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THE FUEL SUPPLY QUESTION.

THE possibility of an insufficient fuel supply for Canadian smelters has been mooted lately. That area of the Crow's Nest field which contains the best and most easily mined coal, is intersected by three creeks which cut the coal measures and the banks of whose canyons form the most economic, in fact the only economic, portals of the mines. Naturally these strategic points number six, two on each creek. Five of them are already under the control of the Crow's Nest Coal company. The south side of the Morissey creek is the only vacant mining site. It is argued that the government should immediately select its coal lands and include the south side of Morissey creek therein, in order to have an effective leverage against the Crow's Nest Coal company in the event of discriminative action against Canadian smelters becoming the policy of that company. As regards the general policy of opening up the American market to Crow's Nest coal and coke, there can be no two opinions. The cheap coal and coke on which our mining and smelting industries depend, can only be secured by a very large and regular output. The greater the market, the larger the output, and, up to a certain maximum at least, the less the cost

of production per ton. The opening of the American market could not of itself interfere with the supply to Canadian smelters, unless it were coupled with a direct policy of discrimination against them to serve purposes ulterior to the mining and marketing of coal and coke. Do such purposes exist? Do they exist in the minds of the present management of the Crow's Nest Coal company? This does not appear to have been proven. A motive has been alleged which has not, so far as we know, given birth to any specific acts. But such a motive might come into existence at any moment, and therefore, it is most important that the vital fuel supply for our mines and smelters should not be the possession of an uncontrolled monopoly. The Crow's Nest Coal company, when incorporated, was recognised to be in the nature of a monopoly. Regulations were placed upon its operations, and that these regulations might be in no danger of evasion, "hostages for good behavior," as the *Monetary Times*, of Toronto, very correctly expresses it, were given. These hostages were 50,000 acres of coal lands to be selected by the government, and 3,840 acres to fall to the Canadian Pacific Railway company, that corporation, however, being debarred from mining coal before 1907.

It is quite clear that if there is no economic outlet for the coal in these lands they will be quite ineffective as hostages. Therefore the government, to safeguard the interests of the consumers, should lay hands on the south side of Morissey creek. But it is also quite clear that, if the government leased this land to an independent company, that company could be only nominally independent of either the Canadian Pacific Railway company, or of the Great Northern Railway company. If it were really controlled by the former, that would be an evasion of the contract made at the time of the incorporation of the Crow's Nest company, if by the latter then the fuel monopoly would be complete and the hostages for its regulation virtually surrendered. We submit that the proper course for the government is to reserve this land with its valuable mining site. Then if the Crow's Nest Coal company shows by any overt act that it is prepared to violate the provisions safeguarding the interests of Canadian consumers, of whom the Canadian Pacific Railway company is the chief, such action might be taken by the government as would ensure a competitive supply even to the extent of permitting the Canadian Pacific Railway company, or a company controlled by that corporation, to mine the coal. To act now as if the Crow's Nest Coal company were already a guilty party, would be as unfair to that company, as

it would be dangerous to the consumers to permit the Crow's Nest Coal company to occupy a position in which it might violate the regulations imposed upon and accepted by it, with impunity.

B. C. MINES AND THE LONDON PRESS.

THE revelations as to the relations existing between a certain class of newspaper in Great Britain and a certain class of company promoter, which have followed the public examination of Mr. Whitaker Wright, are precisely similar to those which followed upon the collapse of Mr. Ernest Terah Hooley. Strange as it may seem, the warnings of experience seem quite inadequate to prevent the absorption of the investor's capital in the maelstrom of London finance, instead of in the productive enterprises for which it is ostensibly subscribed. The means by which an inflated value is given to shares, and by which shares of no value at all are foisted upon the public, are simple in method, and surprisingly effective in result. In order that a market may be made in any group of shares, it is necessary that they should be continually in the mouths of all who affect an interest in such investments, and that fluctuations in their price, should afford an apparently dazzling opportunity for the small investor to make money by an appreciation in their market value. This individual is taught to avoid any contemplation of assets or dividends, and to fix his eyes only upon the making-up price at the end of every account. By that account he measures himself as richer or poorer at the close of every fortnight or so. This price is carefully maintained by companies, or syndicates, or individuals interested in the unloading of the shares upon the unfortunate person who becomes their ultimate owner. It is quite easy, and highly profitable to buy shares ninety-nine times, if they can be sold for the hundredth time at an advanced price. The element of risk, except the risk of going to prison, is entirely eliminated, if the method of Mr. Wright be adopted, that, namely, of using other people's money to carry on such operations.

These market operations, however, would, by themselves, not accomplish the end in view. It is necessary that the public, as well as the manipulators, should be induced to deal in the shares. And this is effected through the co-operation of the financial press which is advisory as well as informative in its character. The promoter who understands his business finds a willing ally in the press, at all events a considerable section of it. The press is subsidised by means of calls in the shares desired to be unloaded. If, through the agency of press puffing, the shares are rigged to a high price, the newspapers met the difference between the price at which their calls are issued, and the price at which they transfer their holdings to the public. Payment is thus made by results, and efficient service on the part of the newspapers secured. Mr. Whitaker Wright, in his public examination, had the audacity to defend this system, or at least to excuse it, as inevit-

able and necessary in connection with company promoting in London. He said that any profit made by the newspapers did not injure the companies as it came not out of their coffers but out of the market. This admission was startling in the utter lack of moral perception which it disclosed. It frankly recognised the promoters and the newspapers as conspiring to swindle the public through the agency of shares in public companies, which the public was induced to buy at a higher price than they were worth. The whole system would seem to point to a systematic corruption which the singling out of one promoter here and there for punishment does nothing to eradicate, and but little to abate. The money which is found to set the ball rolling is found by shrewd men who expect to be participators in the profits of market manipulation. The buying and selling ramifies and spreads through the community, each astute purchaser expecting the shares to be forced to a still higher price, knowing nothing and caring less about the merits of the property they represent. It is really a game of "last man out," and the last man is inevitably the credulous and unsuspecting but *bona fide* investor. In this system the head and front of the offending is the fraudulent promoter. But it may be asked whether the abuse is remedied by his punishment and exposure, whether he is not the natural and inevitable outcome of a financial corruption which substitutes gambling for enterprise and the desire to fleece your neighbour for the aspiration to earn legitimate profits for yourself.

As it affects the interests of the investor this system of company promotion is of no particular interest to the people of British Columbia. They have not any large accumulations of capital to invest, and, for what they have, they avoid London companies like a pestilence or a reptile. As for the English investor, we would only be too glad to protect him if he displayed any willingness to be protected. Occasionally he shows a faint desire to learn something about the mines in which his money is at stake. When he does, he is as likely as not to address inquiries to a British Columbia journal about the position and prospects of Stratton's Independence mine at Cripple Creek in Colorado. But the interests of British Columbia, nevertheless, are very seriously affected by the methods of company promotion adopted in Great Britain. It is hardly too much to say that they are at least four times as costly as those in vogue by the people of other countries, and that the mines so handled have to be four times as rich to give satisfaction as would be ample to recompense Canadian or American investors. When our mines fail to come up to this exaggerated demand upon them the tendency is to give the country a bad name, to quarrel with its resources, legislation or industrial conditions. This tendency it is needless to say, is carefully fostered by promoters, lest inconvenient attention may be drawn to their own mismanagement and rapacity. Of course what we have been saying is not true of all London promoters and companies, but it is true that it is almost

impossible to introduce to the British public companies reasonably capitalised and amply endowed with working funds because such companies cannot afford to be bled in the manner necessary to secure their proper advertisement. Consequently the stream of capital is either checked or flows only from a spring polluted by inflation and misrepresentation, if not actual fraud. The conditions are exceedingly propitious at the present time for a renewal of interest in British Columbia on the London market. A foundation of solid achievement is being laid by companies whose shares are largely unknown and neglected. But is there any ground to hope that with renewed interest the old abuses will not flourish as luxuriantly as before. If they do, no permanent prosperity can be built up in the industry of mining by such a system, and for solid development upon a reasonable and productive basis we must still look to capital from Eastern Canada and the United States, assisted by private companies and syndicates financed in Great Britain. From the great bubble corporations blown upon the London market we can only look in the future for what we already have to regret in the past, namely, a short period of unreal activity followed by very real depression, and an attempt to place the sole responsibility for the latter upon the natural resources, legislative enactments or industrial conditions of the Province.

COPPER — THE QUESTION OF SUPPLY AND DEMAND.

THE period of violent fluctuation in the price of copper appears to be over. After plunging downwards to a virtually panic price it has recovered a little and is now endeavouring to find a stable mean at which to rest. There are those who profess to see in the recent events in the copper market nothing more than the results of an internecine strife between the main producers. It is more scientific and more correct to admit that the operating cause was the law of supply and demand breaking through and asserting its supremacy over the artificial restrictions some of the main producers have been endeavouring to impose upon it. In the November issue of the *MINING RECORD*, before the facts then visible with regard to the supply of and demand for copper had materially influenced the highly artificial price of the metal, we took the following view of the market situation:—

“There is no trust in the world strong enough to control or limit the production of copper except by permitting the demand to regulate the price. If, in the face of a supply in excess of the demand, the Amalgamated Copper company endeavours to maintain the price of copper at from 16 to 17 cents a pound, its success will only last as long as its money does and that will not be very long. The success of a trust in maintaining an artificial price of any commodity in a particular country is purely and simply a question of controlling the sources of supply in that country, and of being protected against outside competition by means of an import duty. It is true that the Amalgamated company controls between 50 and 60 per cent. of the copper produced in the United States. Suppose it limited production in the mines it was able to control, and at the same time maintained the price at its present level, it would be only placing a bonus upon the production of mines it was unable to control, and fostering the development of new countries and new mines to enter into competition with it. . . . It is, however, extremely unlikely that the Amalgamated Copper company

will embark on any such Quixotic enterprise. Its immense resources may indeed be used, and widely used, to steady the market, and prevent undue fluctuations from purely temporary causes, but we do not credit that company with any wild intention of tilting up against the law of supply and demand in reference to such a commodity as copper. Therefore, the only outlook at present seems to be a lower range of prices, and we rather think that so far as the producer is concerned, that lower range of prices is already becoming apparent in the contracts for matte being entered into now.”

Subsequent events have proved how accurate our diagnosis of the market's symptoms was; they have justified and confirmed the view that the fall in copper was due to natural causes which the manipulations of the most powerful company could not prevent, not to an outbreak of competitive rivalry for the control of the copper market.

It is interesting to compare the operations of the Secretan syndicate which resulted in such a disastrous collapse, with recent events in the copper-producing industry.

The Secretan syndicate endeavoured to limit the output of copper by agreement among the producers. It then proceeded to enhance the price by speculative purchases, and to maintain it by carrying all the copper which was offered. In marked contrast with the purely artificial character of that boom the late high price of copper was induced by an expansion of industry which carried the demand for copper beyond the supply. Consequently the situation was inherently stronger so long as the exceptional demand continued. But just so soon as it abated the price could only be maintained by adopting the same methods of accumulation practised by the Paris syndicate. The longer this went on the more serious the disturbance to the industry which was bound to follow. Fortunately a halt was called before complete temporary demoralisation of the copper mining industry became inevitable.

The arrangement which, it is reported, has now been arrived at between the Amalgamated Copper company and the Rio Tinto company, appears to be an arrangement for the gradual reabsorption of an accumulated surplus of copper by consumers, rather than an attempt to artificially control the market. It has had the effect of steadying the market and of averting anything in the nature of a panic. A similar method was adopted in dealing with the accumulations of copper made by the Secretan syndicate. The future price of copper depends upon whether its present price is low enough to allow of the rapid absorption of the surplus, and to prevent undue encroachment upon the market of new sources of supply. If the limitation of output by the main producers is counterbalanced by continued and growing competition on the part of new producers, the main producers will eventually be forced to market the copper they are now retaining in their mines at a lower price. If, on the other hand, expansion of demand can now overcome increase of production from new sources, the copper market has arrived at a condition of stable equilibrium, and may even display a tendency towards higher prices as the surplus disappears.

Apart from a severe check to industry, an industrial depression, seriously decreasing the demand for copper,

and upsetting all present calculations, there is no feature in the present situation which need cause alarm to those interested in copper mining in British Columbia. British Columbia, as we have pointed out before, possesses resources which permit of copper being mined and manufactured and marketed, as cheaply as in any other country. Our copper ores usually contain gold and silver as by-products. We have coal and coke, timber and water power in abundance and in close proximity to our copper mines. The day which sees decadence in copper mining in British Columbia, will see its total destruction in many other parts of the world. Thus we see that, at the present time, in spite of a lower price and, presumably, smaller profits, our mine owners are reaching forward to a greater expansion and development of the industry.

A LONDON FINANCIAL PAPER AND BRITISH COLUMBIA.

THE London *Economist* in its issue of the 25th of January, publishes an article from its "Special Mining Commissioner" which is a gem of inaccurate depreciation. It professes to deal with British Columbian mines. The article begins by stating:—"No mining country, in my mind, is associated with such absolute disappointment as British Columbia. Three years ago when I was there first, mines were starting up everywhere; to-day most of these are closed down, and the remaining ones are making no profit." If this correspondent would study external facts instead of his own mind and what exists therein, he would not make so egregious an assertion as that. During 1901 tons of ore mined, gross value of metals extracted, and dividends distributed all show a satisfactory increase. The value of British Columbia's output of the precious metals has just doubled since 1899, which this correspondent refers to as a halcyon year of promise.

After a paragraph of generalisations which can only be described as appalling, the correspondent goes on:—

"Now, let us look more closely into some of these statements. I was in Rossland just over two months ago. This was thought some years back to be likely to turn into a great gold field. But as the lodes were opened in depth they were found to be highly unreliable. The ore is found in lenses only, not in permanent reef bodies; the values run in chutes which come and go—principally go—in the most distractingly irregular way, and the lodes, being replacement or secondary formations, may themselves suddenly cease to exist at certain depths. Thus, all these ore bodies lying on the slopes of Red Mountain, which once looked so promising, are to-day but a sorry lot of speculations."

It is only fair, however, to state that one of these sorry speculations is afterwards referred to as "essentially a big mine." The use of the word "essentially" in this connection is a reflection more on the editor of the *Economist* than on anyone else. How any editor of even ordinary discrimination could have permitted a contributor to so essentially contradict himself passes comprehension. For either the opinion of this correspondent on the Le Roi mine is not worth having, or else his description of the present condition of the Rossland district is a farrago of nonsense. So far any self-

respecting editor could have detected his correspondent's inaccuracy and untrustworthiness. But anyone knowing anything of Rossland could go further and assert with confidence that the alternatives are mutually exclusive in appearance only, and that the correspondent's facts are as incorrect as his opinion is valueless. The Nelson district is dismissed as follows:—

"In the Nelson district nearly every mine is moribund. Nothing ever seems to happen. The Hall Mines, a silver and copper property, works away now and then with no real result. The Athabasca just keeps its nose above water. The Granite-Duncan-Poorman group is in a dense mist, and the Dundee, Fern, Porto Rico, and such like are what would be called in Australia tripe. The Ymir alone remains. It has opened, although I have not seen it for three years, into the excellent mine I thought it would. Shareholders must remember, however, that it is not sound business to value a quartz mine with, say, three years' ore in sight on the 10 per cent. dividend basis. Let the directors of the Ymir put their extra profits into mine development. If they pay away all the profits, it will look too much as if big holders were anxious to put the shares above their intrinsic value and get out."

We should have thought that everybody knew that after a long siege of mismanagement and consequent distress the Hall Mines had been reorganised on a paying basis and was making satisfactory profits. As to the other properties mentioned their output has always been small except the Ymir, whose directors will no doubt be astonished to learn that they have not been pursuing a conservative course.

The cream of the whole article, however, is the reference to the Boundary district:—

"In the Boundary district quite a flourishing smelting industry had sprung up. The ores are low-grade copper, with small gold and silver contents, and they were being smelted at the lowest cost of treating copper ores in the world. But the gross value of the ore was very small. At a big price for copper a little profit was made, but now that copper has fallen I don't see how these properties can possibly work at a profit. They are owned by Canadian capital. This slump in copper, and the coming slump in lead, and perhaps silver, threatens to close a lot of low-grade mines in British Columbia, and throw thousands out of employment."

Quite a flourishing smelting industry had sprung up. According to this authority, it is now apparently no longer in existence and there are no thirty tons of blister copper being produced daily. We learn also that a lot of low-grade mines in British Columbia are to be closed down throwing thousands out of employment. The impossibility of this, when most of the mines are closed down already, might have occurred to the editor of the *Economist*. This sort of article appearing in English newspapers is very irritating and very damaging. But we ourselves, the people of this Province, are largely responsible for it. We have taken, and are taking, no trouble to have the facts about the country widely known. Have we any right to complain when we have left the field to malice, ignorance and misrepresentation? This article in the *Economist* is really a crystallisation of the opinion held abroad of British Columbia. The resuscitation of dogs with a bad name is a no easy task. Even in the Province itself detraction and depreciation have been used in the heat of internal controversy. Ugly-looking birds our own chickens are when they come home to roost, are they not? The *MINING RECORD* is the one feeble little voice which speaks abroad with the authority of accurate information, and what between the clouds of depreciation outside the

Province and the apathy towards its best interests within its own borders, that voice has frequently been nearly smothered.

AMERICAN ENTERPRISE AND COAST MINING.

MINING on the coast of British Columbia and on Vancouver Island is taking on a new phase which is most important from the point of view of production. One by one the more developed properties are emerging from the condition of prospects, handicapped by financial difficulties, and intermittently productive for the purpose of warding off the sheriff, into that of mines financed by strong companies, with ample funds for development, and in a position to study economy of operation. Once having arrived at this stage, the Coast will develop rapidly in respect to the mining industry; but it must be confessed that it has taken a long time to arrive. Failures and misfortunes have, from time to time, set this portion of the Province back. But in addition to positive failures in mining operations, there has been a sad failure to recognise the mineral resources of the district. Until within a short time ago, the universal note was one of depreciation of the mineral resources of the Coast and of Vancouver Island. Nowhere was this note of depreciation more loudly sounded than right on the spot. The reason for this was probably, that not being themselves experienced in mining, the people of Victoria and Vancouver relied far too much upon authority and far too little upon that faith which defies authority, and moves mountains, and makes mines. The spirit of the engineer is critical and rightly so; the man who develops a mine cannot afford to be critical. If he were, he would succumb under the disappointments and difficulties which assail him at every step. The MINING RECORD has a number of candid friends who are never quite happy because we do not maintain an attitude of carping and lugubrious pessimism towards the present condition and future prospects of the mining industry in British Columbia. We stirred up a number of these last summer, when we ventured to assert that production was increasing rapidly. How far ahead the facts were of even our anticipations, must be fresh in the memory of all. No doubt many of them will be apt to feel, in reading this article, that we are endeavouring to generate a sentiment of false enthusiasm in reference to the Coast, and likely by injudicious recognition of possibilities to inaugurate an injurious boom. Nothing is farther from our intentions. But it is permissible to point out that if the mining developments of the last two years had been outlined two years ago, it would have been regarded as booming of the most pernicious kind, and yet that the public sentiment so engendered towards the Coast districts would have been true to the facts, whereas the sentiment actually existing at that time was not merely depressing, but actually false. It is not by any means an easy task

to appreciate resources with such nice discrimination, as not to give apparent encouragement to wildcat enterprises which prey upon the credulous investor. But we feel, and feel very strongly, that developments are taking place now in the Coast districts which will carry them as far beyond present anticipations, as the facts of to-day are beyond the anticipations of two years ago.

