Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- [X] Coloured covers/ Couverture de couleur
- [ ] Covers damaged/ Couverture endommagée
- [ ] Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- [ ] Cover title missing/ Le titre de couverture manque
- [ ] Coloured maps/ Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- [✓] Bound with other material/ Relié avec d'autres documents
- [✓] Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- [ ] Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- [ ] Additional comments:/ Commentaires supplémentaires:

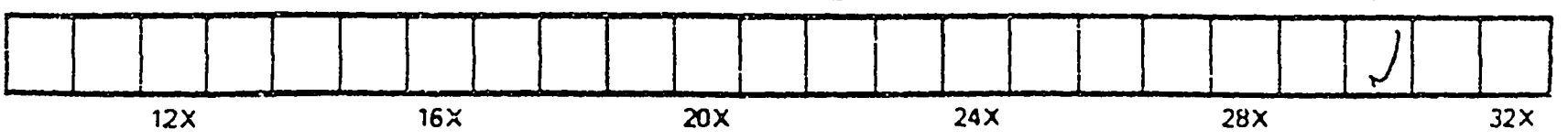
- [X] Coloured pages/ Pages de couleur
- [ ] Pages damaged/ Pages endommagées
- [ ] Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- [✓] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached/ Pages détachées
- [ ] Showthrough/ Transparence
- [✓] Quality of print varies/ Qualité inégale de l'impression
- [✓] Continuous pagination/ Pagination continue
- [ ] Includes index(es)/ Comprend un (des) index

Title on header taken from:/ Le titre de l'en-tête provient:

- [ ] Title page of issue/ Page de titre de la livraison
- [ ] Caption of issue/ Titre de départ de la livraison
- [ ] Masthead/ Générique (périodiques) de la livraison

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X 12X 14X 16X 18X 20X 22X 24X 26X 28X 30X 32X



NINETEENTH YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

Vol. XX—No. X. OTTAWA, OCTOBER 31st, 1901. Vol. XX--No. X.

19th YEAR OF PUBLICATION.

The Canadian Mining Review

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING AND ENGINEERING JOURNAL PUBLISHED IN THE DOMINION OF CANADA.

B. T. A. BELL, Editor and Proprietor.
Secretary, Canadian Mining Institute, etc.

Published Monthly.

OFFICES { Slater Building, Ottawa; Windsor Hotel, Montreal.

VOL. XX., No. 10. OCTOBER, 1901. VOL. XX., No. 10.

Concerning Mine Management.

Information concerning several properties in Canada has recently been received by the REVIEW which emphasizes the embryo character of much of the mining work that, as a generality, has been done in the newer regions of Canada during the "boom" times of the last five or six years, and it clearly shows the want of men who have been trained in the principles of mine management.

It is a truism that the majority of men who have been put in charge of the important work of opening and developing mineral properties in the newer portions of Canada have been, to put it very mildly, novices, entirely inexperienced and untrained.

That such a group of incompetents has done more to wreck mining corporations and create adverse capitalistic opinion than the demerits of the properties themselves, is apparent to any student of the situation. The gross incompetence of the management rather than "inadequate mineral resources" has been the rock upon which most of the mine promotions of the last five or six years have been wrecked.

We have seen subservient prospectors and workmen, who have become the blind tools of the promoter, rewarded with the superintendency when the promotion became a fact, and the treasury was full. Promoters themselves, in some cases, have filled the office of general manager because their temporary residence in mining camps had familiarized them to a certain extent with the use of some technical terms. Ambitious young graduates of mining schools, whose experience was *nil*, but whose needs were considerable, have been employed at cheap wages ($100 a month or so) by companies whose funds were extremely limited, and whose funds after such an appointment have been *nil*; men whose abilities and experience as shift bosses, foremen, assayers or book-keepers was unquestionable have been put in charge as superintendents or managers because of their honesty, but with disastrous results as managers.

These errors have most frequently been committed by English and Canadian companies; the former for reasons which have already been alluded to in former numbers of the REVIEW, the latter because of their general ignorance of the whole subject of mining; the American companies have managed somewhat better, as they should have done from their greater experience in this line. It is easy to mention specific cases in specific places. In the Yukon, at Atlin Lake, in the Kootenays, both East and West, and in the gold fields of Western Ontario examples are frequent where the working capital of the company has been totally expended without results, because of the manager of the company not knowing *how* his work should be done, or because he was not able to have it done economically, or because he frittered it away in expenses that were not directly connected with the development of his property. In one case a mortar block for a stamp mill was put down upon a rock surface which had a slope of 35°, the manager congratulating himself upon having a "solid rock" foundation for his mill. At the end of one year, which was a disastrous year financially, the superintendent "wondered" how it was that his stamps were striking the back of his mortar, and had to "wonder" until a visiting engineer called attention to his foundation. In another case a promoter, with the title of managing director and mine manager, has been unable to erect a 20-stamp mill and accessories with $60,000. In another case an English corporation with an abundance of working capital entrusted the selection of properties to a young English engineer of no experience, to whom they paid the magnificent stipend of £300 per annum, at the same time entrusting him entirely with the expenditure of some £50,000 of capital. In this case it is unnecessary to say that the results were nothing. In another case a man with a good reputation as a mine examiner or geologist, but who was totally inexperienced in the *practical* engineering work required at a mine, put his shaft-house on the highest point of his property, thereby necessitating the haulage of fuel and all supplies up a steep grade to a height of nearly 200 feet more than was necessary, and equipped this shaft-house with machinery, etc., which to-day has been relegated to the scrap heap. Some time ago a foreigner, placed in charge of a Canadian property, chanced to see a Tremaine stamp mill at work in another country; by some unexplained method of figuring, this so-called engineer saw a tremendous economy in the use of this steam stamp over the gravity stamp, and at a large expense to his company tore down the existing gravity stamp mill and erected batteries of Tremaine stamps, with accessories totally inadequate and unnecessary; the sequel of all of which was the collapse and shutting down of the entire property.

