge-channels, subsidised 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	..
	45,174 15 11	33,648 7 9	38,284 10 5
1885–86.			
Water-races	3,660 4 9	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, subsidised by Mines Department	14,773 2 3	13,043 15 9	12,477 9 2
Roads to mines, other than gold, subsidised by Mines Department	1,551 19 10	4,327 0 10	490 12 8
Works undertaken by prospecting associations, subsidised by Mines Department	11,860 18 0	1,999 5 7	6,389 5 9
Construction of drainage- and sludge-channels, subsidised by Mines Department	10,051 14 9	3,994 16 6	6,995 9 9
Schools of Mines	2,160 9 7	1,260 9 7	900 0 0
	71,602 7 10	43,049 5 3	61,785 1 4
1886–87.			
Water-races	..	1,928 14 4	3,466 0 8
Roads on goldfields	12,453 3 5	22,229 16 1	17,791 7 0
Roads and tracks undertaken by County Councils, subsidized by Mines Department	12,613 4 8	7,415 19 6	10,455 1 5
Roads to mines, other than gold, subsidised by Mines Department	..	306 1 0	110 13 1
Works undertaken by prospecting associations, and companies, subsidised by Mines Department	15,671 19 6	4,521 7 3	4,618 4 7
Construction of drainage- and sludge-channels, subsidised by Mines Department	5,549 14 6	6,207 18 0	672 6 10
Diamond and other drills	422 15 6	422 15 6	..
Schools of Mines	3,183 7 1	3,383 7 1	700 0 0
	49,894 4 8	46,415 18 9	37,813 14 4
1887–88.			
Water-races	6 6 6	6 6 6	..
Roads on goldfields	6,860 4 3	17,281 11 3	7,370 0 0
Roads and tracks undertaken by County Councils, subsidised by Mines Department	2,998 15 0	8,012 5 2	3,942 4 2
Roads to mines, other than gold, subsidised by Mines Department	..	14 5 4	..
Works undertaken by prospecting associations and companies, subsidised by Mines Department	6,456 8 0	2,949 19 11	924 8 0
Construction of drainage- and sludge-channels, subsidized by Mines Department	..	1,009 4 11	2,054 10 6
Schools of Mines	1,859 3 7	2,221 19 4	337 4 3
Aids to treatment of ores	1,200 0 0	390 18 3	209 1 9
	19,380 17 4	31,886 10 8	14,837 8 8

VALUE OF WORKS CONSTRUCTED—*continued.*

SUMMARY.

Nature of Work.	Total Cost of Construction, or Amount authorised 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	37,764 14 11	37,447 15 3	..
Roads on goldfields	81,962 7 7	74,592 7 7	7,370 0 0
Subsidised tracks	96,793 13 0	56,610 13 6	3,942 4 2
Subsidised tracks, other than gold	6,146 9 10	4,759 6 2	..
Prospecting	48,055 18 10	12,928 12 9	924 8 0
Drainage-channels	25,401 9 3	14,730 14 9	2,054 10 6
Diamond drills	4,022 15 6	2,280 15 6	..
Schools of Mines	7,203 0 3	6,865 16 0	337 4 3
Treatment of ores	1,200 0 0	390 18 3	209 1 9
	308,550 9 2	210,606 19 9	14,837 8 8

NOTE.—Authorities were cancelled or written off during 1887-88 as follows:—

Prospecting subsidies	£2,343 15 10
Water-races	3,466 0 8
Subsidised tracks	3,829 10 3
Roads on goldfields	948 10 7
Drainage-channels	43 6 0
Schools of Mines	150 0 0
	£10,781 3 4

It will be seen from this table that the value of new works undertaken and expenditure on Schools of Mines during last year has been £19,380 17s. 4d., as against £49,894 4s. 8d. for the year previous, thus showing the value of works authorised last year to be £20,513 7s. 4d. less than the preceding one; while the expenditure last year was £31,886 10s. 8d., as against £46,415 18s. 9d. for the previous year, thus showing a decrease in the expenditure of £14,529 8s. 1d. The liabilities on works in progress at the end of last year amount to £14,837 8s. 8d., while at the end of the previous year they were £37,813 14s. 4d. The reduction of the liabilities is due to the cancellation of authorities for works as shown in the foot-note to the foregoing statement. The total value of works in progress and constructed during the five years the votes have been under the control of the Hon. the Minister of Mines amounts to £308,550 9s. 2d., and the expenditure to £210,606 19s. 9d.