A very curious and interesting feature of these developments is that they are due to initiative enterprise and capital from the United States. The Britannia mine, the Van Anda mine and the Marble Bay mine have all recently passed into American control. Capital which comes into a country comes into it to stay and it does not matter much where it comes from. Even the profits are largely reinvested and made fruitful in their turn. The important thing is to get capital, not to get it from any particular source. Our experience of English capital in this country has been singularly unfortunate. Extravagance, mismanagement and waste have, in some fatal manner, seemed to follow upon its entry. Whereas economy, development and profits have signalled each invasion of mining capital from the United States. So that there is little doubt that the present incursion into the mining territory of the Coast will at least serve our pockets, if it does not suit our prejudices. It is certainly odd that British capital should have turned its back upon the Lenora mine, the Britannia mine and the Van Anda mine, and that local an American enterprise should have immediately taken them up in a business-like, intelligent, and likely to be successful, manner. And it is not less remarkable that as an immediate result, a feeling of hope and confidence should pervade the community which the operations of British capital were never able to inspire. The earlier development of the United States was almost entirely achieved by British capital or by continental capital invested through the agency of English companies. This has nearly all been reabsorbed by the Americans themselves. A similar movement is taking place in Canada. But the capital employed is American and not British. There is no necessity to take alarm at this. Capital is not influenced by, nor does it influence national sentiment. The United States did not lose any of its national independence through the obligations it was under to Great Britain. It is just as unlikely that Canada should lose its national independence through its obligations of a similar nature to the United States. American capital we eagerly welcome and the more highly the enterprise which brings it here is remunerated, the better we are pleased.

The reports and accounts of the Cariboo, Camp McKinney, mine were presented to the shareholders early in February and a dividend of 1½ cents per share declared. In anticipation of a favourable report the shares rose very rapidly from 15 to 33 cents, but since the publication of the report have been decidedly weaker, partly, no doubt, because the speculative interest in them has been relaxed, and partly, because the position of the

mine as disclosed is not particularly bright, though in some ways sound enough. It appears that Mr. George Macaulay presented the company with \$30,000 to be expended in certain development work which he conceived would strengthen the reserves and increase the value of the mine. Whether this work has been as conclusive as it might have been is not easy to decipher, but there is no doubt that the mine's development and ore reserves are in a fairly satisfactory condition. During the year it earned \$14,000 or thereabouts, over and above the expenditure provided for by this donation. So that at the end of the year there were \$50,000 in hand, made up from \$15,000 carried forward, \$30,000 donated, and \$14,000 earned. Out of this, the directors have distributed $1\frac{1}{2}$ cents per share leaving a balance of over \$30,000 to be carried forward. The directors were quite justified in this course, provided they do not consider that as large a percentage of earnings need be spent on development during the coming year. During last year, roughly, \$2 per ton of ore milled were spent on development and machinery. The drain on the profits of the mine may be lessened either by the expenditure of a smaller gross sum or by a greater average value of the ore milled. Presumably the directors were not acting in the dark in deciding to distribute a larger proportion of the funds in hand than the net proceeds of the mine, after all operating expenses were met, justified. The position of the mine is much better than it was a year ago, although large net profits are never likely to characterise its operations in the future. Wise shareholders will regard any considerable increase of profits from the discovery of high-grade ore as an acceptable donation, not from Mr. Macaulay, but from Nature, rather than as a reason for any material permanent enhancement of the capital value of their holdings.

The frequency with which articles on the Athabasca mine appear in the columns of the technical press indicates that that property is of exceptional interest from a scientific point of view. It reminds us of some peculiarly complicated medical "case" which sets the whole world of medicine agog with interest. Medical "cases," however, are generally unhappy in themselves, and unprofitable as members of society. It is with mines as it is with men, those who show the fewest deviations from the normal are likely to be the most satisfactory from a practical point of view. They are not interesting to specialists, the end of mining is not the building up of an exact science of mining, but the profitable extraction of mineral, and the science of mining is subordinate to that object. The science of mining is largely constructed from the observation of peculiarities in vein structure and the occurrence of mineral. But such peculiarities are highly expansive to shareholders, and it is perhaps unfortunate that they seldom profit as individuals by the difficulties their experience has taught others to anticipate and avoid. Just as the unfortunate medical "case" may give others similarly or likely to be similarly afflicted, a better chance of health and happiness,

without any opportunity of individual participation therein.

Our excellent contemporary the *Critic*, of London, in a recent issue vigorously attacked the Hon. J. H. Turner, the newly appointed agent-general of British Columbia in London, pointing out that his unfortunate connection with the notorious Morris-Catton swindles unfitted him to hold so responsible a post. The *Critic* argued that either Mr. Turner knew what he was about in associating himself with Catton, or he did not. If he did know he is as big a rascal as Catton, if he did not then he shows himself to be an irresponsible person, and neither a rogue nor a fool should be the accredited representative in London of so important a part of the Empire as British Columbia. Generally applied the *Critic* conclusions would be sound enough, but we in British Columbia who know and respect Mr. Turner refuse to admit that because he made one "bad break" he is either fool or knave. If ever there was a thoroughly honest public man Mr. Turner is one, and even as things are a man can't be utterly incapable to hold cabinet rank in the Provincial Legislature for a period extending over a dozen or so years. The *Critic* states further that Catton's Golden Twins fraud was perpetrated under Mr. Turner's very nose, which would seem to imply an abnormal development in that feature; for the Golden Twins mine is in Ontario, some two thousand miles away, and not in British Columbia as suggested. Our contemporary's article was manifestly well intentioned, but even Mr. Hess in his life time may have been guilty of more than one indiscreet action which he has since had reason to regret or feel ashamed of, and, if so, he would not like to be judged by the standard of these mistakes. Is it therefore always quite fair to rake up old scores, or to pillory a man because his judgment was once at fault?

It is announced that the negotiations for the transfer of the "Pyritic" smelter at Boundary Falls to the Montreal & Boston Copper Co., owners of the Sunset mine near Greenwood, has been successfully consummated. This is very pleasing and welcome intelligence, as the operation of another large smelter in the Boundary district means a further considerable increase of ore production from that territory. The company in question has already shown excellent judgment in the manner in which the Sunset mine has been placed upon a productive footing.

THE SILVER-LEAD INDUSTRY OF BRITISH COLUMBIA.

By DOUGLAS LAY, A. R. S. M.

THE New Year opens with brightened prospects for the silver-lead industry of the Province. The recent reduction in the freight and treatment rates on lead ores announced by the smelting companies, is a material concession, and will go far to alleviate the state of depression incumbent upon a low metal market, and will lead to renewed activity on the part of many mines. Last year closed with silver-lead mining at a virtual standstill, the low prices of lead and silver, coupled with the prevailing freight and treatment rates, permit-

ting of the shipment of only very rich ore, while many mines found it quite impossible to ship at all under the then conditions, and had perforce to close down entirely, or proceed only with development work. The more favourable conditions now prevailing, however, will greatly encourage the mining companies, and in many cases will make all the difference between profitable and unprofitable operation.

The present concession on the part of the smelters, amounting to practically a reduction of \$4 per ton in the freight and treatment rates of lead ores, is certainly liberal, but there are conditions adhering thereto which did not apply to the former rate, and which rather detract from the advantages of the new rate, so far as the miner is concerned. The new conditions are:—

(1). The amount of zinc treated without penalty (50 cents per unit over 8 per cent.) is reduced from 10 per cent. to 8 per cent.

(2) To avoid the risk increased by the smelters in buying metals on a falling market, they will pay, upon receipt of ore, only 90 per cent. of its net value as calculated from the market then prevailing. Final settlement will be made 90 days later, when any depreciation in market value will have to be stood by the mine, and on the other hand a rise in value of the metals will be made up by the smelter.

To far as the growth, development, and ultimate well-being of the mining industry of the Province is concerned, the question of freight and treatment rates is of paramount importance, the great majority of the ore demanding the intervention of the smelter. But it is a question that must ever be a vexed one, and so far as treatment rates are concerned perhaps no basis of settlement will ever be arrived at equally satisfactory to both miner and smelter alike. The smelter from his unassailable position, perhaps justly, regarding the miner as ever prone to cavil, and deeming that his (the miner's) proper attitude should be one of patient submission, rather than of aggressive self-assertion. While the miner, on his part, unable to possess himself of the belief that his ore is smelted merely as an act of accommodation, ever clings to the conviction that smelting rates were framed entirely for the benefit of the smelter, to the complete exclusion of his own interests. Be that as it may, and without in any way taking up the brief of the miner, a contrast between the gross net values of silver-lead ores as calculated upon the new basis of settlement will be of interest.

Lead \$2.25 per 100 lbs.
Silver 55 cts. per oz.

and a freight treatment rate of \$15 per ton (as against the old rate of \$19 per ton) we have:

GROSS VALUE PER TON.

LEAD, 1,000 lbs. @ \$2.35 per 100 lbs \$23 50
SILVER, 30 ozs. at 55 cts. 16 50
Total gross value \$40 00

NET VALUE PER TON, AS ALLOWED BY SMELTER.

LEAD, smelter pay for lead at London quotation less \$1.00 per 100 lbs. after 10 per cent. of lead contents, as calculated per assay, have been deducted.
1,000 lbs. lead less 10 per cent. = 900 lbs.
900 lbs lead @ \$1.35 per 100 lbs. \$12 15
SILVER, smelter pay for silver at New York quotation deduct-
5 per cent. of silver contents as calculated by assay.
30 ozs. silver less 5 per cent. = 28.5 ozs.
28.5 ozs. @ 55 cts. per oz 15 67
\$27 82
Deduct freight and treatment 15 00
Total net value \$12 82

Smelting charges are based upon a 10 per cent. loss of lead contents, as determined by fire assay (a loss of about 11.7 per cent. of *ultimate* lead contents), and upon a 5 per cent. loss of silver contents. Thus in the case of an ore carrying 50 per cent. lead, and 30 grs. silver per ton (which ore will perhaps represent the average of the silver-lead ores of British Columbia) with market quotations.

It will be seen from the above that the difference between gross and net value of lead ores is very marked. Moreover, when from the net value as above given has been deducted the total cost of mining the ore and placing it on the railway cars, and also the government duty, the margin of profit accruing to the mining company is not great. However, the net value allowed by the smelter is greater by some 45 per cent. than that resulting from the old freight and treatment rate.

The miner is prone to contend that in view of the many modern improvements in the metallurgical field, the high perfection to which the science of metallurgy has been brought, it is not unreasonable to suppose that in a large up-to-date plant this 10 per cent. of the lead contents and 5 per cent. of silver contents is not lost beyond recovery, and that while in the slag ultimate losses must of necessity occur, yet by means of suitable plant, a considerable proportion of this 10 per cent. of lead and 5 per cent. of silver contents, is susceptible of recovery. Without having access to detailed records of smelting campaigns, it is hazardous to state to what extent such a contention is justified. But there is abundant reason to maintain that the miner's estimate of the smelter's profits is, in the great majority of cases, excessive; that in lead smelting (copper smelting is another matter) on a small scale, only a small profit accrues to the smelter, to use a colloquialism, there is "nothing in it." In the case of large lead-smelting plants there is reason to believe that it may be otherwise.

"The man in the street," unburdened with technical knowledge, will promptly ask, why do not the various mining companies in the Province erect smelters of their own, if they are dissatisfied with smelting rates? The answer is that in the great majority of cases that is impossible. Very rarely does one mine produce ore that can be smelted without admixture with other ores. "Wet" ores (i. e., ores rich in lead or copper) requiring to be mixed with "dry" ores (i. e., ores poor in, or ores containing no lead or copper). Without going deeply into technicalities, a "wet" ore requires a relatively large amount of "dry" ore for purposes of smelting. The following factors are of paramount importance in lead smelting and justify or not, as the case may be, the erection of a smelter in any district:—

(1). The *amount* of ore in sight in the section of country where the smelter is to be built. Obviously a smelting works must have a certain supply of ore always on hand, and a continuous shipment must be guaranteed.

(2). The *character* of the ores, as regards their essential fluxing properties, i. e., the amounts of iron, silica and lime, which they contain. Also the proportion of "wet" to "dry" in the district.

(3). The presence or absence in the district of *fluxes*, i. e., iron ore or limestone. There is a certain proportion of iron, silica and lime, which forms the most satisfactory smelting mixture in any district, and rarely, comparatively, can ores be mixed so as to yield this proportion without addition of some flux in the shape of iron ore or limestone, supplies of which should be consequently easily accessible.

(4). The *grade* (i. e., richness in gold and silver) of the *bullion*, which can be produced. The grade of the bullion has to be kept within rather narrow limits, and

very low-grade bullion would not pay for refining at all. In other words, it is quite possible that a district might produce ores which, while suitable so far as their mere fluxing properties were concerned, yet on account of their values in gold and silver being too low, would render the profitable operation of a smelter an impossibility.

(5). It is necessary to obtain a treatment rate on the maximum amount of material charged into the furnace. In other words the ores of the district must be capable of such admixture, that they require as small an addition as possible of mere flux — limestone or iron ore. Which latter are not only expensive in themselves, but also take up room in the furnace which might be occupied by ore. For example: Suppose in one case 500 lbs. of an ore A requires 500 lbs. of flux, and in another case 500 lbs. of ore A can be smelted by admixture with 500 lbs. of ore B, obviously in the latter case, the capacity of the furnace, so far as ore treatment is concerned, is doubled and the cost of smelting is reduced by one-half.

It would seem then that while every credit is due the smelting companies for the assistance they are now rendering the mining interests at a time of depression, yet the lasting and permanent well-being of the mining industry as a whole, and of the silver-lead industry in particular, is dependent upon one of two events; either

(1). The operation of a refinery in the Province coupled with the imposition of a duty on all imported lead; or

(2). The erection of a co-operative smelting and refining works at some central point in the Province, by the mining companies of the Province, which should be operated for their exclusive benefit, and in the advantages of which they would participate. Concerning this latter scheme, its materialisation would doubtless involve the overcoming of many difficulties, and opposition would be met with. Nevertheless, whether feasible or not, it would seem ideal in its perfected state. The project at one time was taken up by one or two prominent mining men but for some reason or other no active measures resulted.

It is to be deprecated that upon the devoted heads of the custom smelting companies much abuse has been wrongfully poured, they having been characterised as "vampires" and so forth. But it must be borne in mind that they, in particular those operating small plants, in many ways are placed at a disadvantage and without doubt must have incurred serious losses of late, buying metals with the market rapidly falling. Since

by the time they were able to market their product a serious depreciation in value must have resulted. Under the new basis of settlement, however, they will not be exposed to this risk, the miner bearing the responsibility. Further, it is not well to lose sight of the fact that smelting companies are not operating in this Province for the benefit of the mining companies exclusively. They are here, as are the latter, to make money—the *argumentum ad hominem*, for their existence. However, to the railway company and to the smelting companies it must be abundantly evident that in view of the improbability of any material increase in the price of lead, they must extend to the mining industry the utmost consideration that is compatible with the conservation of their own interests. Neither would it be by any means short-sighted policy on their part, were they

to foster that industry, so far as lay within their power, at this early stage of its career. Such could be effected without any great act of self-abnegation being involved on the part of those instrumental therein.

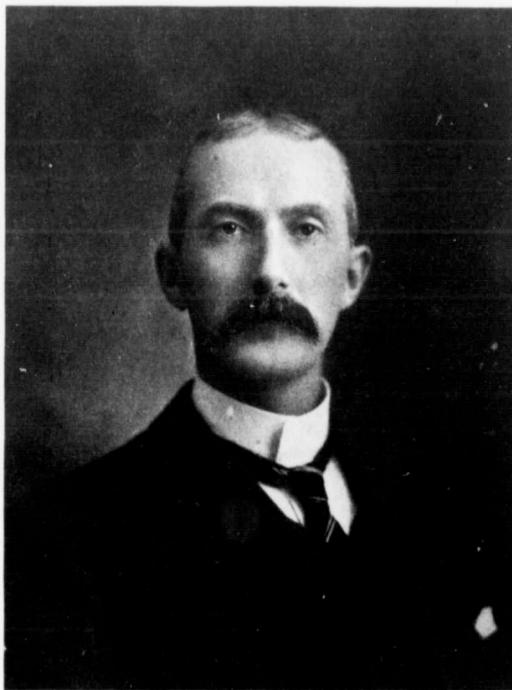
As matters now stand, for silver-lead mining particularly, is the outlook brightening and while some few months ago it was impossible to contemplate the future other than with serious thought, if not with anxiety, now their is good reason to anticipate better times and a general renewal of activity.

That British Columbia will ever be a South Africa or a Western Australia, the most sanguine will not for a moment contend. The nature of her ore, apart altogether from its extent, places the issue in such a position that it is within the realm of the impossible. But that British Columbia will prove fertile to a very

large extent in mining resources there is abundant evidence to show.

MINING MEN OF THE PROVINCE.

We have much pleasure in reproducing herewith, as one of our series of photographs of "Mining Men of the Province," a recent portrait of Mr. J. J. Campbell, the exceedingly able and efficient agent and business manager of the smelting department of the Hall Mining & Smelting Co., Limited. Mr. Campbell is very closely identified with the mining industry in British Columbia, and is most active in every effort to promote its interests and welfare.



MR. J. J. CAMPBELL, OF THE HALL MINING & SMELTING CO.

THE ARLINGTON TRAMWAY.

By H. E. T. HAULFAIN, C. E.

THERE seems a prevailing idea that aerial tramways are necessarily complex devices requiring specialized skill, both in design and construction, and that their successful installation and operation is impossible without the use of innumerable patented devices.

This doubtless is true of long lines with large capacity, but for short lines with a limited daily tonnage the problem is comparatively simple.

There are many properties in the early stages of development where a cheap tramway would be of considerable benefit, the following account of the tramway at the Arlington mine, Erie, B. C., may be of interest :

The line is 2,250 feet between bins and the difference in elevation is 500 feet.

For the lower half of the line the cables are seven feet apart, but from the middle up they gradually come together and at the top are only three inches apart. This enables both buckets to load from the same chute. The standards are of simple design and construction. Their general plan can be seen from the photos. The highest standard is 58 feet high and is of the crossed type. The upper standards are of the open type to permit of the cables being close together.

The method of supporting the cables is original with myself and is very simple and effective.

Simple hooks 36 inches long and made by the mine blacksmith from iron one inch by two inch, are simply hung over the caps.

On these hooks are placed simple cast-iron saddles grooved on the top to receive the cable and with a socket in the bottom to sit on the hook. The radius of the top curve is three feet and the length of the saddle



AERIAL TRAMWAY AT THE ARLINGTON MINE, ERIE, B. C.

The two main standing cables are one inch in diameter and were obtained from The Hall Mining & Smelting Co., being the discarded rope from their long tramway.