The point of all this is that the country and the mineral properties have no call to be condemned. It is very rarely that one hears of the condemnation of the manager, but the property is reported to be "no good," not the man in charge; and it is to this item as well as to the exceedingly bad financial methods which have been practiced as regards some Canadian companies, that is due the disappearance of British Columbia and other Canadian mines, not only from the eastern market but also from the London market.

It may pertinently be asked by the reader whether the science and mining schools connected with our universities are not turning out trained mining engineers who are available for such positions? The answer unquestionably is, "No;" that they are not turning out such engineers, nor can they do so, for the reason that no schools can turn out men who are competent to direct operations as a whole, because

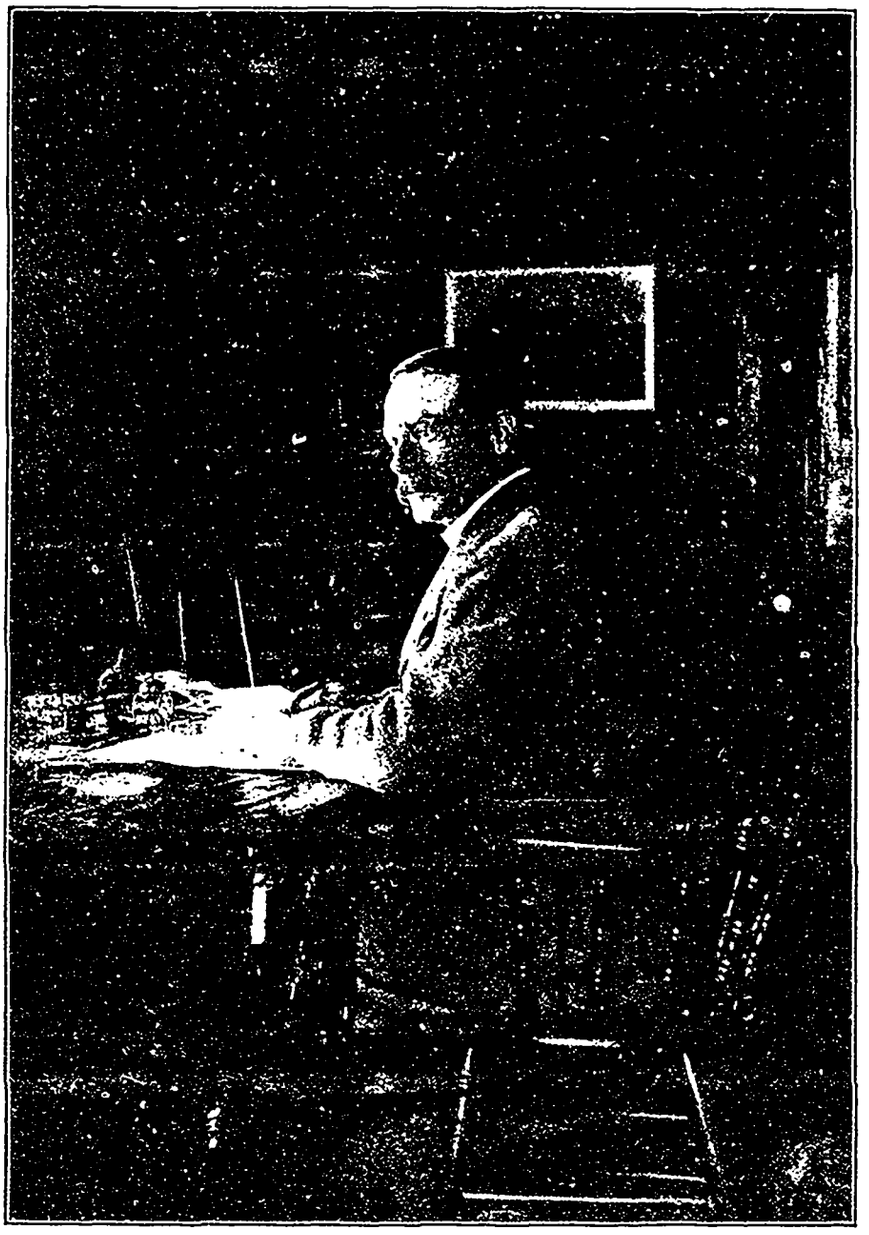
such competence comes only from experience, and somewhat wide experience too. This necessary experience has impressed upon the man who has had it, the necessity for economy and for creeping before walking. The knowledge that if one is to make a success he must spend less than 100 cents out of every dollar received, is the knowledge that our technical schools do not teach. Mining is taught as a science and not as a business, and no provision is made in the curriculums of the scientific schools for the infusion of a little of that hard horse sense, as it is called, which means practically a business training. There is no panacea to cure this evil. With the increased experience of Canada in mining will come an increased number of men whose training has been adequate to enable them to handle mines successfully. To the investors who have already tried the incompetent manager and lost their money, it would appear useless to say, "Try again with fresh money and with experienced men."