Although there has already been a large expenditure on works for the development of the mining industry, there still remains a great deal yet to be done in the construction of roads and tracks in mining districts, in order to allow of machinery being brought on to the ground, ores taken from the mines to the place of treatment, and also to open up the country so that it can be prospected.

Annexed is a list of works in progress and constructed, taken from the departmental records, showing the actual expenditure and liabilities on each at the end of last year.

I have, &c.,

HENRY A. GORDON, M.A. Inst. M.E.,
Inspecting Engineer.

The Under-Secretary 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, 1888.

Locality and Nature of Works.	Total Cost, or Amount authorised.	Amount of Contribution paid by Mines Department.	Amount due by Mines Department on Works still in Progress.
NORTH ISLAND.			
ROADS (SUBSIDISED).			
Coromandel County.	£ s. d.	£ s. d.	£ s. d.
Old saw-mill towards Matawai	300 0 0	100 0 0	66 13 4
Extension of Paul's Creek track	300 0 0	..	150 0 0
Tiki bridge to old saw-mill	300 0 0	..	150 0 0
Old saw-mill to Eccleston's	400 0 0	..	200 0 0
Harbour View track extension	150 0 0	..	75 0 0
Mercury Bay Road	400 0 0	..	200 0 0
Tiki to sea-beach at Wilson's	300 0 0	..	150 0 0
	2,150 0 0	100 0 0	991 13 4
Thames County.			
Karaka Creek to Lucky Hit	600 0 0	167 5 3	132 14 9
Waiotahi towards Mercury Bay	616 3 0	261 5 6	99 9 10
Waiomo Creek to Tapu	1,500 0 0	524 12 10	225 7 2
Puriri to New Discovery	200 0 0	..	100 0 0
Te Mata Road	200 0 0	..	100 0 0
Track to Hikutaia Goldfield	200 0 0	73 17 7	26 2 5
Hikutaia towards Marototo	200 0 0	..	100 0 0
New Find to Waiomo Battery	110 0 0	30 0 0	25 0 0
Alabama Creek track	60 0 0	..	30 0 0
	3,686 3 0	1,057 1 2	838 14 2
Ohinemuri County.			
Strengthening four bridges on Waihi Road	200 0 0	..	133 6 8
Road from battery tramway to Waihi gold- and silver-mines	300 0 0	..	150 0 0
Marototo track	100 0 0	..	50 0 0
	600 0 0	..	333 6 8
SOUTH ISLAND.			
ROADS (SUBSIDISED).			
Waimea County.			
Road to open up Tableland Diggings	260 0 0	115 0 0	15 0 0
Buller County.			
Extension of road at Croninville	100 0 0	..	50 0 0
Waimangaroa to sea-beach	80 0 0	..	40 0 0
	180 0 0	..	90 0 0
Inangahua County.			
Larry's Creek to Lyell	1,500 0 0	..	750 0 0
Grey County.			
Irishman's to Lake Brunner	2,400 0 0	900 0 0	300 0 0
Deep Creek to Bell Hill	800 0 0	176 10 0	223 10 0
Hatter's Terrace Road	800 0 0	..	400 0 0
	4,000 0 0	1,076 10 0	923 10 0
ROADS CONSTRUCTED WHOLLY BY MINES DEPARTMENT.			
Whangamata Road	150 0 0	..	150 0 0
Aorere Valley to Karamea and Mokihinui	22,375 10 5	18,459 1 5	3,916 9 0
Cobden to Seventeen-mile Beach	2,886 1 4	2,652 1 4	234 0 0
Owen Valley Road	2,195 3 8	2,045 3 8	150 0 0
Bridle-track to Upper Anatoki	850 0 0	833 8 0	16 12 0
Improving tracks, Collingwood to Takaka, Motueka, &c.	9,276 4 5	8,949 14 5	326 10 0
Jackson's Bay to Cascade and Gorge Rivers Districts	4,426 15 9	2,850 6 9	1,576 9 0
Arthur's Point to Skipper's	8,570 4 1	7,570 4 1	1,000 0 0
Contingencies	10 3 0	10 3 0	..
	50,740 2 8	43,370 2 8	7,370 0 0
WATER-RACES.			
Argyle Water-race	7,653 15 1	7,653 15 1	..
Nelson Creek Water-race	957 16 7	957 16 7	..
Waimea-Kumara Water-race	10,765 10 3	10,765 10 3	..
Mikonui Water-race	13,997 1 4	13,997 1 4	..
Mount Ida Water-race	3,100 0 0	3,100 0 0	..
Contingencies	639 12 8	639 12 8	..
	37,113 15 11	37,113 15 11	..