The working strains in their heavy long line are high and the rope has to be replaced before it is worn out and much of it is in excellent condition for stationary cables.

It is anchored at the top by being passed twice around a log and then clamped. The log is placed behind two convenient stumps to which it is spiked.

At the lower end each cable is passed around a convenient stump and after being hauled taut with a block and tackle and a horse, is simply clamped with three screw clamps.

These main cables are supported by 11 standards besides the two terminals and the largest span is 280 feet.

is 16 inches, and it being free to rock on the hook, allows of a very smooth passage for the buckets.

Besides cheapness and simplicity of construction these hooks have the added advantage of being free to swing on the caps, thus allowing the saddles to move with the cable, instead of the cables slipping in the saddles.

The design of the buckets can best be gathered from the photographs. They have a capacity of between 12 and 13 cubic feet and carry an average load of 1,200 pounds.

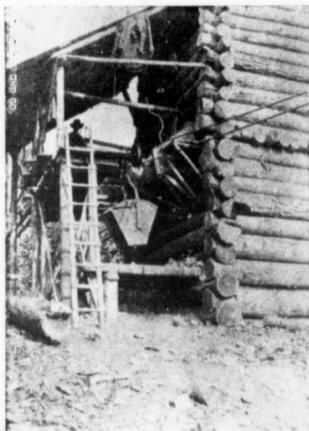
They are supported on a carriage with sheaves 30 inches between centres. The sheaves are of ordinary cast iron 18 inches in diameter over all and with a groove three inches deep, and are connected by two iron bars four inches deep by half an inch thick.

A steel pin midway between the sheaves supports the bale.

The releasing trigger can be plainly seen in the photo.

It is automatically released by running up an inclined board at the lower terminal.

The two buckets are fastened one at each end of a



UPPER LOADING STATION — SHOWING TRIGGER AND GENERAL CONSTRUCTION OF BUCKET.

steel cable $\frac{5}{16}$ of an inch in diameter and of such a length that when one bucket is at the lower terminal the other is at the top.



LOADED BUCKET IN TRANSIT.

This cable passes completely around a four-foot bull wheel lined with ordinary $\frac{3}{8}$ inch rubber packing. The

cable crosses itself just in front of the bull wheel and runs over two pair of guide wheels one foot in diameter and also rubber lined.

Along the line it is supported on simple wooden collars, as shown in the photograph.

As these become worn fresh slats are tacked on. These rollers have a one-inch iron pipe through the centre and run on iron rods. Though simple they are thoroughly effective and require little attention.

The brake is an iron band shod with wood on a cast-iron brake wheel and is kept thoroughly lubricated with graphite and grease.

An emergency brake is provided, consisting of a plank at the back of the bull wheel, and on this plank are two hardwood wheels one foot in diameter, placed to fit in the groove of the bull wheel and press the small cable into the rubber packing. This has so far not been required, but a coating of ice on the small cable or some such an emergency might, at some very particular moment, call for it.

Our usual running rate is from eight to ten trips an hour, but over sixteen trips have been run in the hour without trouble.

The lower anchor of the main cables is some 150 feet from the lower terminal bin, and to keep the two cables taut two boxes were hung from the middle of this span and loaded with about three tons of rock each.

The complete cost of this tramway including everything excepting the bins and including the troubles attending the start, amounted to less than \$2,300, or about \$1 per foot.

It has been running now for six months without any trouble whatever, and the only hitch that has occurred was from the grooves in the running sheaves filling up with soft snow.

The addition of a tail rope might perhaps help the smooth running of the buckets, but has not been considered necessary.

Lately an intermediate loading station has been built 300 feet from the upper one.

The bucket is loaded with 300 or 400 lbs. at the upper station and this carries it to the intermediate station, where 900 lbs. are added and the trip is completed in the usual way.

MINERAL OCCURRENCES AT WHITE HORSE.

By J. P. WHITNEY.

THE town of White Horse, the eastern terminal of the White Pass & Yukon railway, is situated on the Fifty-mile river, two miles below the famous White Horse rapids. It is the head of navigation and the gateway to the Yukon gold fields. The town boasts of four general merchandise stores, seven hotels, and numerous restaurants and saloons. The Canadian Bank of Commerce has a branch house established, and a newspaper, *The Daily Evening Star*, chronicles the happenings from the outside world in the publication of telegraphic despatches. The post office, a two-story building, erected at a cost of \$20,000, also the Dominion telegraphic and the public works offices, and the railroad warehouses extending for a thousand feet along the banks of the river, help to give White Horse a quite metropolitan aspect, while in the background are the barracks of the Northwest Mounted Police.

One mile west of White Horse is a bed of fire-clay. Last summer sixty-five thousand white bricks were made, and fifteen thousand pressed brick. West and south of White Horse, from four to ten miles, lies the great copper belt which has been prospected along its length for eighteen miles, but there is still an immense area of country, referred to in the Canadian geological reports. The claims that have been partially developed are the Rabbit Foot, Anaconda, War Eagle, Copper

pyrite and green-copper carbonates, in the condition of sand, or disintegrated granular limestone stained with copper. Azurite is rare; chalcocite and black oxide occur sparingly, but native copper seems to be absent as well as the red oxide. The typical ore is bornite. These outcrops are scattered all over the plateau, and denuded in the general erosion. They are found resting on the granite with no line in the vicinity, or associated with the patches of lime which

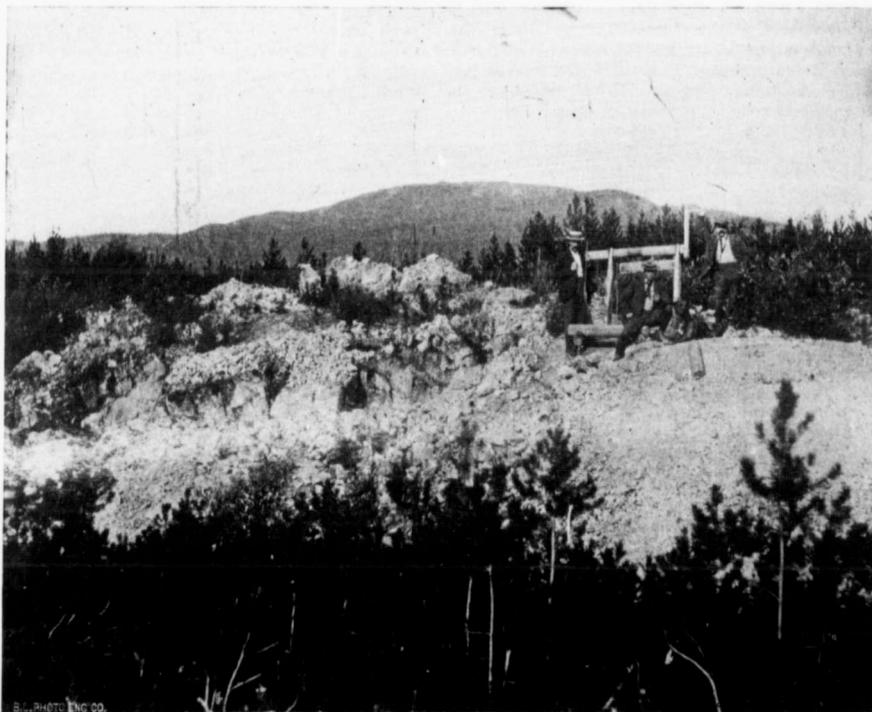


King, Carlisle, Pueblo, Grafters, Arctic Chief, and the Corovette group, and assessment work has been done on two hundred claims.

Two distinctive classes of ore are present and their occurrence is quite different. We have large masses of specular or magnetic iron, as at the Pueblo, where it is hematite, or at the Little Chief, where magnetite prevails, both carrying a moderate tenor of copper; or outcrops of much smaller dimensions in which the ore is essentially bornite, with occasional patches of chalcocite

still remain; and their discovery in the dense tangle is largely a matter of accident, even to the careful searcher.

A car load of ore was shipped this year from the Copper King to the smelter in Tacoma, the ore averaging forty-five per cent. copper and netting ninety dollars per ton. At present the owners of this claim have ready for shipment four hundred sacks of high-grade ore. A shaft has been sunk thirty feet in depth on the lead and strikes of high-grade material are frequent. Capital, however, is required to thoroughly develop the



RABBIT'S FOOT MINE AT WHITE HORSE, SHOWING ORE BODY.



THE COPPER KING MINE AT WHITE HORSE.

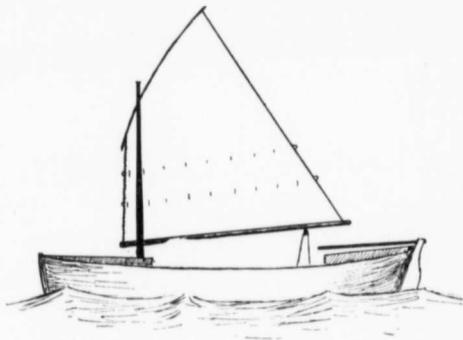
properties. Twelve miles southwest of the town are areas which were recently sold for the sum of three hundred thousand dollars, and arrangements are made to commence the development of this property at the beginning of the new year.

TYPES OF BOATS FOR PROSPECTORS.

By HERBERT CARMICHAEL,
Government Analyst and Assayer.

AS undoubtedly a large number of prospectors will be exploring our coasts next year, a few words as to the type of boats in use may not be out of place. The earliest craft found on the coast was the Indian canoe. Canoes are made on practically two distinct patterns: the West Coast of Vancouver Island canoe, and the Northern or Queen Charlotte Island canoe.

Representatives of these types are shown in the accompanying cuts. These craft were built of a considerable size considering that they were invariably cut or dug out from a single cedar tree, being often 40 feet



long by 7 feet beam, but it must be remembered that a canoe with 7 feet beam could be made out of a cedar having a diameter of only 6 feet.

This was accomplished after hollowing out the canoe by fire and chipping, by filling it with water and heating the water by throwing in hot stones, then while the wood was soft and pliable forcing out the sides with sticks acting as stretchers.

The bow forms the principal distinction between the two types, that of the West Coast canoe being much larger and carved at the end to represent the figure of some animal; this portion is a separate piece of wood and is sewn on to the body of the boat by thongs of spruce root. This bow has a large amount of flare which the West Coast Indians claim is of great service in parting the waves while a landing is being made through surf, this is invariably done stern first with the bow pointing seaward; the bow has, however, a prejudicial effect when sailing with a beam wind by throwing the boat's head off the wind.

The stern of the West Coast canoe is vertical and differs in this respect from the Queen Charlotte Island craft, which has a stern cut away with a long curve, which makes it much more difficult to attach a rudder.

A peculiarity of the northern canoe is a rectangular piece cut out of the bow below the water line. I made several enquiries as to the origin or reason for doing this but the only answer I got was that it had always

been so, its usefulness appears to be confined to catching in any kelp bed you may be going through.

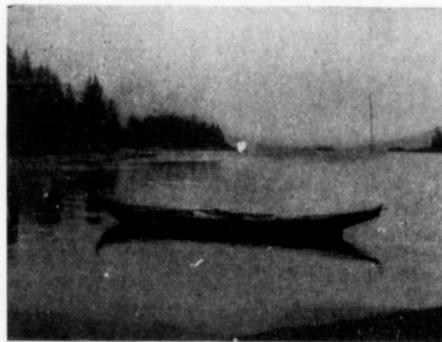
A danger is always present with cedar canoes, they may split in a sea from end to end, this is more liable to occur when the canoe is old and the bottom has worn thin. This point should be specially looked to before venturing on rough water.

It is doubtful if sails were used by the Indians before the advent of the white man, that used now is a sprit sail of rectangular form with a long gaff, this is kept from falling off the wind by a line from the peak, in fact it is the end of the main sheet carried to the peak and forming a loop.

It is wonderful how these canoes will hold up to the wind when sailing on the beam, especially if laden, this is no doubt due to their great length in proportion to beam.

An ingenious method of reefing is employed by the Indians, they slack in the sprit and roll a portion of the sail round the mast.

For general use on the coast, and even for river work where polling has to be done, men who have used both prefer the Indian to the Peterboro canoe, except when



A TYPICAL INDIAN CANOE.

much portaging has to be done which gives the advantage of lightness to the latter.

It appears to be only a matter of a few years till the canoe, as now used, will have disappeared and the Columbia river boat taken its place, the Indians are getting quite expert at the building of these boats which are usually from 30 to 26 feet long.

The small boats used by the B. C. sealing fleet have claimed considerable attention from the prospector; these open boats about 18 feet long are very seaworthy, carry a lot of stuff, sails fairly well when properly rigged (which is seldom), but are heavy and takes it out of a man on a long pull.

The boat for the prospector should be light enough for one man to row easily, should sail well enough to hold her own on a beam wind, and be reasonable in price without any fancy fittings.

This boat commends itself to me more than the five tonner with a cabin, as I have seen such a boat hang for weeks in a calm—calms being the rule in the "inside" waters during the summer months.

The boat which suggests itself as most nearly meeting the requirements would be about 18 to 20 feet long, rather small in the beam, decked for some distance fore and aft with a small side deck and coamings, these latter are of great help in preventing the top of the short seas from coming in.

The deck should have small hatches to admit of using all the available space.

For a sail I would suggest the use of a rig that is seldom seen on the coast but has many advantages for a small boat, viz.: "The Balance Lug," shown in the accompanying figure.

This sail dispenses with the use of rings on the mast, has only one halyard and is easily detached when not in use, it can be used as a fly to cover the boat, or in front of the tent, the spars which are left attached holding it down to perfection.

Last, but not least, let the seeker after fortune provide himself with two pairs of wrought-iron galvanised rowlocks, not the short cast-iron abominations too often used, and let him tie them securely to the boat and prevent the recriminations which occur as the rowlock sinks quietly out of sight in a hundred fathoms deep,

so-called "ore in sight" is only "ore in imagination." The former expression, it is true, is not a happy one, for the ungotten ore of a mine can never be all in sight even when "blocked out" in the most complete manner possible in the regular working of mines. No matter how small the pillars, or masses of ore, blocked out may be, there must always be a large proportion in the interior of them which cannot be seen. But if a person of experience can see the four sides of a rectangular mass of ore, in a vein, for example, he can, in the great majority of cases, form an estimate—not absolutely accurate, it is true, but sufficiently so for commercial purposes—of the quantity of ore contained in that pillar. He may in some cases be able to do so if he can only examine three sides of the ore mass, or again even when only two opposite sides are in view; but in each of these cases he will have to employ a different factor



A PROSPECTOR'S BOAT AT BARCLAY SOUND.

and the calculation which follows as to how far the piece of rope tied round the ore and through the rowlock hole will carry him.

ORE IN SIGHT.†

By J. D. KENDALL.

THE estimation of ore in sight is very far from being one of the most difficult matters with which an engineer has to deal. Yet some of the most serious losses in mining have been incurred through errors in such estimates, and engineers have, very properly, been most severely censured for their failures in this connection. It is therefore proposed to bring the matter before the Institution with a view of making some recommendations which, if followed, will in the future greatly reduce, if they do not prevent altogether, the losses which have so frequently arisen in the past from so-called estimates of ore in sight.

Definition of terms.—Ore in sight is an expression of very common occurrence in reports on mines. The meaning attached to the phrase does not appear, however, to be always the same. In some instances the

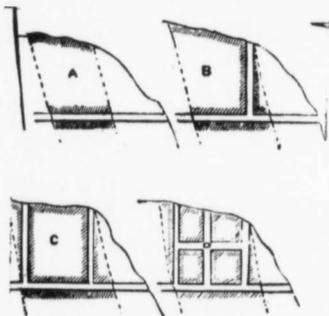
of safety. This factor will also vary with the size of the mass under consideration. These remarks may be extended to ore bodies of other shapes. On the other hand, if only one side of a mass of ore can be seen, it must be perfectly clear that no one can tell what quantity of ore is in that mass. The side visible may show a large area of ore, but quantity of ore involves a third dimension. If this be wanting we cannot possibly know anything about quantity. The third dimension, so often unfortunately assumed, can only be ascertained, with an approach to accuracy, by "blocking out," so that "ore in sight" may be looked upon as synonymous with "ore blocked out."

By "blocking out" is meant the exposure of ore on two, three, or four sides of a rectangular or other shaped mass, as is partly shown in the following diagram.

These four drawings represent, in vertical section along an ordinary vein, the same mass of ore — A, B, C, and D — on which different amounts of work have been done. It must be quite clear to anyone who has had experience of ore deposits, that it is a much more difficult matter to say what quantity of ore is in block A than in block B. It is likewise more difficult to estimate the quantity in B than in C, and if the block be still further opened up by workings, as in Fig. 4, the

† From a paper read before the Institute of Mining and Metallurgy.

problem becomes easier still. Allowances to cover any possible error from nips, intrusions or inclusions, would have to be greater in the case of A than in that of B, and greater for B than for C. The allowances must, in fact, be inversely proportional to the amount of blocking out. They must also vary as the distances apart of the exposed sides vary. For example, in the case of No. 1, if the tunnel were 200 feet below the surface at block A, the estimation of the probable amount of ore in that block would be much more difficult than if the depth were only 50 feet, and therefore greater allow-



ances for possible variations must be made. The same remarks apply to the other figures. The extent of allowance, that is the factor of safety, depends largely upon the character of the deposit, and must be determined on the spot for each particular case.

Blocking out does not mean simply the exposure of ore by trenches, tunnels, drifts, winzes and raises, but includes also the exposures that sometimes result from denudation.

Why blocking out is necessary.—Owing to the very irregular manner in which ore deposits usually occur no one can, as a rule, form even an approximate idea of their extent until the boundaries have been determined by actual work. But even if the main or outside boundaries of a deposit be known there is still much to be learned with regard to the inside boundaries, for most, if not all, deposits contain more or fewer and larger or smaller inclusions of country rock, or other barren ground, about which we cannot know anything until the deposit has been more or less blocked out.

Variations also occur in the quality of ore in different parts of a deposit, so that the more we see of it and the more samples we can take, the more likely are we to arrive at the average quality of the workable portion of it.

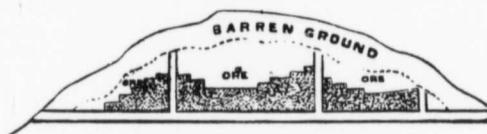
The man who has not, from experience, realised the truth of the above statements will be apt to permit his fancy to form his facts, and so reach conclusions which will most probably be altogether unreliable; for he will assume extensions which may not exist, continuity where they may (and probably will) be great interruption and uniformity where there is great variation.

A few of many instances that have come within the writer's experience will now be given of the unreliability of estimates of ore in sight which are made when the ground under consideration has been insufficiently blocked out.

Illustrations of erroneous methods.—The first illustration relates to a deposit of argentiferous galena, which occurred as a vein. The diagram below gives a section along the vein, and shows the amount of work done at the time the engineer of an intending purchaser made an estimate of the ore in sight.