The Outlook for Copper.

A hundred and one reasons have been assigned for the breakdown in copper. What may be the immediate explanation, it would be hard to say. One, which referred it to the action of the Amalgamated Copper Company, has been contradicted. It was to the effect that that concern had an intention to start a crusade against the market in order to break the price with the object of creating a situation that would compel the Rio Tinto Company to join the "combine." It has long been known that the individuals who direct the affairs of the latter have from the outset cherished a hope that they would be able to capture the British company, and that they were prepared to pay a handsome price for the alliance. It was several months ago said that they would willingly pay $300.00 per share for a block of Rio Tintos which would suffice to give them control. That may have been an exaggeration, but there can be no doubt they would have been agreeable to offer handsome terms to effect a "deal" which would have greatly strengthened their hands and been of immense assistance in enabling them to make another step in advance in furthering a policy designed to secure command of the market in the two hemispheres.

There is, however, no necessity to assume speculative machinations as a prime or even an important contributory cause of the fall in the price of copper. It is much more reasonable to conclude that demand and supply have been the two most potent influences at work. During the industrial "boom" of the last three or four years an immense stimulus was given to consumption by reason, for the most part, of the great expansion of the electrical industries. This was especially the case in Germany. While the excitement lasted, a sharp impetus was given to the price, which rose from $250.00 to about $400.00 per ton. In 1898 the production of the whole world was a trifle over 424,000 tons, and the average price about $250.00 per ton; while last year the average price was over $365.00, and the output about 486,000 tons, so that while the price rose over 43 per cent., the production only increased a trifle over 14 per cent. When the copper "boom" was in full career, and merchants and speculators, though in many cases deprecating what seemed to them to be a tendency to undue inflation, expressed the view that the metal was destined to remain at a permanently higher level than in the past, and fixed in their minds an average of about $350.00 as a reasonable figure. It was suggested that the excitement would, like all such displays in the past, be ephemeral, and that if the demand was to be kept at a normal level the price would have to come down to about $300.00 as a maximum. Last month it fell to $300.00, from which there was subsequently a moderate rally. While the increased demand helped to lift the price to an average of about $365.00 during the past couple of years, there can be very little doubt that clever manipulation by the Amalgamated Copper group also aided the movement. The output controlled by the "combine" is about a hundred and eighty thousand tons per annum, which is rather more than seventy-five per cent. of the total American production, and a little over thirty-seven per cent. of the entire world's output, the latter being, roughly, 486,000 tons. In order to sustain the price, it has for some time past been restricting its sales, and it is reported—and the statement is made by the late manager of the United Metals Selling Company, which has the handling of the metal of the "combine"—that the latter had on hand at the beginning of August last an accumulated stock amounting to about 60,000 tons. The impression is, that since that time this stock has been largely added to, in which case it is not improbable that the "combine" is carrying upwards of one-third of the total American output. The stock of the metal in Europe is estimated to be only one month's consumption, and from this the inference has been drawn that it would require a very little increase in the demand to give a fresh upward impulse to the price. It has, however, to be borne in mind that the moderate extent of the European supply is mainly due to manipulation by the American "combine," which has been a persistent importer of "standard" metal for the purpose of supporting the market; so to suppose it can go on indefinitely playing the same game would be absurd. What its actual financial resources may be there is no possibility of ascertaining. The fact that it has a capital, as represented by its stock, of over thirty-one millions sterling is no guide to its actual pecuniary strength, seeing that the foregoing capital represents, as to a very large percentage, mere "water."

The one broad fact, to which too much weight cannot be given in considering the position and prospects of the copper market, is that the general industrial conditions now prevailing in Europe are vastly different from what they were a year or eighteen months ago. There has, for instance, been something like a collapse in electrical enterprise on the other side, the demand in connection with which was the backbone of the copper "boom," and from what has happened of late in Germany, France and Belgium, it would be the height of folly to suppose that the requirements of this branch of business will for a considerable time to come be of anything like the large dimensions attained in 1899. Since then this continent has produced far more of the metal than was needed for home consumption, which there is reason to believe is also on the wane. The "hidden" stocks in the United States must be much more extensive than one would be warranted in inferring from published statistics, and there is no evidence that production, either there or elsewhere for that matter, is being reduced. The companies controlled by the "combine" might decide to diminish their output, but that would not necessarily prompt like action on the part of other producers, while so far as outside producers are concerned they, in consequence of the want of an understanding or of any kind of solidarity among themselves, will be guided in what they do by ordinary business considerations. Until quite recently attention was given much too exclusively to the supposed increasing requirements of the trade. It was only a short time ago stated by a gentleman, who is regarded as an authority on the subject, that consumption was keeping level with production throughout the world, that stocks were bare, and that in order to meet the needs of the expanding electrical industry some new source of supply would have to be found in the course of the next few years. Equally fantastic calculations were indulged in during the great Secretan gamble, the end of which was disastrous. There is no need to dive deeply into statistics in order to arrive at the conclusion that this copper business has been overdone. It was no mere accident which brought down the price from nearly $370 per ton at the opening of the present year to within a trifle of $300 last month. The point to be borne in mind is that in 1898, with a total production of 424,000 tons, the average price was about $255, and that the output will this year be very considerably greater; so that, assuming that trade and industrial conditions continue at



MR. R. RANDOLPH BRUCE, B.Sc., C.E.,

Manager and part owner of the Paradise Mine, Windermere District, B.C.

their present level, or that there is a reversion of those prevailing at the earlier period, there would be nothing surprising if a still further decline in the price of the metal took place notwithstanding the most strenuous efforts on the part of the United States "combine" to support the market artificially.