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

Locality and Nature of Works.	Total Cost, or Amount authorised.	Amount of Contribution paid by Mines Department.	Amount due by Mines Department on Works still in Progress.
DRAINAGE AND SLUDGE-CHANNELS.	£ s. d.	£ s. d.	£ s. d.
Alteration of Big Pump, Thames	4,000 0 0	..	2,000 0 0
Ross Sludge- and Stormwater-channel	1,554 10 6	1,500 0 0	54 10 6
	5,554 10 6	1,500 0 0	2,054 10 6
PROSPECTING SUBSIDIES.			
Deep-level Tunnel, Reefton	6,492 0 0	3,009 0 0	237 0 0
Kapanga Gold-mining Company (Limited)	20,000 0 0	337 0 0	663 0 0
Deep-level Tunnel, Manaia	500 0 0	225 12 0	24 8 0
	26,992 0 0	3,571 12 0	924 8 0
AIDS TOWARDS THE TREATMENT OF ORES.			
Testing Plant, School of Mines, Thames	1,200 0 0	390 18 3	209 1 9
Schools of Mines	7,203 0 3	6,865 16 0	337 4 3

Summary of Works.

Roads (subsidised)—	£ s. d.	£ s. d.	£ s. d.
Coromandel County	2,150 0 0	100 0 0	991 13 4
Thames County	3,686 3 0	1,057 1 2	838 14 2
Ohinemuri County	600 0 0	..	333 6 8
Waimea County	260 0 0	115 0 0	15 0 0
Buller County	180 0 0	..	90 0 0
Inangahua County	1,500 0 0	..	750 0 0
Grey County	4,000 0 0	1,076 10 0	923 10 0
	12,376 3 0	2,348 11 2	3,942 4 2
Roads constructed wholly by Mines Department	50,740 2 8	43,370 2 8	7,370 0 0
Water-races	37,113 15 11	37,113 15 11	..
Drainage- and sludge-channels	5,554 10 6	1,500 0 0	2,054 10 6
Prospecting subsidies	26,992 0 0	3,571 12 0	924 8 0
Aids towards the treatment of ores	1,200 0 0	390 18 3	209 1 9
Schools of Mines	7,203 0 3	6,865 16 0	337 4 3
Totals	141,179 12 4	95,160 16 0	14,837 8 8

HENRY GORDON, M.A. Inst. M.E.,
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 prior to the 31st March, 1888.