Had the vein carried ore at the surface it would have

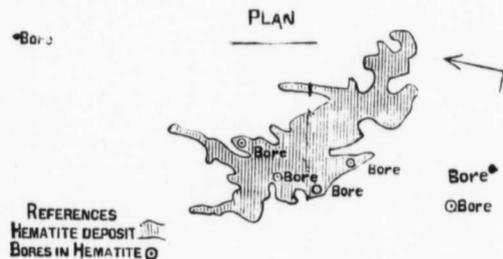
been fairly safe to infer that the ore in the back of the stopes would extend to the surface, but without satisfying himself of the existence of ore in the vein at the surface, the engineer referred to assumed that the body of ore he had seen in the stopes would extend out to



"day." Had he taken the trouble—as he ought to have done—to ascertain what really was on the surface, his estimate would have been very different from what it was, if indeed he had thought it possible to make one. The writer followed soon after with the same object, but failing to find any ore at the surface—that is lacking the third dimension—did not make an estimate, because the ore above the stopes could not be said to be in sight.

When the stopes were extended upwards, it was found that the ore actually nipped out along the dotted line in the diagram.

Another instance is in connection with a deposit of hematite. The deposit had been discovered by means of boring. Hematite had been found in five holes at the points shown in the following diagram:—

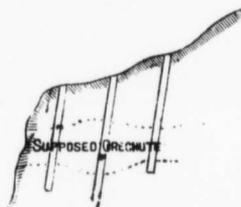


It was assumed that all the bores which passed through ore were in one and the same deposit, that the deposit extended literally much beyond the bores, and that therefore a body of ore containing at least 650,000 tons had been "thoroughly proved"—to adopt an expression made use of in the report prepared for the sale of the property—which expression may be considered as another way of writing "ore in sight." This estimate led to a very serious lawsuit, for when the deposit was practically exhausted only 41,879 tons of ore had been raised, the lateral extent of the deposit being shown in the above diagram. To assume that all the bores which cut hematite were in one deposit was to disregard entirely all experience of such deposits. But further, the founding of such conclusions so important, financially, on such insufficient data is most reprehensible. If the ore had been more thoroughly bored, or blocked out by workings, before any estimate had been attempted no such ruinous mistake could have been made.

Let us now consider an estimate of ore in sight relating to some gold-bearing veins. In its disregard of facts and its confident reliance upon assumption, this is, perhaps, the most reprehensible instance that has ever come under the writer's notice. One vein could only be seen for a length of about 50 feet in a trench about 4 feet deep. The width of the vein in the trench was

about 18 inches. On these data it was assumed—for prospectus purposes it ought to be said—that the vein contained 1,000,000 tons of ore. There were three other veins in the property which—also for prospectus purposes—were assumed to contain over 4,000,000 tons of ore, although there was not sufficient work done on them to thoroughly prove the existence of 4,000 tons. In this case we have not simply the assumption of the third dimension, the whole three are assumed. Can we wonder that severe things are sometimes said of those who make such an unscientific use of the imagination. Whether it be from incompetence or dishonesty is immaterial, the final outcome is alike disastrous commercially. That any competent person ever made such an estimate is incredible, and that anyone should issue such an estimate to the public, after its utter unreliability had been pointed out fully, is, to say the least, most discreditably.

Another instance may be given to show the risks that are sometimes run in estimating quantities on a minimum of information. The vertical projection below was submitted to the writer by the owner of the property to which it related, with a view to sale.



An ore chute was represented as existing in the form indicated above and a quantity given, corresponding thereto, as ore in sight. When the writer examined the mine he found that no chute existed. The country rock was limestone, in beds 2 to 4 feet thick, standing nearly on end. The overlying rock was igneous. The ore, a highly argentiferous galena, occurred intermittently along the bed planes of the limestone as shown below, in plan, on an enlarged scale.

The different lots of ore seen in the uppermost tunnel were not on the same bed planes as those in the level below, which again differed from those seen in the bottom tunnel. Moreover, ore occurred outside the supposed ore chute altogether. As a matter of fact, there was not a scrap of evidence to show that such an ore chute, as was assumed, existed. Not one of the lenses of ore extended from one level to the other. Had the ground been further blocked out by a number of raises, the invalidity of the inferences drawn with regard to the supposed ore chute would have been demonstrated.

Losses resulting from overestimate.—Excessive estimates of ore in sight not only enable promoters to obtain exorbitant prices for their properties, but most probably induce the purchasers to erect expensive treatment plants, which soon become useless where they stand, and often altogether valueless on account of the cost of removing them. Both these results cause unnecessary expenditure, which means avoidable loss, and therefore they are highly detrimental to honest mining. To put it on no higher plane, that ought to be quite sufficient to induce engineers to keep their estimates within the bounds of fact.

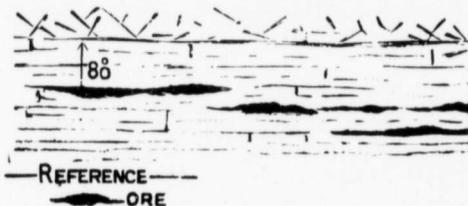
Suggestions.—As a rule, statements as to the quantity of ore in sight, like many other statements in reports, are made so that there is no possible way of checking them without going on to the ground. You have the

simple statement that there are so many tons of ore in sight, and you are expected to accept it. That is not as it should be. Every statement of such quantity should be accompanied by an accurate plan and vertical section, on a working scale, which shall indicate the extent of ore to be estimated, and show clearly the ore which is known to exist, as distinguished from that which is only inferred. The width of the pay chute should be marked on the section at equal distances apart. Samples should also be taken at equal distances. The frequency of both will depend upon the character of the deposit. If variable in form, but fairly uniform in quality, the widths will need to be taken much more frequently than the samples. If the quality is variable the samples must be taken frequently. The width or length, area and weight which each sample represents should in every instance be stated. It is important, too, that the lines along which the samples are taken be shown on the plan. Ore deposits are frequently more or less banded, and, often, the values vary in the different bands. It is necessary therefore that, in such deposits, the samples be taken across the banding, and not lengthwise of it. If taken in the latter direction the latter may be wholly from a rich band, or wholly from a poor one, and therefore, do not represent the average quality at that part of the deposit.

If these suggestions be followed we shall hear much less than in the past of errors in estimating ore in sight, for anyone can then check the calculations, and see at a glance what has been observed and what assumed. Only by wilful misrepresentation could the facts then be concealed.

Some people, unfortunately, are incapable of recording facts accurately, either from lack of the necessary training, or because their observations are more or less vitiated by all sorts of ideas that are not paralleled by phenomena, so that what is becomes twisted into what, from their point of view, ought to be. Such men would be much more useful in the realms of fiction than in a mine.

Others, again, are more or less capable of making the observations suggested, but from lack of experience



in structural geology, are not, in some cases, capable of forming a reliable opinion as to the quantity of ore in sight. The work of such men could be checked if their reports were prepared as recommended.

The careless and reckless who might arily write down a few figures in the usual omnibus sentence as to the quantity of ore in sight—looking upon them probably as a mere matter of opinion—would doubtless feel themselves compelled to go into the matter thoroughly when the facts on which their opinion was based had to be set forth clearly in the manner suggested.

It is also necessary that a statement should be made as to who is responsible for the different data employed, as for example: Who made the geological observations, who took the samples, who made the assays, who supplied the plans. The value to be attached to each part and to the whole can then be fixed with some degree of uses data supplied by one less able or less careful, the

conclusions of the former may be of very little value. In conclusion, the writer wishes it to be clearly understood that this communication is not so much intended to set forth all the methods and precautions needed in estimating ore in sight, many of which can only be determined on the spot, as to urge the importance of having all the observations of fact relied on so set out in the report and accompanying plan that any one competent to do so may check the results. The effect of such a course will probably be to induce greater care on the part of those responsible for the estimates, and at the same time increase the confidence of those for whom the estimates are made by affording a clear indication of what is meant by "ore in sight" in each particular case.

THE TREATMENT OF TAILINGS BY THE CYANIDE PROCESS AT THE ATHABASCA MINE, NEAR NELSON, B. C.†

BY E. NELSON FELL, NELSON, B. C.

AS this plant is the first ever erected in British Columbia for the treatment of tailings by the cyanide process, and as the ores of this mine are of a character not unusual among gold ores of this Province, it is probable that a description of the principal features of the plant, and of the methods employed in its operation, may be interesting.

These works were designed after a careful study of the process, in a small experimental plant, for a period of six months. During this period ten percolation tests on charges of tailings of 1,100 lbs. each, eight percolation tests on similar charges of concentrates, and twenty-six tests on concentrates in a revolving barrel, were made besides laboratory experiments.

The ore consists of a quartz gangue, containing a little lime and variable quantities of the sulphides of iron, lead and zinc. The following figures, giving the analyses of the ore before milling, and of the tailings after milling, which constituted the material to be cyanided, are based on the daily samples taken during February and March, 1901.

ANALYSES OF ORE AND TAILINGS.

	February		March	
	Ore. Per cent.	Tailings. Per cent.	Ore. Per cent.	Tailings. Per cent.
Zn	1.93	0.91	1.92	0.91
Fe	7.04	2.65	8.16	3.03
Pb	1.63	0.20	1.24	0.21
CaO	4.97	2.46	1.56	1.43
S	5.99	1.71	6.02	1.75
Al ₂ O ₃	3.20	3.20	3.45	3.40
SiO ₂	74.20	85.00	74.30	86.10
	Oz.	Oz.	Oz.	Oz.
	Per ton.	Per ton.	Per ton.	Per ton.
Au	1.68	0.32	1.34	0.27
Ag	1.32	0.38	1.34	trace.

The plan was designed to have a capacity of 30 tons per diem, with a 5-day period of treatment, including the charging and discharging of the leaching-tanks. Some changes which have been introduced, and which will be described later, have so reduced the period of treatment that the plant may now be considered to have a capacity of 50 tons per diem.

It is located on a steep hillside, and Figs. 1 and 2, showing the plan and side elevation, will explain its general arrangement.

At every step of the process, except the pumping of

the spent solution from the sumps to the solution-tanks, the materials are always moved by gravity. In order to secure this result large excavations had to be made in difficult ground, and heavy masonry had to be provided for retaining walls and tank foundations; the total excavation being about 10,000, and the aggregate of granite masonry about 1,250 cubic yards. The cost of this work was great, and the total cost of the plant amounted to \$31,096.79. Every effort was used to secure solidity of construction, and nothing but good material and workmanship was employed throughout.

The plant was located to receive the tailings direct from the mill, in two distributing-tanks, 14 feet in diameter and 10 feet in height. The tanks are fitted with annular launders around the rim and are filled with water before the admission of the tailings; the overflow is carried off in the annular launders, and thence in iron pipes to the waste-launders under the leaching-vats.

In order to control the proportion of slimes allowed to escape, a slimes arrester is provided. This consists of a sheet of iron, 10 in. wide, fitted inside each tank, about 1 inch from the staves, extending all the way round, and held in position by 8 iron brackets. This sheet is arranged so that it can be raised entirely above the level of the tank, or lowered and immersed until the upper edge is but slightly above the level of the water. In this position it is most effectual in arresting the outflow of slimes. The exact position of the sheet can be regulated to suit the character of the ore under treatment.

The tailings are distributed in these tanks by eight-arm distributors, working automatically. The tanks are fitted with filters and are connected, beneath the filter, with the waste-water receiver, which is in turn connected with the vacuum pump. The filters are protected by perforated boards against injury in shovelling out the tailings. When the tanks are full, the supernatant water is siphoned off, and connection is then made with the waste-water vacuum-tank for about twelve hours. At the end of this time the tailings are so nearly dry that a shovelful thrown into the vat below breaks up into a loose pile of sand. (The importance of this fact will be shown later).

The distributor-tanks are placed over the leaching-tanks, on a frame partly of steel and partly of timber, in such a way that each tank can be discharged by three side doors into any one of three of the leaching-tanks. Our usual practice has been to accumulate about 35 tons in a distributor-tank at one time; after drying, these can be discharged by shovelling at a cost of about eight cents per ton.

The leaching-vats are five in number, arranged under the distributor-tanks as described above, and shown in Fig. 1. They are 18 feet in diameter and 4 feet in height, are fitted with cloth filters and center discharge doors, rectangular in shape, tightly closed up by bolts, and removable from the inside. Around the door frame is a wooden frame to which the filter cloth is attached; and, before the sands are admitted, a wooden cover is admitted over the iron door, having a pyramidal top to facilitate the current of the solution. The outlet pipe for the solution connects with the bottom of the vat and runs either to (1) the strong gold tank; (2) the weak gold tank; (3) the waste-water vacuum tank; (4) directly to waste. The pipe connections are such that any or all of the leaching-vats can drain through any or all of these channels simultaneously and independently. This is a very important provision for saving of time in the operation of the plant. Both solution and water are admitted to these tanks on top of the sands, and distributed through a floating box with perforated sides.

† Paper read before the American Institute of Mining Engineers, Mexican meeting.

This method of admission was found to be easier and more effective, and to give better results, than the plan of admitting the solution under the filter bottom. The spent sands are removed by being sluiced out through the centre discharge door—an operation which requires about three or four hours. We employ a hose with a 1-inch nozzle, under an effective head of about 200 feet.

The gold tanks are two in number, 10 ft. in diameter and 6 ft. in height, fitted with heads and connected with the vacuum pump. In practice we seldom use this connection, except at the end of the leaching process, as the pump has a tendency to cause the sands to pack in the leaching-vats and to interfere with percolation.

From the gold tanks the solution is run to the zinc-boxes, which are arranged in two series of twelve each. Each is a square movable iron box, with a capacity of one cubic foot of zinc shavings; and each is independent of the other boxes. Below the zinc-boxes are two sump-tanks 12 feet in diameter and 6 feet in height.

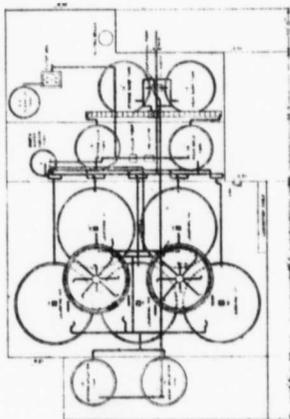


FIG. 1.

The solutions from either series of zinc-boxes can be drained into either sump, independently of the other, or can be drained to waste. Above the sumps is placed the centrifugal pump which forces the solution back to the solution-tanks—two in number, 10 feet in diameter and 6 feet high. The solution can be pumped from either sump-tank to either solution-tank.

The solution is made up to the required strength in the strong tank by placing the requisite quantity of cyanide in an iron basket, having sides of wire netting, and lowering the basket into the solution. The cyanide is entirely dissolved in this manner in about one hour. We quickly abandoned the plan of making up a large amount of strong solution in a stock-tank, as we found that the loss by decomposition was heavy.

The work done in the plant has been of two kinds: (1) The treatment of tailings direct from the mill (from February 18th to May 10th); and (2) the treatment of accumulated tailings (from May 10th to July 30th). The first group will be hereinafter referred to as "mill-tailings," and the second as "dam-tailings." Both groups were from the same mill and the same class of ore.

During the first period 841 tons of mill-tailings, and during the second period 1582.4 tons of dam-tailings, were treated, making a total of 2423.4 tons. At the end of the second period the entire contents of the zinc-

boxes were cleaned up. The tonnage was estimated, by considering 23 cubic feet of settled sands to be equal to one ton. This figure was first arrived at after careful measurements, but we realised that it was only approximate. The actual value of bullion recovered was \$17,179.77, while the amount which should have been discovered (estimating the tonnage as above, and the recovery as the difference in the assay value of the tailings before and after treatment) is \$20,085.74. In considering this discrepancy, it must be remembered that, at the commencement, the plant was quite new, and some time elapsed before the plant was running smoothly, leaks were stopped, and the various stages of the work were brought up to an efficient condition.

The average value of the mill-tailings was, before treatment, \$5.28, and after treatment, \$1.34 per ton—a recovery of 75 per cent. The average value of the dam-

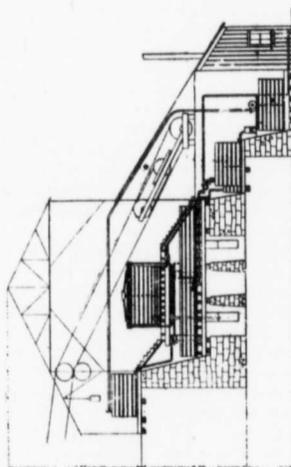


FIG. 2.

tailings was, before treatment, \$10.80, and after treatment \$2.17 per ton—a recovery of 80 per cent.

In considering the percentage of recovery in the case of the mill-tailings, the question of the conditions under which these tailings were deposited becomes very important. Before the filters were introduced into the settling-tanks, the value of the tailings was \$6.00 per ton before treatment and \$1.74 after treatment, or a recovery of 71 per cent. After the filters were introduced, the value of the tailings before treatment was \$4.20, and after treatment 54 cents per ton, giving a recovery of 87 per cent. The figures are averages; but to emphasise this point further, I herewith give the assays of the last seven charges of mill-tailings treated at a time when the plant was running smoothly.

Lot.	Before	After
	Treatment.	Treatment.
	Per ton.	Per ton.
21	\$6.20	\$0.21
22	3.10	0.42
23	2.48	0.21
24	1.65	0.21
25	2.27	0.21
26	3.51	0.21
27	4.96	0.21

This exhibit shows that under this system, we were able to extract practically all the gold values, even from tailings containing fairly high values at the start. I attribute this satisfactory improvement principally to

the improved physical condition of the sands, due to the introduction of the filters in the settling-tanks.

Time of treatment.—Before placing the filters in the distributing-tanks and obtaining the sands in a desirable condition, the average time occupied on each charge was 5 days 14 hours; after the change was made as above, the time occupied in treating 62 charges was 3,902 hours, or an average time of 2 days 15 hours. The results of this important saving of time were far-reaching; the capacity of the plant was nearly doubled; the percentage of extraction was improved (by improved percolation); and less solution was necessary, involving less decomposition and consumption of both cyanide and zinc.

Consumption of material.—During the periods under consideration, 2,423 tons of tailings were treated, with a total consumption of 4,977 lbs. of cyanide, costing \$1,360.65, and 950 lbs. of zinc, costing (uncut) \$123.50. The cost of cutting is included in the regular wages of the plant. These figures show that 2.05 lbs. of cyanide costing 54 cents, and 0.39 lbs. of zinc, costing 5.07 cts., were consumed per ton of tailings treated. Owing to various difficulties met with at the start, these figures do not exhibit what was being done when the process was running smoothly, and what can be relied upon in the future. During the month of July our consumption on tailings of the assay value of about \$10 per ton in gold was 1.25 lbs. of cyanide, costing 35 cents, and 0.25 lb. of zinc, costing 3.25 cents, making a total of 38.25 cents per ton. By careful and systematic work I believe an improvement on these figures might be realised.

General working costs.—The following table exhibits, in column 1, the actual working costs incurred in treating 2,423 tons from February to August. In column 2 are shown the costs which, from our past experience, I believe we can confidently anticipate when the plant is in regular working order and treating 40 tons per diem, which is a very moderate estimate of its capacity.