Some English Methods.

The issues of the London financial papers during the last two months have contained many articles, long and short, with reference to the collapse of the remarkable combination which embraced the London & Globe Financial Corporation, the British America Corporation, the Standard Exploration Company, and the half-dozen subsidiary companies formed therefrom or thereby. The whole of these articles are extremely interesting reading, but are too long to be reproduced. Condensed into as small compass as possible, the story is that the British America Corporation, registered in October, 1897, was promoted by the London & Globe Company in December, 1897. The capital was £1,500,000, of which £1,000,000 was offered for subscription; £200,000 was reserved for the Standard Exploration Co., and £800,000 was subscribed by the public.

The Hon. Chas. H. Macintosh had, prior to December, 1897, sold options (in British Columbia and the Yukon) to the London and Globe Financial Corporation for £100,000; these same options were sold to the newly formed company, the B. A. by the London and Globe for the price of £500,000. The first property acquired was the LeRoi mine for which the British America Corporation paid in cash the sum of $3,280,000. In conjunction with the London and Globe Company the British America Corporation registered the LeRoi Mining Co. with a capital of £1,000,000. The profit on the turnover to the LeRoi Company amounted to £165,000 stg. which was equally divided between the British America Corporation and the London and Globe Co. Following this transaction rapidly were the flotations of the East and West LeRoi and Columbia Kootenay properties, no part of the capital of which was issued to the public, and none of which possessed any working capital, which was provided solely from the treasury of the British America Corporation.

The effect of these transactions was a paper profit to each of the parent corporations, the British America Coporation and the London and Globe, of nearly half a million pounds, and a very important question, which will be decided in the future, is whether or not there was a partnership between the London and Globe and the British America Corporation, and, if so, to what extent the liabilities of the British America Corporation will affect the London and Globe Corporation.

The fact stands out clearly that both the London and Globe and the British America Corporation were making transactions on paper only, and were, together with the Standard Exploration Company, using their cash and assets in gambling in shares on the Stock Exchange.

The only point directly affecting us here in Canada is the cloud and disgrace which has thereby unjustly been attached to British Columbia, and all Canadian properties, in the London market. There is no reason whatever why British Columbia should be introduced into this stinking mess of company promotion and finance It is one of the points of the English trader to damn a whole country because one of his number has played a rascally game in which some of the counters used were from British Columbia. So far as the interwoven English companies in this affair are concerned their counters might just as well have been marked Kamtschatka or Borneo as British Columbia. We are thankful that there is a London and British Columbia Gold Fields Limited with a reputation which should, partially at any rate, offset the disgraces of the Whittaker Wright outfit.

OUR ILLUSTRATIONS.

The Rock Lake Mining Company.

Our illustrations this month reproduce some excellent photographs illustrating the important copper mining operations being carried on by the Rock Lake Mining Company in the Township of Aberdeen, near Bruce Mines, Province of Ontario.

The company was organized in March, 1899, under charter from the Ontario Government, and has a paid up capital of $3,000,000 in shares having a par value of $10.00 each, and it is directed by a board of officers comprising; Mayer Wile, Buffalo, N.Y., president; Henry Weil, New York, vice-president; Lawson C. Holden, Sault Ste. Marie, Mich., secretary; Byron G. Coryell, Chesaning, Mich., treasurer, Arthur S. Burrows, Bruce Mines, Ont., general manager.

The mining property held by the company comprises about 1,550 acres. The vein worked has an average width of from 17 to 46 feet and carries copper in the form of chalcopyrite, bornite, and in places some black oxide.

The main shaft has been sunk for a distance of 425 feet. It is divided into three compartments—a manway and two hoisting compartments; one hoisting compartment being fitted with guides for a kibble cross-head and one fitted up for a cage. The shaft is well trimmed up and securely timbered. Three levels have been driven 100 ft. apart.

The character of the ore may be gathered from the following analyses of average samples:—

1st	Level	and	cross-cut	average	7.28 p.c. refined copper to the ton.
2nd	"	"	"	3.86 p.c.	" "
3rd	"	"	"	2.35 p.c.	" "

An up-to-date mining plant including duplex Rand ten-drill compressor, hoisting engine, etc., is in place, and a mill having a capacity to crush and concentrate 200 tons per day has been installed, the machinery being furnished by the Jenckes Machine Company of Sherbrooke, Que. The ore from the mine is dumped in storage bins, from which it is fed by gravity into a 20 x 30-inch Blake crusher, the product all passing to a revolving trommel of 1 inch mesh, the oversize going to a set of belted 16 x 30-inch rolls provided with ball and socket bearings. From these rolls the ore is elevated to the trommel mentioned above. From the trommel the ore passes to four sizing screens 7/16, 5/16, 3/16 and 1/16 inch. The oversize from the screens is fed to jigs with parallel motion plungers. The last screenings from the finest screens are fed to a settling tank to be treated on finer jigs. The middlings from jigs are crushed in another set of 10 x 30-inch rolls and elevated to the set of four sizing screens mentioned above. The tailings from jigs are fed to a set of high speed 6 x 48-inch rolls, then elevated to a settling tank and after having been sized are fed over Wilfley tables. Concentrates from jigs and tables are settled in large bins. Adjacent to mill is an engine and boiler house 38 x 64 ft. in which are installed a 250 h.p. tandem condensing Corliss engine and three 80 h.p. tubular boilers, the power plant being designed to furnish power not only for the present concentrating mill and electric lighting plant but also for a largely increased mill for which provision has been made.