Locality and Nature of Works.	Total Cost.	Amount of Contribution paid by Mines Department.
NORTH ISLAND.		
ROADS (SUBSIDISED).		
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
Golden Belt Track	100 0 0	50 0 0
Tokatea Road (repairs)	300 0 0	150 0 0
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
Track, Bismarck Battery to Kennedy Bay	200 0 0	133 6 8
Road up Manaia	675 10 6	450 7 0
Extension of Vaughan's and Vizard's Tracks	150 0 0	100 0 0
Vizard's towards Marebel	200 0 0	133 6 8
Extending and widening Waitaia Road	100 0 0	66 13 4
Makarau to Waiau	1,000 0 0	666 13 4
Waikawau to Tiki	500 0 0	333 6 8
Manaia to Tiki	500 0 0	250 0 0
Old Saw-mill towards Awakanae	600 0 0	400 0 0
Paul's Creek to Cabbage Bay	200 0 0	133 6 8
	6,413 13 9	4,125 15 10
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 Lucky Hit 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 Wicks'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
Widening road from bridge over Hape Creek to Otanui Mines	183 17 0	122 11 4
Track, Karangahake Goldfield	784 1 0	522 14 0
Kauaeranga Valley to Otanui	470 7 0	313 11 4
Tapu Road to mines	81 17 9	54 11 10
Tauranga Road to Karangahake Bridge-site	341 5 0	227 10 0
Karangahake Bridge	229 6 6	152 17 8
Track up Maungakerikeri Creek	93 4 4	62 2 11
Thames Borough boundary to Hape Creek No. 2	600 0 0	300 0 0
Upper Karaka Road	179 13 0	119 15 4
Repairing flood damages, Waiotahi, Moanataiari, Karaka, and Collarbone Roads	350 0 0	175 0 0
Sea-beach to Waiomo	750 0 0	375 0 0
Te Papa Gully Road	75 0 0	37 10 0
	7,989 10 5	4,964 0 2
Ohinemuri County.		
Track up Tui Creek	306 0 0	153 0 0
Prospecting-track, Whangamata and Waitekauri	200 0 0	166 13 4
Tramway, Karangahake to Railey's Reduction Works	400 0 0	200 0 0
	906 0 0	519 13 4
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	497 17 0	331 18 0
Track to claims at Buck's Reef	55 5 6	36 17 0
Track, Fern Spur to Butler's Spur	231 17 9	154 11 10
Tracks up Stoney Creek, Te Aroha Goldfield, &c.	54 0 0	36 0 0
	20,339 0 3	13,559 6 10
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
Road, Makara Junction to Terawhiti	450 0 0	225 0 0
	959 16 6	435 17 0

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

Locality and Nature of Works.	Total Cost.			Amount of Contribution paid by Mines Department.		
SOUTH ISLAND.						
ROADS (SUBSIDISED).						
Tuapeka County.	£	s.	d.	£	s.	d.
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
Clutha River to Campbell's	76	9	0	50	19	4
Waitahuna to copper-mine	200	0	0	133	6	8
Road to open up quarry for Waitahuna Bridge	160	9	10	106	19	11
Waipori Road, *viâ* Bungtown	566	8	10	283	4	5
	2,003	7	8	1,241	3	8
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
Waikaka to Switzer's	150	0	0	100	0	0
Road near Waikaka Township	150	0	0	100	0	0
	1,005	0	0	670	0	0
Westland County.						
Improving track, Butcher's Creek to Gentle Annie Terrace	225	10	0	163	13	4
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 Loop-line Dam	449	11	0	299	14	0
Rough Wainihinihini to Upper Dam	450	0	0	300	0	0
Browning's Pass to Reefs	3,311	6	0	2,207	10	8
Okarito Forks to Teal Creek	600	0	0	400	0	0
	9,251	0	0	5,941	17	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
Road, Limestone to Maori Creek	800	0	0	533	6	8
Red Jack's to Nelson Creek	601	17	6	401	5	0
Barrytown to Deadman's	2,240	0	0	1,493	6	8
German Gully to Arnold's Flat	120	0	0	60	0	0
Baird's Terrace to Lake Brunner	400	0	0	200	0	0
	11,058	4	0	7,600	18	2
Marlborough County.						
Track, Deep Creek to Dead Horse Creek	68	0	0	45	6	8
Inangahua County.						
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 Capleston up Little Boatman's Creek	379	0	0	252	13	4
Dray-road from Capleston 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 Capleston	358	0	0	238	13	4
Survey and expenses	250	0	0	166	13	4
Track from Cariboo to Big River	728	0	0	364	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 Capleston to Larry's Creek	640	0	0	426	13	4
Track to connect Capleston with Lone Star	75	0	0	50	0	0
Crushington to Globe Company's workings	403	0	0	201	10	0
Snowy Creek Track	85	15	0	42	17	6
Reefton to Big River	1,792	0	0	1,194	13	4
Glenroy to Horse Terrace	254	0	0	122	10	0
	12,755	0	0	8,150	11	6