	ACTUAL AND ESTIMATED COSTS.	
	(1) Cts. per ton.	(2) Cts. per ton.
Foreman	28.8	9.7
Assistants	62.6	27.7
Assaying	16.5	5.5
Total wages	107.9	42.9
Cyanide.....	54.0	35.0
Zinc	5.0	3.0
Sulphuric acid	4.6	4.0
Assay and refinery	12.0	5.0
Fuel and sundries	5.3	2.0
	80.9	49.0
	\$1.88	\$0.92

Precipitation in the zinc-boxes.—For this purpose two series, each of 12 individual sheet-iron boxes, were used, with zinc shavings as the precipitating material. The shavings were cut on a Hampton zinc-lathe, which proved satisfactory, with little waste of zinc. The precipitation was very perfect, even when the solution was allowed to run as rapidly as possible. In all of the numerous assays which we took from the lowest of the zinc-boxes, we never once found gold of a greater value than 21 cents per ton of solution, and usually found only faint traces. When we commenced working, we kept the strong and weak solutions in separate gold-tanks; but we found that when the weak solution was below 0.05 per cent. in strength, the precipitation was imperfect and, on the other hand, when the strong solution was over 0.15 per cent. the consumption of zinc was excessive. We, therefore, partially mixed the so-

lutions so that the solution in the strong gold-tank should run about 0.10 or 0.12 per cent., and the solution in the weak gold-tank from 0.08 to 0.10 per cent. in cyanide. In this manner a perfect precipitation was obtained, with a much reduced consumption of zinc and cyanide in the zinc-boxes, and the strength of the solution in the strong sump-tank was maintained at about 0.08 and in the weak sump-tank at about 0.06 per cent. The solutions were thus kept at convenient strength for use as weak washes in the leaching-vats, and no waste of solution was incurred. During the passage of the solution through the zinc-boxes a heavy deposition of carbonate of lime takes place.

Clean-up.—Once a month the zinc-boxes were removed one by one to the chamber in which was placed the acid-tank, 6 feet 6 inches in diameter, and 2 feet 6 inches high. The zinc-boxes were thoroughly cleaned of slimes in this tank, and as much of the zinc was replaced as was thought desirable. The slimes were then settled with alum for 12 hours, and the water was siphoned off into a settling-tank. Hot water was then added, with sufficient acid to dissolve the zinc thoroughly. The liquor was then drained off through a filter box connected with the vacuum-pump. The filter material consisted of two woollen blankets and one canton-flannel sheet, firmly held in place by wooden cleats, and one canton-flannel filter, the sides of which came over the top of the box, loosely tacked in place. The slimes were then thoroughly washed with hot water and the washings were drained off through the filter-box. The slimes were then washed into the filter, drained dry, and removed bodily in the cloth; and the whole was dried on a pan fitted with a hood. The product was melted with an excess of silica in a graphite pot, and the resultant slag was melted with litharge and the lead was cupelled. The bar obtained by this process averaged about as follows: Gold, 548; silver, 294; base metals, 158 thousandths.

Method of treatment.—After repeated experiments we adopted the following as our standard method of treatment:

The strong-solution tank was filled from the sump and made up to the strength of 0.24 per cent. cyanide. This tank contained about 12.5 tons of solution. The charge to be treated consisted of about 35 tons of tailings. About 7 tons of solution was admitted onto the tailings. This quantity was sufficient to saturate the tailings and to allow the solution to stand about 6 inches deep on the top. They were allowed to soak thus for four hours. The outlet-cock was then opened and the solution was drained into one of the gold-tanks. The draining process occupied about half an hour. As the last of the solution was draining off, a sample was taken to be assayed for both gold and cyanide. The rest of the solution (about 5.5 tons) from the strong tank was then admitted, standing about 6 inches deep on the tailings, and they were allowed to soak for eight hours, after which the solution was drained off and sampled as before. In the meantime the weak-solution tank had been filled with solution from the strong sump, running about 0.08 in cyanide. This weak solution was then admitted (as required) to the tailings and the outlet-cock from the latter left open. In this manner the solution drained through rapidly, fresh solution being added whenever the surface of the tailings began to appear above the solution in the leaching-vat. When the last of the solution from the solution-tank had been admitted, the outlet-cock of the leaching-vat was closed. After the lapse of eight hours the cock was opened, and the solution drained off and sampled as before. In the meantime the solution-tank had been again filled, but

this time with solution from the weak sump, running about 0.06 in cyanide. This tankful was then admitted to the tailings and continuously drained off, and a second tankful from the weak sump was drained through the tailings in a similar manner; during which process samples were taken at intervals, to be assayed for cyanide and gold. A water wash was then admitted and drained through continuously, until the solution coming off gave not more than 0.06 in cyanide after repeated samplings, some of which were also reserved for gold. The process was then declared closed. So regular was the process in operation that, during many months of working, we neither accumulated solution, nor found it necessary to throw away solution, except what remained in the tank at the time the process was declared closed. This remainder contained only minute quantities of gold. The resultant solutions in the sump were so uniform in character that we could, in practice, regularly add to one tankful of solution, pumped direct from the strong sump, 50 pounds of cyanide, to bring it up to our standard grade of 0.24 per cent.

The cyanide contents were determined by the nitrate of silver test. The tests for strength of cyanide and the assays of the solutions for gold corresponded so regularly that the foreman in charge of the plant could estimate with accuracy and certainty the gold contents of the solutions during the various stages of the operations. The record of the gold assays, however, gave the data from which these estimations could be intelligently withdrawn, and from which small changes were suggested from time to time.

In practice this programme had to be modified more or less, in order to harmonise with the other branches of the reduction works and the character of the sands under treatment. The following description shows the actual details of treatment, and the results obtained from the treatment of lot 59, which was a fair average of the process:

June 26th, at noon, turned on strong solution (0.24 per cent.) until same stood 6 inches deep on the sands; allowed to stand 4 hours. At 4 p. m. opened outlet-cock and allowed solution to run into gold-tanks; at 4.30 p. m., as the last of the solution was passing off, took sample which assayed "nothing" in cyanide and \$9.30 in gold. Closed outlet-cock, admitted fresh charge of strong solution, and allowed to stand 8 hours. At 12.30 (midnight), June 27th, opened outlet-cock, and at 1 a. m. took sample, as before, which assayed 0.06 cyanide and \$28.94 in gold. At 1 a. m. turned on weak solution (0.08 cyanide), allowing same to drain through without interruption till 4 a. m. Sample at 4 a. m., assayed 0.10 cyanide and \$8.08 in gold. Shut off outlet-cock and allowed solution to stand until 1.30 p. m. Opened outlet-cock and admitted fresh solution (0.06 cyanide) and allowed same to run through, admitting fresh solution as required till 12.30 (midnight), June 28th. Sample taken at 10 p. m., assayed 0.07 cyanide and \$0.62 in gold. Closed outlet-cock and allowed to stand until 5 a. m. Opened outlet-cock at 5 a. m. and allowed fresh solution to run through until 11 a. m. Sample taken at 6 a. m., ran 0.06 cyanide and \$0.42 in gold; and sample taken at 11 a. m. ran 0.6 cyanide and \$0.21 in gold. At 11 a. m. turned in water wash till 2 p. m. Sample taken at 12.30 p. m., ran 0.06 cyanide and \$0.21 in gold; and sample taken at 3 p. m. ran 0.06 cyanide and \$0.21 in gold. At this point the process was declared finished; the wash was drained to waste and the tailings were discharged.

Assay of the tailings before treatment gave \$13.02, and after treatment \$2.07 in gold. Percentage of recovery, 84.1. Time occupied, 3 days, 2.5 hours.

The reason why the process was apparently unduly

prolonged at the closed was to avoid any possible loss which might occur by any such sudden variations as occasionally took place, at the close of the operations, in the value of the solution. Moreover, as long as the solution was not being unduly accumulated, there was no advantage in allowing any values, however small, to run to waste.

It is worthy of note that the first sample taken would usually fail to show any trace of cyanide by the nitrate of silver test, while often assaying notable quantities in gold. The solutions were saved from the commencement, as the solution of the gold seemed to take place immediately. No preliminary treatment with lime was used in the process, as we never found any evidence of acidity, either positive or latent, in the tailings.

The general conclusion which I would draw from the above is, that the process is likely to prove very valuable for the treatment of ore of this class, which is a very common class to be found in this country. I have presented the above figures exactly as they occurred; and in my estimated averages the general results have suffered seriously from certain individual failures, the causes of which we well understand, and which are likely to occur when a new plant is started. All of the factors of success are present. The gold is dissolved very rapidly; the precipitation is perfect; the consumption of cyanide and zinc is small; and the time required is short.

We have also carried out a series of experiments on the treatment of the concentrates from the mill, in a revolving barrel. The result of these has been so satisfactory that I believe the process would be successful on a working scale.

The following figures are the result of the last six runs which we made:

Dry Weight of Concentrates, lbs.	Gold before treatment, Oz. per ton.	Gold after treatment, Oz. per ton.	Extraction, Per cent.	Strength of solution, Per cent.	Loss of cyanide, Lbs.	Duration of treatment, Hours.
40	7.58	.20	97.4	1	6.20	24
40	5.26	.76	85.5	1	8.10	24
40	4.74	.42	91.1	1	7.80	24
40	2.78	.14	94.9	1	9.75	24
40	4.60	.36	92.2	1.25	6.40	24
40	3.92	.12	96.9	1	6.15	24

I infer that a recovery of at least 90 (and probably 92 or 93) per cent. of the gold values could be insured at a cost for cyanide of about \$2.15 per ton. These figures refer only to the recovery of gold; but in our case, and in the case of other ores in this district, gold (and a trifling quantity of silver) is the only valuable material in the concentrates. When lead or other valuable products form an important item in the value of concentrates this process would not be applicable.

I wish to acknowledge my indebtedness in the preparation of this paper to Messrs. H. W. Mussen, engineer, F. Vans Agnew, assayer, and A. Constans, foreman, all of whom furnished valuable information in connection therewith.

GOLD DREDGING.

IN view of the increasing interest in gold dredging that is being awakened in the mining public, and as some of the more recent ventures in this line of work in British Columbia have proven eminently suc-

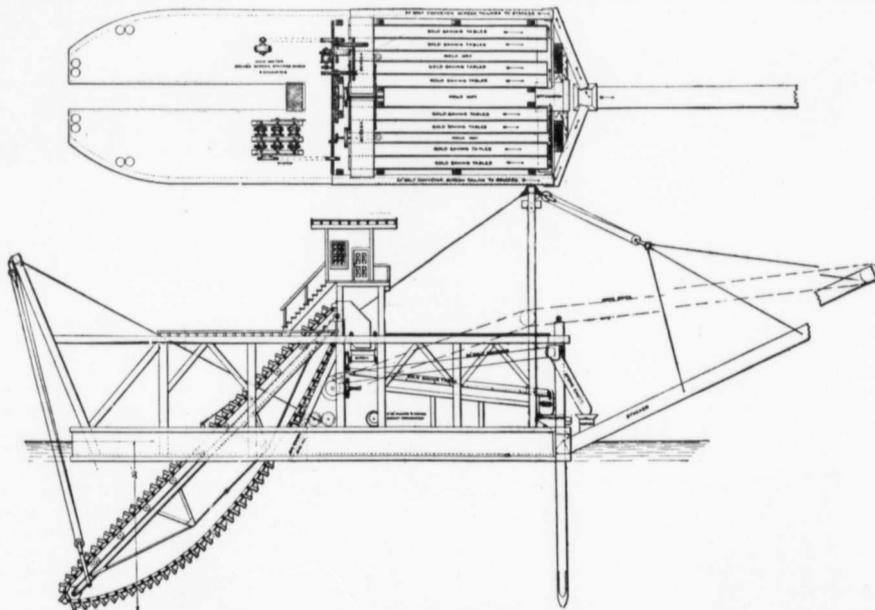
cessful, the possibilities are that the near future will see many new companies formed for the purpose of carrying on this most modern style of placer mining. A description, therefore, of some of the latest and most approved machinery for the purpose may not come amiss.

The most important feature leading to success in this work, next to securing suitable dredging ground, is securing suitable dredging machinery. It has been thoroughly demonstrated in the past that, no matter how good the ground might be, that the success of the venture is entirely dependent on the machinery used and its careful operation. It is also true that, owing to the character of the work and the excessive wear and tear upon parts of the machinery, due to the action of grit and gravel to which it is exposed, and in which it must to a certain extent work, the machinery must be made strong and substantial beyond the possibility of breakage, the moving parts must be protected as far as possible from contact with the grit and the parts which must necessarily be worn by contact with the gravel

astern and carried down by the current to a point where they will not interfere with the operation of the boat. The fines containing the values pass through the screen upon four double under currents or sluices which are arranged according to the nature of the gold which is to be saved with riffles or burlaps upon which the values may be concentrated.

The cut illustrates but one style of dredge, a sort of standard type for the usual run of work. Where special difficulties are to be coped with, special machinery must be designed for the purpose, and, in fact, almost every placer presents some especial features which make it desirable that the machinery should be made to suit actual existing conditions. No one machine can be made which will successfully and economically work in any and all placers.

The details of the machinery as furnished by the Link-Belt Company have been very carefully worked out, and especial pains have been taken to make these machines powerful, substantial and durable. The Ewart guaran-



THE LINK-BELT COMPANY'S GOLD DREDGING MACHINERY.—FIG. 1.

must be easily renewable with a minimum of expense and delay. The items of expense for repairs and delays arising from breakdowns and from worn parts have heretofore been the largest factors of expense with which the dredger has been forced to contend.

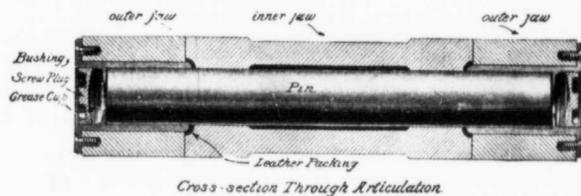
The Link-Belt Machinery Company, of Chicago, U. S. A., have recently placed upon the market a modern, carefully designed and constructed, placer dredge, a general view of which is shown in outline in Fig. 1. The gravel is excavated and raised by the endless chain of buckets and delivered to two screens which extend across the hull about midship. These screens are of the shaking or the revolving type, according to the nature of the gravels which they are to separate. The gravel being washed and screened, the tailings are delivered to a sluice or conveyor and carried to a stacker which overhangs the stern of the boat. In river dredging the stacker is not commonly necessary and the coarse tailings may be delivered over the side of the boat by a chute from the end of the screen, the fines being sluiced

and carried down by the current to a point where they will not interfere with the operation of the boat. The shafting and transmission machinery are of exceptional quality. The bearings are of the improved self-oiling and chain-oiling type and require but little attention. All gearing used on the dredge is of the best quality of cast steel. The Link-Belt patent equalising gears are used to transmit power to the head shaft and equalise the strains in the excavating chain. The tumblers for the excavating chain are provided with removable steel-wearing faces.

The bucket chain is the design of Mr. G. L. Holmes, assistant engineer of the company, and patents have been taken out covering the essential points. Mr. Holmes has given much time to the study of his class of work and has designed a bucket chain having many desirable features. The joints of the chain are absolutely grit proof; the pins, which are large in diameter, are completely enclosed, there being no unprotected passage by which sand or other grit may enter the bear-

ings. The joints are closed by packing rings of heavy pressed leather, so placed as to be able to exclude grit from the bearings and at the same time not be subject to excessive wear themselves. The pins are plain, straight bars of turned steel and require no forging or

rocks or to many other accidental happenings incidental to this class of work. The grease is forced through the bearings in a direction opposite to the only one by which grit might possibly enter in case the packing should become worn, thus serving to carry out any



Cross-section Through Articulation

FIG. 2.—PIN AND BUSHING FOR CHAIN.

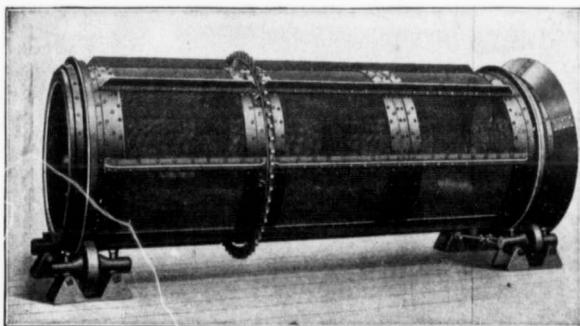


FIG. 4.—SCREEN.



FIG. 3.—CHAIN AND BUCKET.

finish beyond cutting to the proper length and turning, and, in extreme cases, hardening. Contrary to the usual practice the pins are made fast in the rear end of one link and turn in the outer or front jaws of the next one; each pin turns in two hardened steel bushings, one at either end, and in case a pin should become so worn as to be considered in danger at a time when no extras are in stock for repairs, it could be replaced with a piece of shafting of the proper diameter and length with very little trouble. The bushings are of steel, accurately machined to size and hardened; being made to gauge they are interchangeable. The bearing surfaces are very smooth and are so hard as to resist abrasion to the greatest extent possible. Each bushing is provided with a receptacle for lubricant and a screw plug for forcing the grease into the bearings.

The grease cups are so located that, while they are readily accessible they are out of danger from falling

small particles that might have partially entered and keeping the bearing surfaces clean and well lubricated at all times. A further desirable feature is the fact that a bushing may be removed without entirely disconnecting the chain, facilitating repairs and making it possible to keep the chain in the best condition at all times, whereas

in some dredge chains the fact that it is necessary to shut down for an indefinite time, and take the chain completely apart in order to renew a pin or bushing, causes the operator to wait as long as possible, perhaps until something gives way, before making the necessary repair. The connections are shown in Fig. 2. The links are made of cast steel or malleable iron, it is superior to sheet steel in point of resistance

to corrosion and may be thickened and strengthened at points as experience has proved to be necessary. The buckets are cast with a rib extending around from side to side immediately in rear of the cutting lip, which serves not only to stiffen the bucket, but also acts as an



A TYPICAL DREDGE.—NO. 5.

abutment for the lip and relieves the rivets holding it of a large portion of the shear that would otherwise come upon them. The cutting lips are of forged steel with a hammer-dressed edge, and are fastened to the bucket and link with large rivets closely placed. A good idea of the size and general proportion of one of these chains may be obtained from Fig. 3, which is from a photograph of a portion of a chain which has recently been shipped to British Columbia.

The screen, which is also reproduced from a photograph in Fig. 4, is built with the same idea of quick and thorough repair; all parts subject to the wearing action of the gravel are of easy access and may be taken out and replaced without disturbing the balance of the screen. The bearings of the rollers on which it turns are of the dirt-protected type and the machine as a whole is strong and durable. It is built with a heavy steel frame to which two heavy turned-steel tires and the driving sprocket are rivetted. The screening sur-

gether in courses like a boiler shell, when a portion becomes worn it is necessary to cut out the rivets and renew a whole course. A further interesting feature of the screen illustrated is the fact that a special grade of wire cloth is used for the screening surface in place of the perforated plate commonly used for gravel screens; this cloth, which is for fine screening, is made of 5-16 inch wire and is 3-8 inch mesh; it is very heavy and substantial, and is the largest diameter of wire that may be woven to this mesh.

Other sizes of wire cloth, up to $1\frac{1}{2}$ -inch mesh woven from 1-inch wire may be substituted if desired, or perforated plate up to $\frac{5}{8}$ -inch or $\frac{3}{4}$ -inch in thickness with such perforations as may be deemed necessary.

The outline drawing cut No. 1, shows an electrically driven machine, but steam dredges are supplies which possess the same general characteristics.