Accessory plant consists of a brickyard equipped with a pug mill and an improved Martin brick machine having a capacity of 10,000 bricks per day. This is located one mile west of the shaft. A sawmill is also erected adjacent to the brick yard. In order to ship the concentrates from the mine to navigable water in Lake Huron the company has organized the Bruce Mines and Algoma Railway Company, Limited, and will construct the line as far as Bruce Mines in the near future.

PROMINENT CANADIAN MINING MEN.

PROF. WILLET G. MILLER,
Whose candidacy to the vacant Chair of Geology at Toronto University is endorsed by Canadian mining men.

S. F. PARRISH, M.E.,
General Manager of the B.C. Chartered Company, at Eholt, B.C.

E. NELSON FELL, A.R.S.M.,
Mining Engineer in charge of the Athabasca Mine, Nelson, B.C.

G. F. RANSOM,
Sandon, B.C.
In charge of the Slocan Sovereign Mines Co.

E. A. SJÖSTEDT, M.E.,
Metallurgist at Clergue Works, Sault St. Marie, Ont.

D. W. ROBB, M.E.,
Of the Robb Engineering Co., Amherst, N.S.

The company also owns a valuable asset in the water power of the Thessalon River from which can be generated electric energy more than sufficient to operate the entire mining and milling plant. The company employs at present over 300 persons.

Gold Dredging on the Saskatchewan.

The North Saskatchewan has hitherto been by far the most important stream upon which gold mining operations have been carried on, and is the only one which has offered a continuous and somewhat considerable output of gold. The length of the river upon which work has been found to pay, under favorable conditions, is, as already defined, about 120 miles; Edmonton being situated almost in the centre of this length of the river. Up to the present time, gold washing has been prosecuted almost entirely by hand or with the aid only of very rude mechanical appliances for lifting small quantities of gravel from the submerged bars and bed of the river. The prosecution of this work has been desultory, being practically limited to the low-water stages of the river, and even then conducted by a number of men who, generally, wish to devote only a part of their time to such work, influenced largely by the inducements offered by employment in other directions. It must be added, however, that experience here as elsewhere in regard to river-bar mining, shows that the best returns are obtained from the first working of such bars, and that, although more or less re-arrangement of material and renewal of accessible gold is brought about each year when the river is in flood, the naturally exposed bars rapidly deteriorate in their yield. For this reason, except at unusually low water, a number of the miners now devote themselves to the working of layers of gravel covered by lighter sandy deposits along the banks of the river, and that these often carry a considerable amount of gold is shown by the fact that some men were engaged with profit, during the past year, in removing from five to eight feet of sand, shovelling underlying gravel from the pit thus formed, wheeling it thirty or forty yards to the edge of the river, and washing it there by hand with an ordinary "grizzly."

A number of dipper dredges of varying construction have been working successfully for a number of years on the river, but these have lately been supplemented by dredges of the New Zealand type built for the Saskatchewan Gold and Platinum Proprietary, Limited. The dredges of this Company, after having undergone some improvements in their gold-saving appliances, are reported to be yielding highly successful results. Other dredges are contemplated, notably by the North-West Dredging Company, which controls the mining rights over some 60 leases covering some 300 miles of the bed of the Saskatchewan.

There appears to be no reason to doubt that satisfactory results comparable with those achieved in a number of cases in New Zealand may be obtained on several rivers in the North-West, and more particularly on the North Saskatchewan. Properly constructed dredges of adequate size and capacity will permit work to be carried on continuously during about half the year. It is to be remembered that such dredges enable the working not only of the bars and bed of the river, but also of the adjacent river-flats, where these do not possess a greater and more permanent value for agricultural occupation. Many of these flats are known to be underlain by auriferous gravels which have never yet been touched.

The Paradise Mine, Windemere, B. C.

Mr. R. Randolph Bruce, B.Sc., whose portrait is reproduced in another page, is one of the most genial and deservedly popular of the mining men in British Columbia, and is well known, particularly in East Kootenay, as the successful manager and part owner of the Paradise Mine, located in Windermere District. Particulars of the progress of development of this property have appeared from time to time in the REVIEW, but the following description by Mr. Chas. F. Nicholson, Assayer, of Peterborough, B.C., given in the last issue of that excellently conducted publication, the *B. C. Mining Record*, will be of interest to many of our readers:—