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

Locality and Nature of Works.	Total Cost.	Amount of Contribution paid by Mines Department.
	£ s. d.	£ s. d.
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
Lyell Bluff to Victor Emmanuel Claim	650 0 0	433 6 8
Beach, Little Wanganui to Mokihinui	300 0 0	100 0 0
Cape Foulwind Road	450 0 0	300 0 0
Road up Nile Valley	56 16 4	28 8 2
Denniston extension	850 0 0	425 0 0
Promised Land towards Motueka	380 0 0	190 0 0
Road over Gentle Annie	200 0 0	100 0 0
Extension, Lyell Creek to Low-level Tunnel	60 0 0	30 0 0
Extension of track 50 chains south of Brighton	140 0 0	70 0 0
Continuation of road, Deadman's Creek	437 17 0	218 18 6
Ngakawhau Railway Station to Mokihinui	50 0 0	25 0 0
Addison's Flat towards ranges	20 0 0	10 0 0
North Terrace to Oparara Diggings	500 0 0	333 6 8
	7,318 0 4	4,281 15 4
Taieri County.		
Mullocky Gully to Silver Peak	499 15 0	333 3 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
Arrowtown to Macetown, construction	225 0 0	150 0 0
Arrowtown to Macetown, maintenance	150 0 0	100 0 0
Invincible Quartz-reef Track, Rees River	300 0 0	200 0 0
Rees Valley to company's workings	61 7 6	30 13 9
Pack-track, Criffel Diggings	50 6 6	33 11 0
Left-hand Branch Road, Skipper's	63 9 10	31 14 11
	1,267 6 1	890 14 6
Waitace County.		
Track, Colac Bay to Round Hill	200 0 0	133 6 8
Pack-track to Round Hill, Colac, and Orepuki	1,050 0 0	500 0 0
	1,250 0 0	633 6 8
Maniototo County.		
Road to Serpentine Diggings	136 10 0	91 0 0
Pig and Whistle to Clarke's Diggings	200 0 0	133 6 8
Shepherd's Hut Flat to Vinegar Hill	100 0 0	66 13 4
Kyeburn Peninsula to Main Road	82 0 0	41 0 0
	518 10 0	332 0 0
Collingwood Road Board.		
Road, West Wanganui	300 0 0	200 0 0
Bridge over Aorere River	173 14 0	115 16 0
	473 14 0	315 16 0
Fiord County.		
Dusky Sound Tracks	300 0 0	200 0 0
Waitaki County.		
Road, Naseby to Livingstone	41 12 0	20 16 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
Westland County Council (tiffin)	350 0 0	233 0 0
Diamond drills for prospecting purposes	422 15 6	422 15 6
	4,022 15 6	2,280 15 6