The half-tone cut No. 5, shows one of the Link-Belt Company's dredges working through the ice, excavat-



A BELT CONVEYOR ON DREDGE IN OPERATION.

face, which may be of perforated plate or wire cloth, as desired, is made in panels of convenient size, bolted on; all bolt heads are flush with the inside of the screen and all parts that are not covered with the clamp plates holding the panels are provided with protecting plates so as to prevent the contact of the gravel with the main frame. The object of the designer was to construct the screen so that there would be a permanent frame which was not subject to extreme wear and which could always remain in place upon its trunnions, and to which the screening surface could be attached in such a manner that any portion could easily be removed when worn or when it was deemed desirable to change the mesh, with the least possible expense and delay. Of course it is impossible to screen large quantities of gravel without considerable wear upon the screening surface, and in the ordinary revolving screen, which is commonly made of perforated plates rolled up and rivetted to-

ing marl for the manufacture of Portland cement. While this is a much lighter class of work than placer mining, yet in some respects it is fully as difficult; and the fact that a machine has been constructed which has worked through the entire winter season without serious expense for repairs speaks volumes for the workmanship of the machinery.

BELT CONVEYORS ON GOLD DREDGES.

AN opportunity of reducing the cost and, at the same time, increasing the efficiency of a dredge is now to be found in the application of the perfected belt conveyor to the work of stacking tailings. The Robins Conveying Belt Company had never followed the common practice of making their experiments vicar-

iously, or at the expense of their customer and, therefore, when they wished to learn the proper size and inclination for stackers of various capacities, they first obtained several tons of round placer gravel of the same sizes as are found in the ancient river beds of California, the stones averaging from 4 to 8 pounds in weight, with a number of larger boulders, weighing as much as a hundred pounds. They then constructed a self-contained belt conveyor, 50 feet in length, so supported that it could be raised to any required pitch. The gravel was delivered in its normally wet condition at the foot of the conveyor and after being delivered into a chute at its upper end, the same material was carried back by a second conveyor and was in this manner used over and over again. It was possible to change at will the speed of the inclined conveyor with electric controller.

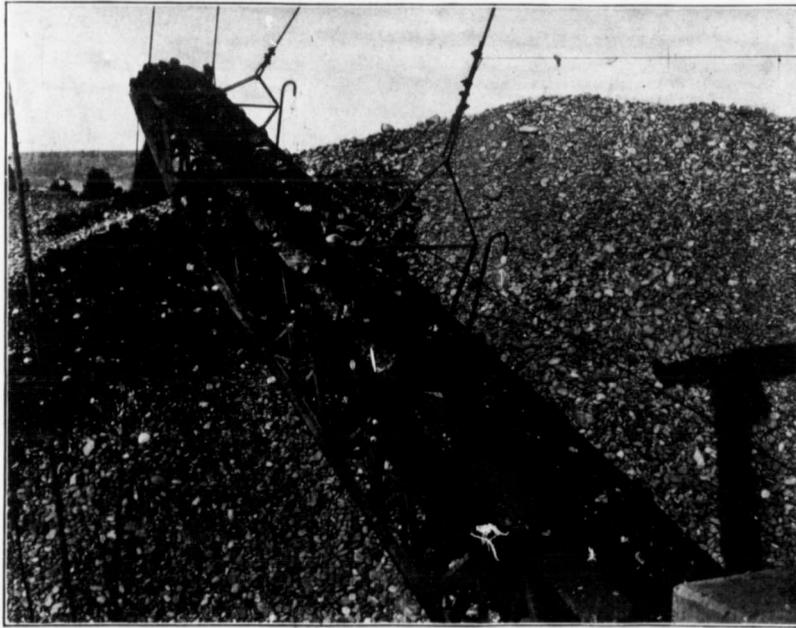
The faithful use of this experimental plant may account for the success of all the tailings stackers which have been supplied by the Robins company. An inter-

inary type. But, of course, the particular advantage which appeals most strongly to the operator of a dredge lies in the fact that a belt conveyor is a very simple machine and is therefore free from the breakdowns which are constantly occurring in stackers constructed in the usual manner with a multiplicity of small parts, the breaking of one which may at any time put the entire machine out of commission for several hours.

Further information in regard to the use of belt conveyors for stacking tailings may be obtained from the Robins Conveying Belt Co., 18-21 Park Row, New York.

MINING IN NEW ZEALAND

A CORRESPONDENT writes from Martor, New Zealand: Your ore bodies in British Columbia seem very similar to that of the Auckland gold fields in this colony. You must either be able to



A SELF-CONTAINED BELT CONVEYOR.

esting example is illustrated herewith in the photographs of the Indian Gold Dredging & Mining Company's machine at Oroville, Cal. This conveyor is 75 feet long with a 28-in. belt, and handles about 75 cubic yards of gravel per hour. The speed of the belt is 250 feet per minute and the angle of inclination is 18° above the horizontal.

A large number of other conveyors of the same type are used in the gold fields of California and Idaho and as far away as Colombia and Eastern Siberia. The conveyors most commonly used are 80 feet long, which permits of stacking tailings to a height of 35 feet. They are made for this work in all sizes between 20 in. and 36 in., and a great advantage of the Robins conveyor for this work lies in the fact that power can be applied at the lower end, thereby saving the long, and generally troublesome, transmission of power by rope or chain to the head end, as is necessary with stackers of the or-

extract the metal much more cheaply or it must be richer but so far as instances go the value per ton seems much the same. The Auckland fields at present are under a cloud. The Barrier reef of which so much was expected, is nearly done, the £1 shares paid up are for sale at 1/8 and no buyers. But our mines are terribly overloaded so that they have to do exceptionally well to pay. I notice the London directors have the nerve to blame the government and people of this country for the failure of companies out of which they have made a pile before one shilling of the shareholders' money had been spent in development. I suppose it is the same with you. Things in the dredging line are very dull here now. A severe slump has followed the boom. The working dredges which now exceed 100 and which are being added to every week are averaging good payable returns. As these returns come back into the shareholders pockets in dividends dredging will again

boom. This dredging is a purely colonial industry so far, but English promoters are already here and when they obtain a full hand the colonial investor will be shut out; while his English brother goes through the process of being swindled by overloading again.

Our richest claim so far is the noted Hartley & Riley, in Otago. This dredge began operations in December, '98, with a share capital paid up of £6,500 of £1 each, and up to date has paid in dividends £8, 17, 6 per share. Other dredges are likely to catch up to her in dividends, but it is very unlikely that the record for the largest weekly output held by her will be beaten.

COMPANY MEETINGS AND REPORTS.

THE CARIBOO-M'KINNEY.

THE third annual meeting of the Cariboo-McKinney Mining & Milling Co., Ltd., was held in Toronto on February the 4th. The annual report of the directors and the report of the managing director were read as follows:—

At the beginning of the year, Mr. Geo. B. McAulay, managing director, submitted to the directors the necessity for some extraordinary development of the mine with a view to locating the ore bodies at various points, and as the financial condition of the company did not then warrant the expenditure contemplated, in order to avoid the incurring of indebtedness, Mr. McAulay very generously donated to the company the sum of \$30,000 to be expended solely in the special development above referred to.

The operations were carried out as suggested by Mr. McAulay, the result being the locating of a continuous ore body 320 feet in length, of an average width of four feet, on the 3rd and 4th levels west on the Cariboo claim, and also the locating of the vein at a point 45 feet below the 5th level east on the Okanagan claim.

It appearing to your directors that it would be desirable to have an independent examination and report upon the mine for the information of the shareholders at this meeting, Mr. Harry McMaster, M.E., was early in December employed for this purpose. Mr. McMaster spent about two weeks in examining the property, and his report will be read to you, and will, I trust, be found satisfactory. It will be noted that Mr. McMaster finds that there is now sufficient ore in sight in the mine to keep the mill running for about two-and-a-half years.

It appears from Mr. McMaster's report, as well as from the report of the managing director, that there are still difficulties to the operation of the mine owing to the many faults in the vein at the east end, where the highest grade ore has heretofore been found, and that the future of the property at this point depends on getting below these disturbances.

At the last annual meeting of the shareholders it was announced that there would be a suspension of dividends for a period, and while there has been no dividend declared during the last calendar year, your directors are pleased to state that they have found themselves able to declare a dividend of one and one-half per cent. out of the surplus earnings of the property, and leave a reserve sufficient to meet contingencies. While your directors are unable at the present time to see their way to the resumption of regular dividends, the surplus earnings of the property, after a provision for a proper reserve, will, from time to time, be divided among the shareholders.

ROBERT JAFFRAY,
President.

STATEMENT OF ACCOUNT, DECEMBER 31, 1901.

Capital stock	\$1,250,000 00	
Bullion	974,537 30	
Rent	19,166 30	
G. B. McAulay, donation for development purposes	30,000 00	
Profit and loss	3,148 02	
Mine and water rights	\$1,717,835 65	
Mill plant	25,771 73	
Hoisting and compressor plant	32,665 67	
Buildings	2,680 48	
Office furniture	242 55	
Mine and mill supply, labour, salaries, expense, etc.	529,043 26	
Development, 1901	33,950 00	
Mineral tax	6,961 10	
Dividends	459,337 52	
Cash in bank	59,363 36	
		\$2,267,851 32
		\$2,267,851 32

Receipts and disbursements for year ending 31st December, 1901.

RECEIPTS.	
Cash in bank 1st January, 1901	\$ 15,693 15
Bullion	137,024 79
Rent	1,166 00
Lots sold	259 87
Donation from G. B. McAulay for development purposes	30,000 00
	\$184,146 81

DISBURSEMENTS.	
Capital account—	
Development	\$33,950 00
Mine and water rights	40 75
Mill plant	60 77
Hoisting and compressor plant	2,441 45
Buildings	53 30
	\$36,546 27
Operating account—	
Hoisting and compressor plant and mining	\$60,035 85
Mill plant and milling	19,966 50
Mineral tax	2,070 77
Expense	3,284 06
Salaries	2,880 00
	\$124,783 45
Cash in bank Dec 31, 1901	59,363 36
	\$184,146 81

Profit and loss account for year ending 31st December, 1901.

REVENUE.	
Balance from 1900	\$ 3,148 02
Bullion	137,024 79
Rent	1,166 00
	\$141,341 81

EXPENDITURE.	
Hoisting and compressor plant and mining	\$93,985 85
Deduct development acct.	33,950 00
	\$60,035 85
Mill plant and milling	19,966 50
Mineral tax	2,070 77
Expense	3,284 06
Salaries	2,880 00
	\$88,237 18
Balance forward to 1902	53,104 63
	\$141,341 81

Verified Clarkson & Cross, auditors.
Toronto, 1st February, 1902.

The Managing Director submitted the following statement of operations during 1901:—

There has been mined and milled during the year 16,862 tons of ore, yielding 9,439 ounces of gold bullion and 428 tons of concentrates. Of this ore about one-half was taken from the Okanagan and Saw Tooth claims, and about one-half from that portion of the Cariboo claim known as the West ore chute.

In my last annual report reference was made to the breaks or faults in the vein on the lower levels. Early in the last year it was found that owing to these breaks

a large amount of extraordinary development work would be required in order if possible to locate the vein west from the then present workings. To this end a system of exploration was planned and carried out as follows:

A diamond drill plant was secured and borings to the extent of 2,200 feet were made at different points from the ground already opened up. In addition to this, the winze from the fourth level east was sunk 110 feet, 400 feet of raises were made from different levels, and 1,600 feet of drifts and crosscuts were run. This extraordinary development entailed a cost of \$33,950.00.

As a result of this work the vein or lode was found in place on the Cariboo claim 495 feet west of the main shaft on the 3rd level. On this level from the point where the vein was struck there has been opened up 320 feet of continuous ore averaging at least 4 feet in width, the face being in ore of the same width. This ore was also found on the 4th level (being 100 feet deeper) at a distance of 350 feet west of the main shaft, and has been opened up on this level for a distance of 220 feet, the vein being of the same average width. For a more particular description of this ore chute reference may be had to the report of Mr. Harry McMaster, M.E., which will be submitted to you.

At a point 45 feet below the 5th level and 30 feet west of the winze on the Okanagan claim, (being the winze hereinbefore referred to) the vein was also found. This ore having been located recently, only 60 feet of drifting has been done. The vein here averages three to four feet in width, and the ore is of high grade.

As a result of the development work carried on during the year, it appears that while the vein on the west end of the present workings on the company's property is continuous, the faulty condition of the vein on the east end, which at this point had been its characteristic from the beginning, would seem to be unimproved at the depth so far reached. In consequence of this it has been considered inadvisable to undertake an extension of the company's milling plant for the present. In the circumstances it appears to be the policy for the company to continue the work on the present lines, following the ore until at greater depth a point may be reached below the disturbances in the vein at the east end of the property, which in the past have been the cause of so much trouble and expense. When this point is reached, and the vein is found continuous at the east as well as the west end of the property, an increase in the milling capacity of the company's plant will be properly in order.

REPORT ON THE CARIBOO-M'KINNEY MINE.

Following out instructions, I left here on December 9th, 1901, for the McKinney mine, where I made a stay of nearly two weeks, making a thorough and careful examination. The following is a report of the condition of the mine as I found it:—

The company's property consists of the Maple Leaf, Emma, Alice, Cariboo, Amelia and Okanagan claims and the Saw Tooth fraction.

Beyond a few test pits and open cuts the work so far has been confined entirely to the Cariboo, Amelia and Okanagan claims and the Saw Tooth fraction and consists of a main shaft 367½ feet deep with levels driven east and west and a winze sunk from the fourth level 590 feet east of the main shaft to a depth of 196 feet, with an intermediate level driven west from it at 57 feet and the fifth level driven east and west at 100 feet.

The ore so far has been divided into three distinct chutes, West, Middle and East.

Taking the Middle Chute first, being to date the most important, as from it the mine has obtained its high

standing among the dividend payers of British Columbia, I find that the ore has practically all been stoped to the third level east of the main shaft from the surface and the fourth level from the surface on the west side. A fault starts from the surface a little west of the whim shaft and follows right down to the fourth level, in fact right through to the fifth, as it is again encountered there having a dip of about 45 degrees east. Below the second level little or no work has been done west of this break, the ore being much broken up and too narrow to work through, further development might again find it of good width. The floor of the third level east is in ore for about 120 feet of workable width; as no connections has been made between this and the fourth level through the ore, there is no knowing to what extent down it is workable.

On the fourth level east a crosscut has been driven which proved the ore to be in place but very much broken and narrow, though still high grade.

On the fifth level, driven west from the winze, only enough work, 300 feet, has been done to cut through the main break, mentioned before as cutting through from the whim shaft, into the solid rock which is here of the same diabase character that has been associated with this chute from the surface down. Judging from this and the throw of the fault, there is little question that a crosscut run south from this point will cut the vein in a very short distance, should no other faulting occur, though whether of good width or not can only be proved by such work.

To a very large extent the early payment of dividends by this company depends upon the vein being found here of workable width; should it not be I would advise work being discontinued on this chute for the time.

The East Chute.—On the surface and down to the second level this is low grade and has not been stoped out to any extent on this account. To this point it varies in width from 4 to 20 feet in places. On the second level it pinches down to one or two inches and continues so to the third level where it again widens to an average of 3½ feet, which width it steadily maintains as far down as it has yet been worked. In the east end faces of the levels, the ore narrows down again and is much broken which has caused work to be stopped in this direction for the present. An important point about this chute of ore, and one of great importance to the mine with regard to its future success, is that though low grade above the third level, from there down it gains wonderfully and has been ever since of a grade that would be considered very high in any mine which had not ore as exceptionally rich as that taken from the middle chute. This increase of values continues down to the 540 level, the lowest point at which it has been tapped as yet.

There is at present enough of this ore in sight to keep the mill running for about six months and every prospect of again finding the lead in place on the sixth level when prospected for there.

The West Chute.—This will, I consider, prove to be the main body and dividend payer of the mine as, though not averaging high, about \$6.00 mill run, it is more consistent and less broken so far as worked up to the present. Being higher up the hill it seems to have had less pressure brought to bear against it.

On this chute no drifting has been done above the third level. The ore was cut on this level 495 feet west from the main shaft and from that point the level is driven all in ore to the end—a distance of about 310 feet with the face of the drift still full in ore. There are indications that the grade is gradually improving towards the west end, though nothing definite can be said on this point without a mill test. Very little stoping has

been done on this level, a block 75 feet high and 260 feet long being all, while of the ore which has been broken down there still remains some 3,000 tons lying in the stope ready to hoist as required. Values vary very much, anything from \$4 to \$70 being obtained. The average may, however, be taken as \$6 mill run. The width varies very little being about 3½ feet, though widening slightly in places.

The fourth level cuts the ore 360 feet west of the main shaft. From this point to the end, a distance of about 220 feet it is entirely in good clean ore. A slight break occurs near the end of the level, but not of a very serious nature. A raise has been put through between this level and the third entirely of ore, showing the continuity of it from one level to the other. In this west end chute you have fully two years of ore in sight.

Summing up I would point out that this mine differs from most in that values while getting richer (very much so in the case of the east chute) never get poorer with depth, also where the vein is found in place it varies very little in width. There is therefore only one thing to be afraid of, and it is a most serious one, that the vein may become too faulted to pay to work owing to the amount of dead rock which would have to be removed in prospecting. Should you ever have the good fortune to get through the faulting, the property will undoubtedly be one of the most valuable in the country. It is for this reason that I would advise work being continued on the third level west, this west chute showing more regularity than either of the others. With four or five hundred feet more drifting and a raise put through from the end to the surface, the ore being found consistent in width and value, you would be quite warranted in doubling your stamp capacity, which would double your receipts, while discontinuing work on the east end would cut your expenses down at least one-third; though I would not advise work being discontinued there until the Middle chute has been found on the fifth level and proved unworkable. Of course work can go on as at present and a small profit be made, but if the idea is to get large profits, an increase in milling capacity with a decrease in the cost per ton of ore handled is necessary.

In closing my report I would like to draw your attention to the excellent manner in which the work in this mine has been carried out by your superintendent, Mr. Keane. Expenses have been kept down to the very lowest figure commensurate with good work; also the admirable manner in which he always has succeeded in recovering the vein, however bad the break may have been, was a continual surprise and pleasure to see.

All of which is respectfully submitted,

HARRY McMASTER.

Copy of Assays—	West Chute. Per ton.	East End Chute. Per ton.
	\$ 2 40	\$18 00
	4 25	46 50
	6 30	27 00
	17 45	71 50
	70 90	

THE AMERICAN BOY MINING CO.

At the annual meeting held in Spokane this month the manager, Mr. T. McGuigan, made the following report: The mine has been developed by 1,738 feet of tunnelling and drifting, 1,360 feet of raise, and 5,422 cubic yards of stoping. The mine shipped 1,743 tons of ore, netting the company \$45,962.28, or a net profit after paying all expenses at the mine of \$5,887. I estimate that the ore in transit to the smelters will clear all of the indebtedness at the mine. Aside from this the company has an indebtedness of but \$1,600. With the splendid showing in the mine there is every reason to

believe the property can be made a dividend payer within the next few months. There is between \$50,000 and \$60,000 worth of ore in sight, and steps are to be taken at once to drive tunnel No. 4, which we estimate will strike the same ore chute in which we are working in tunnel No. 3. The tunnel to the ore chute will not exceed 120 feet in length. The pay streak in No. 3 averages 2½ feet wide and assays from 75 to 81 per cent. lead and 150 ounces of silver. We have already followed the pay streak in No. 3 a distance of 35 feet.