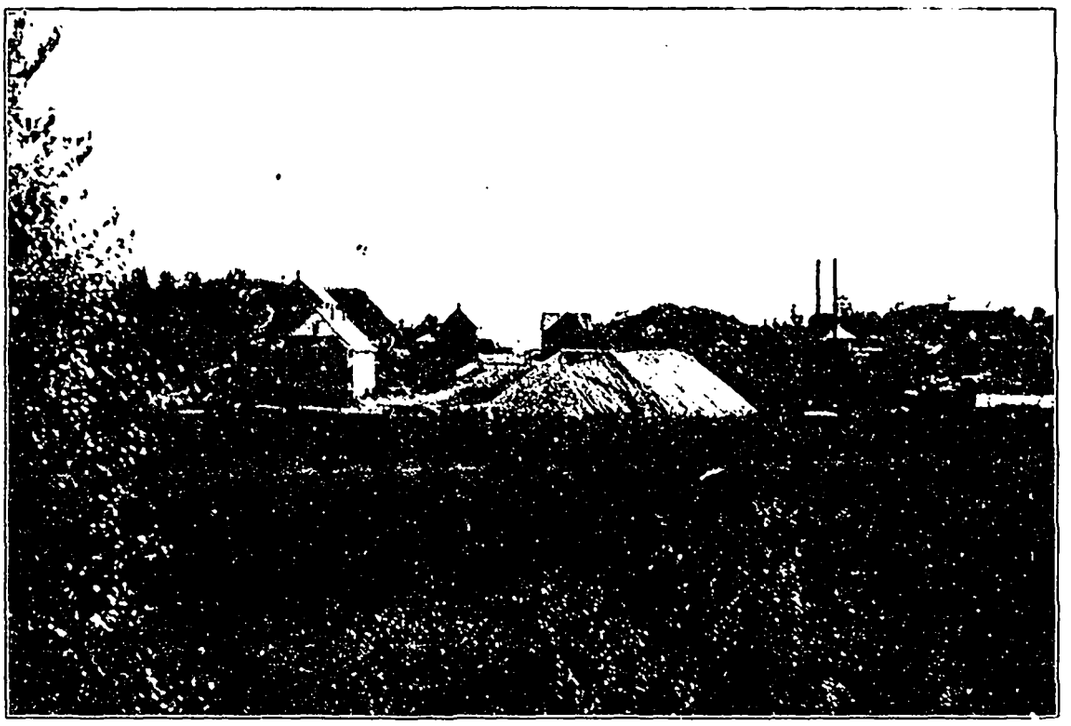
"The Paradise Mine, in the Windermere District of East Kootenay, was located in August, 1899, and bonded in June, 1900, to Messrs. H. C. Hammond, Toronto, and R. Randolph Bruce. What is now No. 4 tunnel had been driven some seventy feet during the winter of 1899-1900, but development work proper was not commenced until June 11, 1900. By the following March, nearly 1,000 tons of ore had been conveyed, for the first five miles from the mine, by rawhide, thence eleven miles by sleigh to the Columbia River at Peterboro. In the spring, upon the opening of navigation, the steamer Duchess conveyed the ore to Golden, whence it was shipped to the Trail smelter *via* the Canadian Pacific Railway. A remarkable feature of this achievement is that the product was taken from the mine by pick and shovel. Not a stick of powder was used.

The mine is reached from Peterboro, on the Columbia river, by a wagon road constructed by the Government in the summer of 1900, and follows the valley formed by Toby Creek. This wagon road was one of the first constructed under the direction of the newly created inspector of trails and roads. The heaviest adverse grade against them is 2 per cent., but it is for a short distance only. The road is an excellent one in every respect. From Toby Creek to the basin in which the Paradise is situated, a good rawhide trail was constructed. The grade of this trail for a great part of the distance is 110 to the mile. It is well constructed and answers all purposes for taking in supplies and bringing out ore.

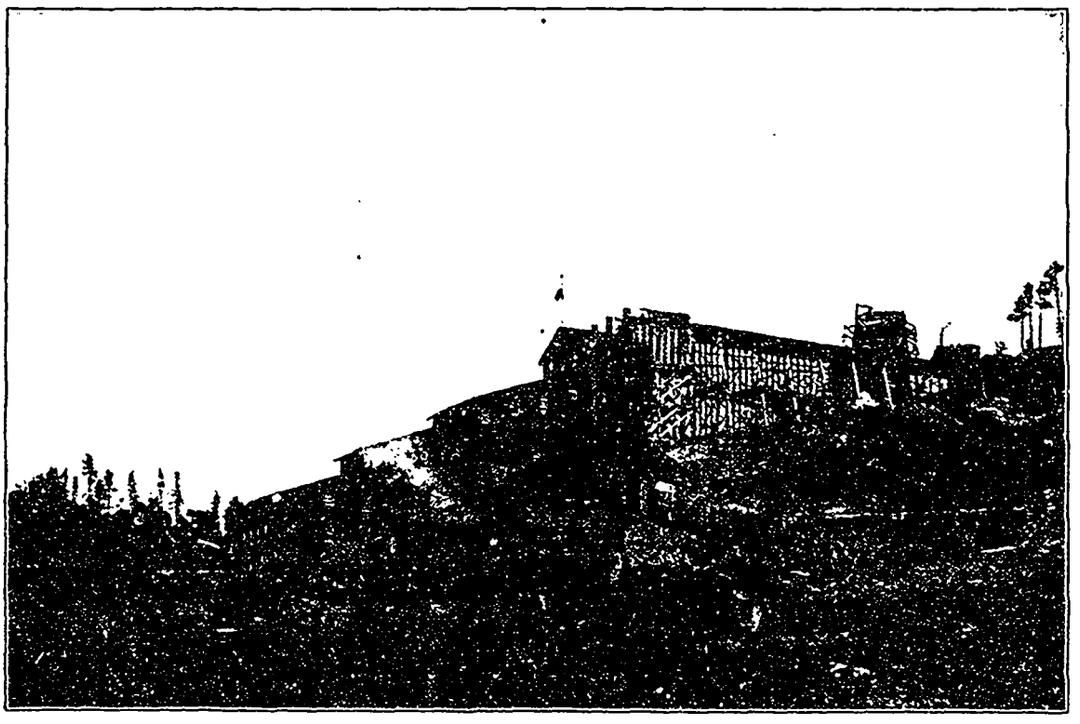
The development work on the property consists of three tunnels. No. 1 tunnel is in the ore chute from which the shipment was made. The ore consists of a friable substance which reacts for lime with acid, and is readily distinguished as pay dirt by its specific gravity. The pay dirt has been given the name "Sand Carbonates" and carries as a usual thing about 50 per cent. lead and 60 oz. silver. In this district the dip of the strata is to the west, and the strike north 20° west, magnetic. On the summit of the mountain on which the Paradise is located and about 1,000 feet from the workings, the dip and strike of the upturned strata is as stated. But in the different workings on the Paradise the dip is shown to be northward and the strike east and west. The ore body is between a contact of slate and lime, and has a dip of 35 degrees. A tunnel was driven in for 30 feet in the ore which at that point was encountered in considerable body. About 500 tons of ore was sacked from this deposit. The pay dirt was found to lead from the north side of this deposit and has been followed by an inclined shaft for 180 feet at an angle of 35 degrees. The floor of this incline is the footwall and the roof the hanging wall. That is, it is assumed that the floor is the footwall, for as a matter of fact the hanging wall has been followed closely and as the timbering is in ledge matter, it is assumed that the ledge may be wider than the excavation on the incline shows. No work has been done to establish that point. At one point only was the excavation made wider than required. At that place the incline was widened to probably 20 feet. The first ore was sacked in September of last year and all the ore with the exception of about two tons, comprising the shipment to the smelter, came out of the deposit of "Sand Carbonates."