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

Locality and Nature of Works.	Total Cost.			Amount of Contribution paid by Mines Department.		
AIDS TO PROSPECTING.	£	s.	d.	£	s.	d.
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
Little Boatman's deep-level tunnel	600	0	0	300	0	0
Oterongia Prospecting Association	198	17	2	99	8	7
Vincent County	137	9	0	68	14	6
Tapanui Prospecting Association	25	0	0	12	10	0
Tuapeka County	12	0	0	6	0	0
Maniototo County	500	0	0	250	0	0
Pullar, Shelmerdine, and Basan	400	0	0	200	0	0
Royal Oak Association	300	0	0	150	0	0
Star of the East Quartz-mining Company	150	0	0	75	0	0
West Coast Prospecting Association	300	0	0	150	0	0
McBride and party	169	2	2	84	11	1
McLean and party	66	0	0	33	0	0
Deep-level Tunnel, Tokatea	700	0	0	350	0	0
Deep-level Tunnel, Owharoa	300	8	0	200	5	4
Deep-level Tunnel, Tapu	1,200	0	0	600	0	0
Deep-level Tunnel, Cedar Creek	1,207	10	0	603	15	0
Manuka Flat Prospecting Association	200	0	0	100	0	0
Red Hill Minerals Company	437	19	10	218	19	11
Tuapeka Prospecting Association	277	0	0	138	10	0
Cardrona Prospecting Association	800	0	0	400	0	0
Cromwell Prospecting Association	500	0	0	250	0	0
Coromandel County	550	0	0	275	0	0
Thames County	309	18	0	154	19	0
Thames Borough	200	0	0	100	0	0
Buller County	146	12	6	73	6	3
Inangahua County	488	7	0	244	3	6
Westland County	1,000	0	0	500	0	0
Grey County	871	15	2	435	17	7
Deep-level Prospecting Association, Waipori	432	9	8	216	4	10
Waipu Prospecting Association	180	0	0	90	0	0
Hokianga County	100	0	0	50	0	0
Vulcan Smelting Works, Onehunga	30	0	0	15	0	0
Ohinemuri County	100	0	0	50	0	0
Waitaki County	29	5	0	14	12	6
Waihemo County	85	9	0	42	14	6
William Fox and party	711	1	8	355	10	10
Kirk and party	176	9	10	88	4	11
Hodge and party	98	13	8	49	6	10
Carey and Hyndman	441	9	4	220	14	8
Don, Boyce, and party	107	16	0	53	18	0
Quentin McKinnon	58	10	0	29	5	0
Bullion Mine, Deep-level Tunnel	300	0	0	150	0	0
Sutherland and party	30	0	0	150	0	0
Contingencies	484	15	10	242	7	11
	21,063	18	10	9,357	0	9
WATER-RACES.						
Water-main, Bull's Battery	350	0	0	100	0	0
Round Hill, Water-race	200	19	0	133	19	4
Tomkiss's Water-race	100	0	0	100	0	0
	650	19	0	333	19	4
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
Long Gully Sludge-channel	150	0	0	100	0	0
New Pipeclay Gully Sludge-channel	1,547	18	0	773	19	0
Kumara Sludge-channel, No. 2	2,762	17	2	2,762	17	2
Ophir Tail-race	2,300	0	0	1,150	0	0
Lawrence Drainage-channel	1,150	0	0	956	14	0
Muddy Creek Channel	2,000	0	0	1,000	0	0
St. Bathan's Channel	2,000	0	0	1,000	0	0
Tailings-outlet, Maerewhenua	1,595	4	0	1,595	4	0
	19,846	18	9	13,230	14	9

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

Locality and Nature of Works.	Total Cost.	Amount of Contribution paid by Mines Department.
ROADS WHOLLY CONSTRUCTED BY GOVERNMENT.	£ s. d.	£ s. d.
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
Waikaia Bush Road	1,000 0 0	1,000 0 0
Waitahuna Bridge	750 0 0	750 0 0
Merrivale Tracks	500 0 0	500 0 0
Mokihinui to Specimen Creek	1,238 7 5	1,238 7 5
Wilberforce Quartz-reef Road	1,818 7 7	1,818 7 7
Opening Mokau River	552 8 0	552 8 0
Lyell to Mokihinui	1,898 11 0	1,898 11 0
Brighton to Seventeen-mile Beach	1,789 7 2	1,789 7 2
Wangapeka to Karamea	2,000 0 0	2,000 0 0
Hatter's Terrace to Bell Hill	400 0 0	400 0 0
Cedar Creek Road	3,000 0 0	3,000 0 0
	31,222 4 11	31,222 4 11
ROADS TO OPEN UP MINES OTHER THAN GOLD.		
Aniseed Valley to Champion Copper-mine	4,963 10 6	4,116 10 6
Richmond Hill to Copper-mine	315 16 0	209 4 0
Track, Ohinemuri Coal-seam	267 3 4	133 11 8
Road, Kanieri Coalfield	600 0 0	300 0 0
	6,146 9 10	4,759 6 2

Summary of Works.