The company now has employed at the mine a force of 22 men.

ACETYLENE MINE LAMPS.

SINCE the discovery in 1892 of the process of making calcium carbide in commercial quantities at a reasonable cost, acetylene gas as an illuminating agent has been before the public in many forms and for many uses, perhaps the best known of which is the brilliant acetylene bicycle lamp which has shown its immense superiority in all points over the older forms of using oil. It has recently been introduced and is meeting with success in a field where the lighting problem is a difficult one, namely, in tunnels and mines.

Various devices using oil, candles and electricity have been presented to solve the problem. Oil has many advantages—it is cheap, is easily obtainable and the men are accustomed to its use. It has, however,



two serious faults. The smoke from it is often so great as to drive men out of small workings, many mines requiring extra ventilation on this account. In gold and silver mines it cannot be used successfully because spilled oil interferes with the separation of the metal. From what figures are obtainable the cost of this method seems to average about 5 cents per miner's lamp for eight hours use.

In the west, paraffine candles have been generally adopted in mines of precious metals. They largely overcome the difficulty of smoke, lessen the fire risk, and are generally more satisfactory than oil, but are far more expensive. Figures obtained from a silver mine in New Mexico may be considered as fairly representative though others may show wide variation. Three hundred and fifty men are employed and the cost of candles is \$3 per man per month, working 30 days.

It would thus at first appear that electricity would be the ideal method of lighting a mine. It has proved satisfactory in many cases, but it has drawbacks. The lights cannot quickly and readily be moved from place to place and withdrawn when a blast is to be fired. The sharp rocks cut the covering and sulphur in the water fumes rapidly destroy the insulation. Conditions of operating vary so greatly that it is difficult to obtain figures which would be even approximately accurate for the cost of electricity per lamp in mining plants, but the general opinion seems to be that a 16 c. p. electric light costs from 8 cents to 10 cents per eight hours.

The ideal light must be bright and clear, free from smoke or smell, easily transported, and one which is inexpensive in first cost and cost

of operation. It must, above all, be capable of use by inexperienced men and those found on the ground. It must be safe, durable and economical.

Acetylene gives a light the brilliance of which is beyond question and on analysis the light is found to be the nearest approach to sunlight of any artificial light yet produced, with regard to its effect on the purity of air in confined spaces, we quote from a recognised authority, Prof. Vivian E. Lewis: "The researches of Dr. Grehan have shown us that when burning with a smokeless flame, no carbon monoxide can be detected in the products emitted by the combustion of acetylene, and its sanitary position will, therefore, be defined by the amount of oxygen abstracted from the air and carbon dioxide produced, as compared with other illuminants. Taking the average-sized room which would be well lighted by an illumination equal to 64 standard candles, we find that this amount of light from the various illuminants would show the following results:

	Oxygen removed from air cubic feet.	Products of water vapour.	Combustion carbon dioxide.
" Sperm candles	38.5	26.2	43.5
" Paraffine in oil	24.9	14.0	39.8
" London gas—			
Batswing burner.....	26.1	29.4	19.2
Argand burner	23.0	25.6	17.0
Regenerative burner ..	10.6	8.3	5.2
Incandescent burner ..	3.1	4.6	1.8
" Acetylene.....	5.0	2.0	4.0 "

The incandescent electric light of course is not mentioned as it is ideal in this respect, but we see that with the exception of the incandescent mantle gas burner, nothing approaches acetylene. It might also be said in justice to the objects of this paper that the paraffine oil mentioned in the table was not burned in smoky miners' lamps where obviously its bad effects would be largely magnified.

Attempts have been made to perfect an acetylene lamp which would endure the severe service imposed by conditions found even in the best tunnels and mines. The Baldwin Acetylene Mine Lamp, illustrated herewith, has been in use for the last year and during this time under close investigation, the results have been uniformly satisfactory. These lamps are now offered in Canada by The James Cooper Manufacturing Co., Ltd., of Montreal.

This lamp is made in two styles, the smaller, known as the Superintendent's Lamp, is intended for superintendents, surveyors, mine bosses, inspectors and others moving about from place to place. It is useful for surveying purposes, as the flame when looked at end on, is only about 1-8 inch in diameter, and there is a metal point on the lamp, just under the centre of the flame, which permits of its being set very accurately over a surveying point. It weighs 9 oz. and will hold a charge of carbide sufficient to keep it burning at full brilliancy for four hours. It takes only a couple of minutes to clear out and recharge the lamp with carbide and fill the tank with water.

The larger form or Gang Lamp, is intended for headings, enlargements, stations and switching points where a large volume of light is required to permit several men to work. The No. 8 lamp, burning ½ foot per hour, gives about 20-candle power. The No. 7 burning ¼ foot per hour, gives slightly more than half this amount of light, or about as much as six sperm candles, or three oil lamps. The actual illuminating effect is far greater since it gives off absolutely no smoke to deaden the light.

These lamps are solidly made of cast iron to stand severe usage and one may be turned upside down or rolled about on its side without fear of the light going out, or in any way affecting its burning qualities.

Relative to the cost of operating, it has been found that 1 lb. of calcium carbide will easily give four cubic feet (often more) of gas. Carbide will cost in quantities about six cents per pound at the mine. No. 7 lamp holds ½ lb. of carbide and has a burner consuming ¼ cubic ft. per hour, or a run of eight hours for three cents. No. 8 holds 1 lb. of carbide, and has a ½-foot burner and will cost 6 cts. for 8 hrs. light.

To afford a further comparison of operating costs we select the New Mexico mine already referred to, working 365 days in the year, and consider it using Baldwin lamps burning ½ lb. of carbide a day:

FIRST YEAR.	
Candles for 350 men at \$3 per month per man one year	\$12,600 00
Lay 365 No. 7 lamps at \$5 cost	1,825 00
175 lbs. carbide a day for one year	3,832 50
	<u>\$6,942 50</u>
SECOND YEAR.	
Candles, same as first year	\$12,600 00
175 lbs. carbide a day	\$3,832 50
Repairs, say 50 cts. a lamp on 350 lamps	175 00
Saved by using Baldwin lamps	\$8,592 50

These lamps have been extensively adopted by the contractors of the New York subway and have proved most suitable for their severe usage.

CANADIAN TRADE IN MINING MACHINERY.†

If evidence were required of the great and rapidly growing importance of the mining and smelting industries of the Dominion to the trade and commerce of the country, it will be found in the immense volume of trade being done by our mining companies with the manufacturers and dealers in mining machinery and mining supplies. For the past couple of years this trade in Canada has aggregated several millions of dollars, and Canadian engineering establishments have been worked to their fullest capacity, while a very large trade has been done with other countries, most notably the United States. Some idea of this expansion may be gathered from the following figures, from the Trade and Navigation Returns periodically published by the Department of Customs. The following table shows the value of the mining and smelting machinery imported free of duty during the fiscal years ended 30th June, 1900 and 1899:—

	1900.	1899.
Nova Scotia.....	\$320,038	\$ 24,243
British Columbia	182,087	88,911
Ontario.....	145,040	142,216
Quebec.....	30,661	26,621
New Brunswick.....	10,246	212
Manitoba.....	1,600	1,080
N. W. Territory.....	674	10,926
Yukon.....	33,841	5,591
	<u>\$724,187</u>	<u>\$299,800</u>

The following table shows the monthly returns of the value of the mining and smelting machinery, free and dutiable, imported into Canada from 30th June, 1900, to 30th September last:—

Month.	Free.	Dutiable.	Total.
July.....	\$59,222	\$7,570	\$66,792
August.....	129,398	2,544	131,942
September.....	151,211	2,786	153,997
October.....	179,954	175	171,129
November.....	110,393	6,801	117,194
December.....	103,794	28,724	132,518
1901.			
January.....	111,134	4,196	115,330
February.....	162,030	9,689	171,719
March.....	62,185	806	62,991
April.....	52,921	517	53,438
May.....	259,309	6,180	265,489
June.....	162,674	12,269	174,943
July.....	58,010	4,267	63,186
August.....	70,979	16,428	87,407
September.....	84,479	599	85,078
Total.....	\$1,749,602	\$103,551	\$1,853,153

The following table shows the sources from which our imports of mining machinery, free and dutiable, were derived:—

Month.	From Free.	U. S.— Dutiable.	Great Britain— Free.	Other Dutiable.	Countries.	Total.
	\$	\$	\$	\$	\$	\$
1900.						
July.....	54,766	7,570	2,320	.....	2,136	66,792
Aug.....	125,751	2,544	3,647	.....	.....	131,942
Sept.....	147,351	2,786	3,860	.....	.....	153,997
Oct.....	162,637	172	8,278	.....	39	171,129
Nov.....	103,993	6,801	6,400	.....	.....	117,129
Dec.....	98,164	4,734	5,030	23,990	.....	132,518
1901.						
Jan.....	111,129	4,196	5	.....	.....	115,330
Feb.....	162,030	9,689	.....	.....	.....	171,719
March.....	58,980	806	.....	.....	3,205	62,991
April.....	51,971	517	950	.....	.....	53,438
May.....	257,523	6,180	1,786	.....	.....	265,489
June.....	162,309	10,602	305	1,667	.....	174,943
July.....	58,486	4,267	433	.....	.....	63,186
August.....	70,764	16,428	215	.....	.....	87,407
Sept.....	82,945	518	1,534	.....	82	85,078
Total.....	\$1,708,859	77,813	35,363	25,657	\$5,461	\$1,853,153

† The Canadian Mining Review.

TRANSFER OF A BOUNDARY SMELTER.

By E. JACOBS.

THE purchase by the Montreal & Boston Copper Co., Ltd., of Montreal, Quebec, of the smelter built early last year by the Standard Pyritic Smelter Co., near Boundary Falls, has been definitely announced. Reports had been in circulation for a week or more, previous to the completion of the transaction, to the effect that it had been closed, but these lacked confirmation until Jan. 20th. The smelter property latterly belonged to Mr. Wm. Price, of Quebec, he

having foreclosed a mortgage he held over it, as the recent sale was made on his behalf, he being represented in this matter by Mr. E. J. Wilson, manager of the Standard Pyritic Smelting Co. The erection of the buildings and equipment of the smelter proceeded for some time under the direction of Mr. Andrew Laidlaw, now of Chicago, who also took a prominent part in organising the Standard Pyritic Smelting Co., but before the plant was installed he sought the assistance of Mr. Jas. W. Neill, for many years manager of the Taylor & Brunton Ore Smelting Co., of Salt Lake, Utah. Later Mr. Wilson, who had for some time been metallurgist in charge of the blast furnaces of the Great Falls smelter, Montana, arrived to take charge of the new works, but owing to the lack of a sufficient ore supply to keep the smelter running continuously and for other reasons, he advised that the furnace be not yet blown in.

The following description of the works has been supplied to the writer:—The large main building—the smelter proper—182 feet in length by 120 ft. in width. Measuring from the feed floor in the centre of the building the height is 64 feet, and from the furnace floor to the roof nearly 80 feet. Facing from the north, on the west end of the building is the sampling department, in which there are two 36-inch and two 48-inch automatic samplers, a 7x10 Blake rock crusher, two sets of 12x20 rolls and two belt elevators. East of the sampling department are located the bins for the sample discard. Next are placed two parallel rows of ore storage bins, eight in a row and each bin 34x16 ft. Farther east are lime and coke storage bins, the whole group of bins occupying the central portion of the building from north to south and over them run double railway tracks. At a lower level the furnace floor extends east from the stone retaining wall 60 feet and has a length of 140 feet. The dust flue, of stone walls with arched brick roof, runs about 200 feet to the steel smokestack which is 9 ft. 6 in. in diameter and 112 feet high above a 14 ft. brick base. On the furnace floor level are two 75-horse-power engines, one to run the No. 7 Connersville blower and the other the sampling machinery. The furnace is 40 in. x 176 in. inside the tyler line and has a normal capacity of 300 tons each 24 hours. It is a larger furnace than those of the Granby and B. C. Copper Co's smelters. A 250-light Siemens-Halske dynamo run by a high speed Atlas engine furnishes lighting facilities. A well-equipped laboratory for assay purposes, and commodious offices also form part of the establishment.

Dr. Wilson has already placed the purchasers in possession of the smelter, and it is stated that Mr. H. C. Belling, the well-known smelter expert, who reported on the works for the new owners, is preparing plans for a coarse crushing plant and various other improvements. The requisite additional machinery will be ordered very shortly and preparations for starting up the works as soon as possible are being pushed, the intention being to smelt ores in the ordinary manner. There is a lot of coal and coke on hand and it is claimed that the Montreal and Boston Copper Co's Sunset mine is now in shape to maintain an output of about 400 tons of ore per diem. Mr. Albert I. Goodell, of Pueblo, Colorado, has been strongly recommended for the position of metallurgist, and it is probable he will shortly arrive at Greenwood to take charge of operations. Mr. Goodell has been engaged at the Philadelphia smelter, Pueblo, and the Kokomo smelter, near Leadville, Colorado, and recently had charge of the Needles Smelting Co's copper-matte plant at Needles, California. Mr. C. R. Craig has already arrived from Seattle to take the post of accountant at the smelter.

The Montreal and Boston Copper Co., Ltd., was organized last year with a capital of \$3,000,000 in 600,000 shares of \$5 each. The leading men in the company are Messrs. J. N. Greenshields, K. C., Montreal; William Mitchell, Drummondville, Quebec; T. Crockett, Riviere du Loup, Quebec; H. H. Melville, Boston, and G. H. and A. A. Munro, Montreal. The company owns the Sunset, Crown Silver, C. O. D. and Florence Fraction mineral claims, all adjoining and situated in Deadwood camp, near Greenwood.

The Sunset is opened up to a depth of 400 feet and the Crown Silver to 262 feet, the total footage of work done on these properties in underground development to January 1st, ult., being 4,516 lineal feet. It is stated that there are at least 250,000 tons of ore in sight above the 200-foot level of the Sunset, and that ore has been cut at both the 300 and 400 levels. Last year 800 tons of ore were shipped to smelters chiefly for test purposes. The equipment at the Sunset includes two 80-horse-power horizontal return tubular boilers, half of a 20-drill duplex air compressor, two air receivers, ten 3½ machine drills, a 100-horse-power, double-cylinder, double-drum, link-motion Jenckes hoisting engine; Laurie feed water-heater, safety-platform cage, electric light plant, well-found tool and repair shop, assay plant, etc. Recently commodious bunk and boarding houses were erected, ore bins with a holding capacity of about 2,000 tons, and an elevated tramway from shaft to ore bins built, and other substantial improvements made. A railway spur was also put in, to facilitate shipment of ore to the smelter. Latterly there have been between 50 and 60 men on the mine pay roll. Captain Harry Johns is in charge and Mr. H. Galbraith, a McGill graduate, is assayer at the mine.

CASCADE'S WATER POWER.

THE development of 3,000 horse-power on the Kettle river at Cascade, 15 miles east of Grand Forks, will soon be an accomplished fact. The work has been in progress for nearly two years. Electrical power will be conveyed by wire to the various mining camps,

thus reducing the cost of mining development. Several of the smelters are also figuring in utilising the same energy. Spring will see the plant in operation. The cheapening of power as compared with steam will permit the handling of mineral bodies that now cannot be worked.

The Cascade power is controlled by the London & British Columbia Goldfields company, of London, England.

At Cascade, the Kettle river rushes through a rock gorge for a distance of half a mile, and has a natural fall of 121 feet. A dam 400 feet long and 50 feet high has been constructed at the head of the gorge, which raises the water 36 feet above the natural level, thus giving a working head of 156 feet at low water.

The permanent water level will be 10 feet below the top of the dam. Provision has also been made to control the water level during periods of high water by a series of sluice ways.

From the dam the water is to be conveyed to the power house, first by an open cut 233 feet long, thence through a tunnel through the solid rock a distance of 410 feet, the tunnel being 12 x 14 feet, thence to an open cut in the rock a distance of 500 feet; from this point, where a concrete bulkhead will be built, the water will be conveyed through a circular flume 12 feet in diameter to the power-house. About 35,000 cubic yards of rock have been excavated from these cuts. The areas are so large that no appreciable loss of water will occur, and the water will enter the flume with a head about equal to the level of the water in the dam.

The power-house is nearing completion. It is a fire-proof structure of stone and brick, 215 x 45 feet in size, and is situated at the foot of the falls, 5,000 feet from the dam.

Electrical machinery of the most improved pattern, together with six turbine wheels of the horizontal type, are now being manufactured especially for this plant.

At the outset the horse-power developed will be 3,000, but later it is expected that a maximum of 6,000 horse-power will be reached. A right of way has been cleared from Cascade to Phoenix via Grand Forks, a distance of 21 miles. This clearing is 122 feet wide. Two separate duplicate lines are being constructed. The poles have already been erected. A heavy copper wire will be used for the transmission of the electrical energy.

SLOCAN CITY MINING DIVISION.

(From Our Own Correspondent.)

A HEAVY mid-February thaw has cut our sleigh roads out, and traffic is practically suspended. The shipments for the six weeks of the year amount to 657 tons, made up from four properties:—

	Tons.
Arlington.....	570
Enterprise.....	60
Neepawa.....	20
Ottawa.....	7
	657

Of these, the last two, though old prospects, are new shippers. The Neepawa is being developed by London capital under Mr. Sandford's management, and the expectation is that the shipments will be steady from this on. The Ottawa has been opened by the leaseholders and seven tons shipped were taken out in developing and in cutting through one ore body, and returned, according to smelter returns, \$1,308.00 net. This high grade ore running 1.162 oz. to the ton, and the balance of the shipment 318 oz. News of the development in camp seems to be very satisfactory. The Iron Horse struck ore at the 50-foot level, and are increasing their force. The Slocan Republic Co. are asking assistance toward the construction of a wagon road up Republic mountain. As this will reach the Viking or Phoenix-Viking mine, as well as the Erin and Peerless groups and form the first step toward the groups at the head of Twelve-Mile creek, they will doubtless get what they ask for. The management are about to put in a hoisting plant on Mount Speculator.

RECENT DEVELOPMENTS IN YMIR DISTRICT.

(From Our Own Correspondent.)

IT is expected that the big cyanide works at the Ymir mine will be ready for the first charge about the first of March. About the end of the same month it is probable that the big crosscut tunnel which has now been run nearly 2,000 feet, will be the subject of great interest, as the estimated distance of the vein is only 2,100 feet from the mouth of the tunnel. Should the vein be encountered and prove to be of as great dimensions and of the same average grade as in the upper levels the life of the mine is assured for a great number of years. The element of doubt as to meeting the vein is however almost eliminated now by reason of the depth obtained in the shaft which has followed the vein down to meet the tunnel, and has now reached a depth of about 800 feet. The London *Statist*, which is always an extremely conservative paper has made an estimate of the total ore which may be calculated upon above the 1,000-foot level, its estimates being based upon figures supplied by the London directors. According to the estimate there will remain to be worked 370,000 tons which, with the present mill practice

with the additional saving by cyanide represents a net profit over and above all expenses of \$1,850,000 to be obtained from the 1,000 foot level. These estimates, however, are based upon an average vein width of 13 feet, for a length of pay chute of 500 feet. This, however, is generally regarded here as very largely underestimated. Within the limit of the 500 foot pay chute, thirteen feet is actually the minimum width, while the maximum reaches forty feet. A fairer average would probably be twenty feet, which would raise the total value of the ore above the 1,000 foot level to over four million and a half dollars.