No. 2 tunnel had been driven at the time of my inspection in August, 182 feet. It is 125 feet vertically below No. 1 tunnel but some little distance to the east, and is a cross-cut to the lead. The

COPPER MINING IN ONTARIO.



Rock Lake Mining Co., Bruce Mines, Ont.—General view of Works, Clubhouse, Boarding House, Shaft House, etc.



Rock Lake Mining Co., Bruce Mines, Ont.—View showing Concentrating Mill from East side.

management is of the opinion that the paystreak between the slate and sillicious lime, will soon be reached. It is the intention to then drift 500 feet which will bring them under the ore shoot in No. 1 tunnel.

No. 4 tunnel is the oldest working on the property and with its cross-cuts and drifts, aggregates 526 feet of work. This tunnel is in a ledge which development has demonstrated to be 40 feet wider. About 300 feet from the entrance a cross-cut was made when ten feet of concentrating galena was encountered. The ore taken out in tunneling through this shoot was sorted and ten tons sacked and sent to the smelter. The ledge matter is well oxidised. Originally it was probably carbonate of iron with stringers of galena. In tunneling stringers of galena were encountered at frequent intervals. Further cross-cutting may discover other ore values similar to that mentioned. No work has yet been done to determe the extent of the ore body referred to. At present the extremity of the tunnel is in a very hard rock seamed with small fissures of quartz.

The theory of the best authorities who have examined the property is that the deposit of so-called "Sand Carbonates" was originally galena. Nuggets of galena were encountered in the workings enclosed in concretionary rings of high grade carbonates. There are indications that the "Sand Carbonates" is a V shaped trough but as already stated the deposit has not been sufficiently explored to show its nature and extent. It is a conundrum that can easily be solved by continued development and investigation.

For a few months following ore production from the mine work was suspended. But in August the manager, Mr. Bruce, resumed operations, Mr. J. J. McMullen, an experienced mining superintendent being placed in charge of the work. The present quotations on lead and silver do not offer an inducement to take out ore for shipment under conditions of present freight and smelter treatment charges but provision is being made for the continuation of development for a year's operations it being the intention of the management to thoroughly exploit the property and solve the problem of the somewhat remarkable ore occurences.

The smelter returns give about 50 per cent. lead and 41 of silver, which the cost of mining has been comparatively light, the transportation and smelter charges are such that the margin of profit is small. Although the ore, with the exception of the small quantity of galena, is free from sulphur, the best freight and treatment quotation that could be obtained from the smelter was $19 per ton from Golden. The cost of transportation from the mine to Golden was about $9 per ton.

With the exception of two cars of $150.00 ore shipped from the Delphine mine in the spring of 1900, the shipment from the Paradise mine was the first from the Windermere district. The Macdonald mine formerly known as the Red Line, will, it is stated, ship several thousand tons this winter. A wagon road is now in course of construction to that property.

Arsenic Refining in Ontario.

Repeated mention has been made of late in the columns of the REVIEW of the successful work in exploiting the auriferous mispickel ores of the Hastings district, Ontario, being carried on by the Canadian Gold Fields, Limited, under the able direction of Mr. P. Kirkgaard. The group of views shown in this issue give a very comprehensive idea of the surface works of the company. During last year 606,000 lbs. of arsenic of an estimated value of $22,725 were produced by this company as a bye product of their gold milling operations. These are the only arsenic refining works, we believe, on the American continent.

New Furnaces at Sydney, Cape Breton, of the Dominion Iron and Steel Company.