	£ s. d.	£ s. d.
Roads (subsidised)—		
Coromandel County	6,413 13 9	4,125 15 10
Thames County	7,989 10 5	4,964 0 2
Ohinemuri County	906 0 0	519 13 4
Piako County	20,339 0 3	13,559 6 10
Hutt County	959 16 6	435 17 0
Tuapeka County	2,003 7 8	1,241 3 8
Southland County	1,005 0 0	670 0 0
Westland County	9,251 0 0	5,941 17 4
Grey County	11,058 4 0	7,600 18 2
Marlborough County	68 0 0	45 6 8
Inangahua County	12,755 0 0	8,150 11 6
Buller County	7,318 0 4	4,281 15 4
Taieri County	499 15 0	333 3 4
Lake County	1,267 6 1	890 14 6
Wallace County	1,250 0 0	633 6 8
Maniototo County	518 10 0	332 0 0
Collingwood Road Board	473 14 0	315 16 0
Fiord County	300 0 0	200 0 0
Waitaki County	41 12 0	20 16 0
	84,417 10 0	54,262 2 4
Diamond and other drills	4,022 15 6	2,280 15 6
Aids to prospecting	21,063 18 10	9,357 0 9
Water-races	650 19 0	333 19 4
Drainage- and sludge-channels	19,846 18 9	13,230 14 9
Roads wholly constructed by Government	31,222 4 11	31,222 4 11
Roads to open up mines other than gold	6,146 9 10	4,759 6 2
Totals	167,370 16 10	115,446 3 9

HENRY A. GORDON, M.A., Inst. M.E.,
Inspecting Engineer.

RETURN showing the RECEIPTS and EXPENDITURE on, and Collateral Advantages derived from the working of, the Water-races constructed and maintained by the Government, during the Year ending the 31st March, 1888.

Name of Water-race.	Receipts.	Expenditure on Maintenance.	Profit or Loss.	Cost of Construction.	Total Cost of Construction.	Percentage on Capital invested.	Average Number of Men employed.	Approximate Amount of Gold obtained.	Value of Gold obtained.	Average Weekly 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 ..	1,793 16 4	1,027 17 11	*765 18 5	118,762 11 8		¾	98	2,960	11,248 0 0	1 16 3
Kumara	7,443 8 2	982 12 0	*6,460 16 2	37,400 2 11	173,363 7 1	16½	185	10,550	40,090 0 0	3 8 5
Kumara Sludge-channel	1,159 15 1	4,260 12 4	†3,100 17 3	17,200 12 6		..	77	191	724 13 6	..
Nelson Creek ..	1,045 1 8	1,173 15 4	†128 13 8	..	90,722 10 8	..	45	1,623	6,207 19 6	2 4 1
Argyle	455 12 9	398 3 10	*57 8 11	..	14,701 15 3	$\frac{3}{16}$	20	630	2,394 0 0	1 17 3
Mikonui ..	95 16 8	..	*95 16 8	..	25,644 9 6	‡	..	..	..	..
Totals ..	11,993 10 8	7,843 1 5	*4,150 9 3	..	304,430 2 6	..	425	15,954	60,664 13 0	2 6 6

* Profit. † Loss. ‡ In construction.

HENRY A. GORDON, M.A. Inst. M.E.,
Inspecting Engineer.

[*Approximate Cost of Paper.*—Preparation, nil; printing (2,050 copies), £71.]

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