The Broken Hill Mining & Development Co. have just received returns from the Nelson smelter on a shipment of 20 tons of ore from the Fourth of July shaft on the Wilcox mine. The ore went over \$70 per ton, the actual net profit after smelter deductions, for freight and treatment being \$1,084 for the single car load. The ore was not picked but taken from all across the pay chute, which varies in width from eighteen inches to four feet.

The strike recently made on the Union Jack mine is rapidly assuming more and more importance, and may now be fairly said to indicate the existence of a large body of high grade ore. The face of the drift on the Queen vein is now all in solid galena ore of which the average of a number of samples went over \$40 in all values. The Active Gold Mining Co. of Cincinnati, who have acquired the property are making preparations for development on a large scale.

DEVELOPMENTS IN LARDEAU DISTRICT.

(From Our Own Correspondent.)

THIS has really been nothing of consequence to report from this locality for some time, as there is no work worth mentioning being carried on except at the Silver Cup and the Nettie L.

In the latter, however, the long upraise connecting the upper and lower workings is completed, and has passed through some very fine ore on the way, indicating the permanence of the ore body at greater depths than it had been followed so far. Of course this will be a very great assistance in developing the resources and extracting the values of the mine, and it is the intention of the management to greatly increase the force of men employed so as to ship much larger quantities of ore than has been done up to the present.

The new Victoria smelter is practically completed, and the assay department is busy examining the various samples offered. If energy and perseverance count for anything, the smelter will surely be a success, and if so will indeed "fill a long felt want" in this district, where so many claims cannot afford the expense of a long haul followed by heavy smelting costs. The owners (who, by the way, have not asked for or received any bonus for erecting their smelter here, which is an agreeable departure from the ordinary method) intend if the present small plant is successful to install a much larger one in the near future, so naturally the result of the experiment is looked forward to with the keenest interest by the citizens of our busy little town.

LEGAL DECISIONS AFFECTING THE MINING INDUSTRY IN BRITISH COLUMBIA.

(Specially Contributed.)

LOWE V. PARKER.

THIS was an action of ejectment tried before Mr. Justice Walkem, at Nelson, B. C., on the 16th day of November, 1900. According to the judgment of the learned judge the facts appear to be that the plaintiff, in 1898, located and recorded near Nelson a mineral claim named the "Rebecca," and that having an interest in an adjoining extension named the "Ida," performed his assessment work for both claims on the "Ida," as he believed, but in reality, as shown by a subsequent survey, not on that claim but on a fraction alongside of it.

The plaintiff was illiterate, and asked the Gold Commissioner if the assessment work on the "Ida" would be regarded as impliedly done on the "Rebecca," to which the Gold Commissioner replied that it would. It was contended for defendant that whether there was a consent by the Gold Commissioner or not to obtain the benefit of work done on the "Ida" to protect the "Rebecca" it was plaintiff's duty to fill the notice of his intention to do his assessment work on one or other of the adjoining claims as required by section 24 of the Miners Act.

Mr. Justice Walkem decided that the plaintiff had been unintentionally misled by the Gold Commissioner, and that section 53 of the Act, which says that "No free miner shall suffer from any act of omission or commission . . . on the part of any government official if such can be proved" applied; and also that the omission to file the notice required by section 26 and the incorrect filling up of the affidavit describing the assessment work, were irregularities, covered by the certificate of work subsequently granted for the "Rebecca." That the assessment work was not done on the "Ida" but on an adjoining fraction was held an excusable mistake under the circumstances, the boundaries of the claim not having been surveyed.

The learned judge pointed out that one of the cardinal principles of the Mineral Act is that a miner is not to be deprived of his claim in consequence of inadvertent mistakes, such as those in this case.

The full court on the 7th November, 1901, dismissed an appeal from Mr. Justice Walkem's decision in plaintiff's favour.

CLEARY ET AL. V. BOSCOWITZ.

In this case on appeal to the Full Court, it was decided that if a certificate of work is to be set aside the Attorney-General must be a party and until set aside all things are presumed in favour of the holder. The section 28 of the Mineral Act referred to in this case and the preceding one is as follows:—

28. "Upon any dispute as to the title to any mineral claim no irregularity happening previous to the date of the record of the last certificate of work shall affect the title thereto, and it shall be assumed that up to that date the title to such claim was perfect, except upon suit of the Attorney-General based upon fraud."

Mr. Justice Drake in his judgment says:—

"This action was dismissed with costs at the hearing, and the chief ground relied on was that the learned Chief Justice had held that the plaintiffs were not allowed to attack the defendant's title on the ground that the certificate of work obtained by the defendant was improperly issued by the Mining Recorder, and that the same had been wrongfully and fraudulently obtained. Section 28 of the Mining Act says that it shall be assumed that up to the date of the last certificate of work the title to the claim was perfect, except from suit of the Attorney-General based upon fraud. One of the objects of this section is to prevent claimants from questioning the correctness or validity of the certificates of work issued by the proper officer. If, as alleged here, the defendant was guilty of fraud in obtaining this certificate the Attorney-General is to bring the suit. There is no regulation in the Act how the party claiming that a fraud has been committed can put the Attorney-General in motion—whether as a relator or by information, or merely as a Crown officer—when satisfied that a fraud has been committed. If the Attorney-General declines to move there is no power in the Act to compel him. We think the Chief Justice was correct in the view he took of the section."

Justices Irving and Martin concurred. Mr. Justice Martin in his judgment says:—

"This case cannot be distinguished from *Lowe v. Parker* in which the court delivered judgment on the 7th instant. There, no work at all was done on the claims by mistake as alleged. Here also no work was done, by deliberate intention, as alleged. But the result is the same because the question of fraud cannot be raised unless the Attorney-General is a party to the suit."

In view of the recent decision of this court in *Gelinas et al. v. Clark; Manley v. Collom and Lowe v. Parker*, the learned trial judge was right in holding that the certificates of work, if regular in themselves, were conclusive evidence that the work had been done.

The appeal was therefore dismissed.

The effect of section 28 of the Mineral Act upon the title to mineral claims is of very great importance. How far the certificate of work is conclusive, and what irregularities it covers seems in view of the decisions not to be decided with altogether absolute definiteness.

CATO.

CORRESPONDENCE.

LEAD SMELTING COSTS.

To the Editor B. C. MINING RECORD.

SIR,—I have read with interest your able article on the "Lead Producing Industry of B. C." However, if I may be permitted to say so, the impression left on the mind after perusal is that the mine owner should be content to leave freight and treatment charges as they are, and trust to others philanthropy to give them his share of their profits over what will satisfy these interests.

That I desire on the part of a mine manager financially backed by the directors, to get for the shareholders all the profits possible is regarded as a misapprehension of the situation, and as only a disturbing influence against the present happy conditions existing for transportation and smelting interests. Because one dollar per hundred pounds is deducted on lead, with other prerequisites under present conditions, therefore, the mine managers should be willing that their argentiferous lead should always be shipped away to be refined, should always be sold through London, instead of direct to consumers.

An effort that B. C. should excel rather than follow in metallurgy and business acumen is surely the right spirit among her mine managers.

Your obedient servant,

Nelson, B. C.

R. C. CAMPBELL-JOHNSTON.

VMIR DISTRICT IN 1901.

To the Editor B. C. MINING RECORD.

SIR,—Will you allow me to make a few corrections in the article on this district which appears in your February issue under my name. The errors referred to must, I think, have arisen in process of sub-editing, or are possibly attributable to my indecipherable calligraphy.

Referring to the Ymir mine, you make me say the tunnel has "300

feet farther to go, so that the connection may be expected in two weeks." There are no better miners anywhere than in Ymir, but I fear they cannot drive 300 feet through hard rock in two weeks. The correct reading should be "ten weeks."

The seventh paragraph of page 66 refers to the Shiloh mine and not to the Fog Horn, the sub-title having been omitted.

At the end of the article, in referring to the Union Jack mine you make me appear guilty of an extraordinary statement, remarkable alike for its grammatical construction and the information it conveys—"recently the resumption of development operations are promising and a large vein of free-milling ore was encountered with a full complement of miners."

Now, the mineral deposits in this neighbourhood are undoubtedly rich and I have every desire to advertise the fact, but I fear that I shall be open to the charge of "booming," did I seek to convey the impression that Providence had been so generous as to deposit "full complement of miners" alongside of rich veins, so that all the discoverer need to attend to would be the proper amalgamation of the two.

I would suggest that your printer either has shares in this district or is desirous of giving it gratuitous advertisement, or he neglected to properly sort out a little "pi."

Ymir, B. C.

Yours truly,
PERCY J. GLEAZER.

RECENT PUBLICATIONS.

WE have received the following new books and publications to which a more extended notice will be given next month:—

Cyanide Practice, by Alfred James, London, E. & F. W. Spon, Limited; New York, Engineering and Mining Journal Incorporated. Price, \$5.00.

General Review of Mining in British Columbia, Bulletin No. 1, Bureau of Provincial Information.

The Financial Crisis in British Columbia, by F. J. Proctor; Vancouver, Evans & Hastings.

CATALOGUES, CIRCULARS AND TRADE NOTICES.

THE Allis-Chalmers Co. received an order through their Salt Lake office, H. V. Croll, manager, for a 60-stamp mill, each stamp weighing 850 lbs., from Allen C. Mason, of Helena, Mont. The mill will be built on the Winston property, four miles from Helena, and will be driven by three electric motors, two for the 60 stamps and one for the large Gates crusher. This mill will have several new features in its construction, among which is a special new design of conveyor for the ore bins, and heavy cast-iron anvil blocks placed under the mortars, which rest upon a large concrete foundation, instead of the ordinary wooden mortar block which has been universally used. This construction will increase the crushing capacity of the stamp from 20 to 25 per cent. It is expected the mill will be in operation by June 1, 1902.

MINING RETURNS AND STATISTICS.

ROSSLAND.

ORE production from Rossland from January 1st to February 15th, was divided as follows:

Mine.	Tons.
Le Roi.....	32,930
Le Roi No. 2.....	6,775
Cascade.....	150
Bonanza.....	60
Velvet.....	40
	49,955

The following is the manager's report of the Le Roi Mining Company for December, dated Rossland, B. C., 18th January:—

Output—The shipments made to the Northport smelter for the month of December totalled 16,556,212 dry tons of 2,000 lbs. each, which had an average gross value of \$10.94 per ton. The following statement gives the general details of the metal contents and values:—

	Per ton.
5,793,209 ozs. Gold at... \$20.00	= \$115,864 or \$7.00
11,005,57 ozs. Silver at..... .56	= 6,063 or .37
46,843 lbs. Copper at..... .12½	= 59,139 or 3.67

Gross values.....	\$181,056
Average value per ton.....	\$10.94

The gross value of the ore is, therefore, taken as \$110,056, from which must be deducted the cost of freight and treatment at \$6 per ton, which amounts to \$99,337, leaving a balance of estimated profit of \$81,719.

SLOCAN.

January shipments from the Slocan district were as follows:—

	Tons.
Payne.....	115
Ivanhoe.....	155
Sunset (Jackson Basin).....	160
Reco.....	80
American Boy.....	84
Arlington.....	440
Hewett.....	356
Bosun.....	100
Last Chance.....	20
Wonderful.....	20
Enterprise.....	60
Queen Bess (for January).....	60
Monitor (for January).....	204

Total tons..... 1,874

The ore shipments through Kaslo for the month of January were 1,725 tons, as follows:—

	Tons.
Whitewater.....	573
Rambler-Cariboo.....	519
Sunset.....	156
American Boy.....	133
Last Chance.....	100
Reco.....	83
Wonderful.....	64
Silver Glance.....	35
Red Fox.....	21
Surprise.....	21
Bismarck.....	20

The output during January and February aggregated approximately 4,000 tons.

BOUNDARY DISTRICT.

Tonnage output from the Boundary district from Jan. 1st to Feb. 22 is reported by the Phoenix Pioneer as under:—

Granby Mines, Phoenix.....	29,557
Snowshoe.....	180
Mother Lode, Deadwood.....	20,652
Winnipeg, Wellington.....	360
Golden Crown.....	330
No. 7 Mine, Central.....	250

Total tons.....	51,329
Granby smelter treatment, tons.....	28,547
Mother Lode smelter treatment, tons.....	21,854

LARDEAU.

The Trout Lake Topic publishes the following table of ore shipments from that district to date. The returns as given are stated to be measurably correct, with the exception of those of the Nettie L. mine. In this case the figures are merely approximate:—

	Pounds.	Gross Value.
Silver Cup.....	2,400,000	\$180,000 00
Nettie L.....	2,340,000	146,250 00
Triune.....	649,776	82,870 27
Cromwell.....	23,289	1,296 79
St. Elmo.....	12,000	510 00
Ethel.....	34,000	1,596 00
Broadview.....	52,000	1,664 00
Great Northern.....	56,000	1,344 00
Lade Group.....	12,000	1,320 00
Beatrice.....	442,000	32,239 39
Ruffed Grouse.....	11,770	507 19
Linson View.....	868	63 17
	6,232,703	\$449,660 81

COAL EXPORTATIONS.

COAL shipments from Vancouver Island collieries during the month of January were divided as follows:—

	Tons.
New Vancouver Coal Co.....	31,923
Union.....	14,574
Ladysmith.....	17,827
	64,324

For the three weeks ending February 20th, the New Vancouver Coal Co. shipped to Puget Sound and Alaskan ports 13,150 tons of coal.

Production from the Crow's Nest collieries now approximates 2,500 tons of coal per day of 16 hours. 636 coke ovens have been constructed, the daily output of coke being 850 tons, 200 tons of which is supplied to the home market.

THE METAL MARKET.

CONDITIONS during the last few weeks appear to have considerably improved, and the market is generally healthier. Silver quotations have shown little fluctuation, prices having ranged between 55 7-8 and 55 1/4. India is at present the principal purchaser, but inquiry from elsewhere is fair, and there is little likelihood of any further decline. Copper is in good demand, and business has been active, although free offerings of some lots in second hands and the absence of any support from the leading interests has somewhat affected the market. Exports from the States continue on a large scale. The latest quotations from New York are Lake, 12 1/4 and 12 3/8; electrolytic, in cakes, wire bars and ingots, 12 and 12 1/4; in cathodes, 11 3/4 and 12; casting copper, 12 and 12 1/8. Lead has been in good demand at unchanged prices in American, the St. Louis quotation being 3-97 1/2 and 4-05, and 4-05 and 4-10, New York. The London market continues to advance, Spanish lead being quoted during the last week of February at £11, 13s. 9d. Spelter is firmer at 3.95 St. Louis, 4.10 New York.

THE LOCAL STOCK MARKET.

LOCAL markets during February have been very active, and there has also been heavy dealings in Republic stocks, in anticipation of the early completion of the railway into that district, when a number of mines will commence production under contract with the Grand Forks smelter. The most active Republic stocks have been Mountain Lion, San Poil, Republic, Lone Pine and Black Tail. Republic advanced from 4 to 13 during the month but reacted to 9. Black Tail advanced from 11 to 14, Mountain Lion from 25 to 35, Lone Pine from 6 to 7 3/4.

In B. C. stocks Crow's Nest shares have advanced from \$80 to \$90, with some sales as high as 92. White Bear has been in considerable demand of late and has advanced from 1 1/2 to 4 cents. Winnipeg has also been active and has advanced from 3 3/4 to 5 1/2. Cariboo-McKinney after advancing to 35 has since rapidly declined to 23. Centre Star, which was quoted at 46 early in the month, is also weaker at 32. Iron Mask has sold at from 17 1/2 to 20, Payne at 28 to 30, Rambler-Cariboo at 82 to 86, Sullivan at 8 1/2 to 9. Waterloo has also been in some demand at from 1 1/2 to 1 3/4 in consequence of a resumption of operations at the mine. All Waterloo shares on which the No. 1, 2 and 3 assessments have not been paid are now forfeitable. The general condition of the market shows improvement.

FEBRUARY DIVIDENDS.

Cariboo-McKinney, 1 1/2 c. per share. \$18,500
Sunset, Jackson Basin, Slocan. 6,000



Provincial Secretary's Office.

His Honour the Lieutenant-Governor in Council has been pleased to make the following appointment:—

17th January, 1902.

Joseph Mackay, of the City of Vancouver, Esquire, to be a Deputy Mining Recorder for the Horsefly District in the Quesnelle Mining Division, with sub-recording office at Harper's Camp, and a Provincial Police Constable.



Coal Mines Regulation Act Amendment Act, 1901.

PROVINCIAL SECRETARY'S OFFICE,

17th January, 1902.

His Honour the Lieutenant-Governor in Council, under the provisions of 1 Edward VII, chapter 36, has been pleased to constitute a Board of Examiners at the undermentioned Coal Mines, namely:—

Nanaimo, represented by the New Vancouver Coal Mining and Land Company, Limited.

Wellington (Extension), represented by the Wellington Colliery Company, Limited.

Comox, represented by the Wellington Colliery Company, Limited. Coal Creek, represented by the Crow's Nest Pass Coal Company, Limited.

Michel, represented by the Crow's Nest Pass Coal Company, Limited.

His Honour the Lieutenant-Governor in Council has been further pleased to appoint the following persons to be Members of the Board of Examiners at the Coal Mine written opposite their respective names, namely:—

Joseph Phrys Planta, of Nanaimo, Esquire, Nanaimo Mine.

John Cunliffe, of Extension, Esquire, Wellington (Extension) Mine.

William Johnston, of Comox, Esquire, Comox Mine.

William Barton, of Fernie, Esquire, Coal Creek Mine.

Evan Evans, of Michel, Esquire, Michel Mine.

William Stainsby, of Morrissey, Esquire, Morrissey Mine.

COAL MINES REGULATION ACT.

BOARD OF EXAMINERS.

Notice is hereby given that the following constitute the Board of Examiners for the Nanaimo Mine during the year 1902:—

Appointed by the Owners { (1) THOMAS MILLS.
(2) BENJAMIN BROWIT.

Alternates { (1) JOHN NEWTON.
(2) THOMAS BUDGE.

Appointed by the Lieutenant-Governor in Council } JOSEPH P. PLANTA.

Elected by the Miners { (1) WILLIAM NEAVE.
(2) GEORGE JOHNSON.

Alternates { (1) THOMAS JAMES SHENTON.
(2) WILLIAM SMITH.

NOTE.—Alternates act as Members of the Board in the absence of those regularly appointed or elected to act thereon.

All persons interested may obtain full information by applying to the Secretary of the Board, Mr. Joseph P. Planta, of Nanaimo, B. C.

Dated this 19th day of February, 1902.

MALLCOTT RICHARDSON,
Secretary, Department of Mines.

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