The furnace plant shown in our photo were erected by the Ritter-Conley Manufacturing Company of Pittsburg

The stacks are 20 feet in diameter at the bosh and 85 feet high; diameter of the hearth, 11 feet 9 inches; at stock line, 14 feet 6 inches; there are (12) twelve 6 inches tuyeres. Each furnace is provided with Julian Kennedy's patent top filling apparatus. The furnace shell is 28 feet in diameter and 23 feet at the top of the furnace. Bustle pipe surrounding columns 46 inches in diameter. Tuyere stocks 12 in number, of improved type with ball joints and adjustable blow pipes. Skip hoist leading from under stock bins to top of furnace is of structural steel and carries two skip cars which rest at the bottom in a steel cased pit. The stoves are of the Cowper type with casing 21 feet in diameter by 85 feet high. Stove chimneys are 9 feet in diameter inside lining, 200 feet high, provided with heavy cast iron bases, bolted to foundation. Boiler house is 53 feet wide, 576 feet long; steel building with brick walls; heavy concrete foundations; contains 8,000 h. p. boilers, with two steel stacks one for each 4,000 h. p. boiler. The boiler stacks are of steel 11 feet inside diameter of lining, and 200 feet high; boilers connected to these stacks by overhead breeching. The boilers are of the Babcock & Wilcox type amply strong for working pressure of 150 lbs. to the square inch.

The engine house is 44 feet 2 inches span, 200 feet long, contains five pairs of blowing engines built by the E. P. Allis Company; and commanded by 1 30-ton electric overhead travelling crane. These engines each have high pressure cylinder, 50 inches diameter, low pressure 96 inches diameter, with blowing tubes 96 inches diameter, all of stroke of 60 inches.

The pump house which is a lean-to on the engine house, is 30 feet span, 200 feet long and contains three horizontal Wilson-Snyder compound direct connected circulating pumps having steam cylinder 18 inches and 32 inches diameter, bronze plungers 24 inches in diameter by 36 inches stroke. Pumps are each rated at 6,000,000 gallons per 24 hours. All pumps are connected to an exhaust line extending to the end of the engine house with connections leading to the condenser system. Provision is made for the connection of a fourth pump if desired. These pumps obtain their water from the harbour and are connected to a 20 x 85 feet stand pipe which supplies water for circulating and cooling purposes.

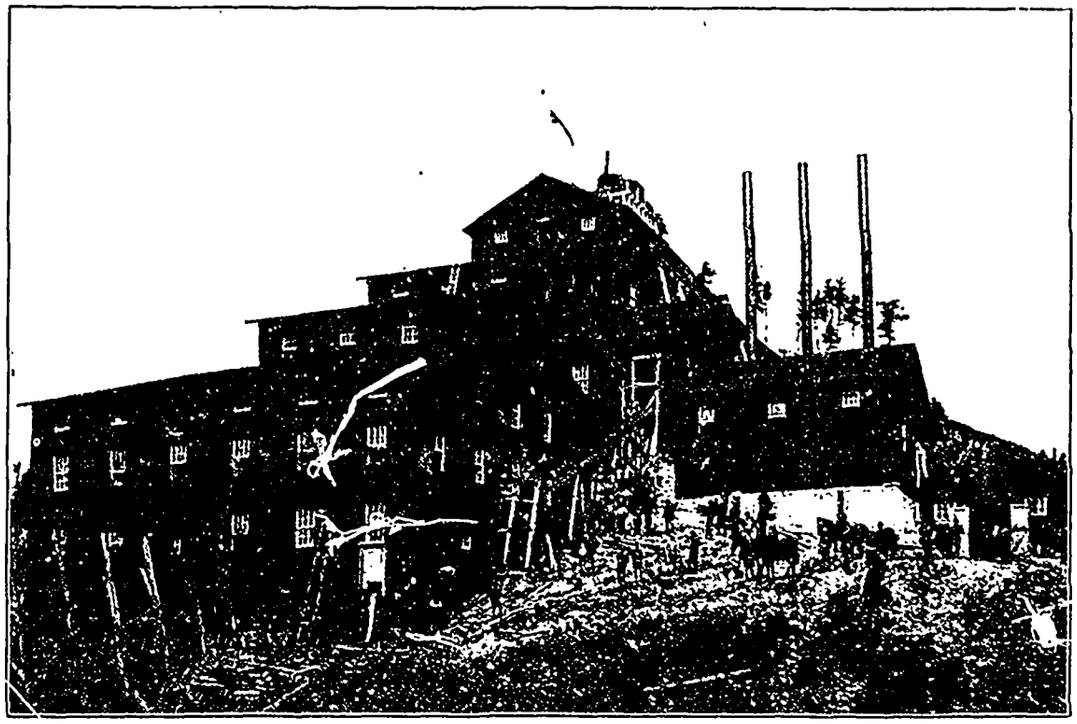
The pump house contains a pair of surface condensers built by the Northey Mfg. Company of Toronto. Through these the return water from the furnaces is used for condensing purposes.

Fresh water supply line leads to the wall of the engine house and has connection to the boiler feed pumps which are three in number and are duplex outside packed plunger type, 14 x 9 x 18 inches stroke; these were built by the Wilson-Snyder Mfg. Co. of Pittsburg, Pa. A valve is placed on the fresh water line for connection to the main salt water well and to the salt water discharge line from the pumps, enabling the use of fresh water in case of emergency for cooling purposes. To the Northey condensers in the pump house there is a connection leading through the wall to a line to the electric power station.

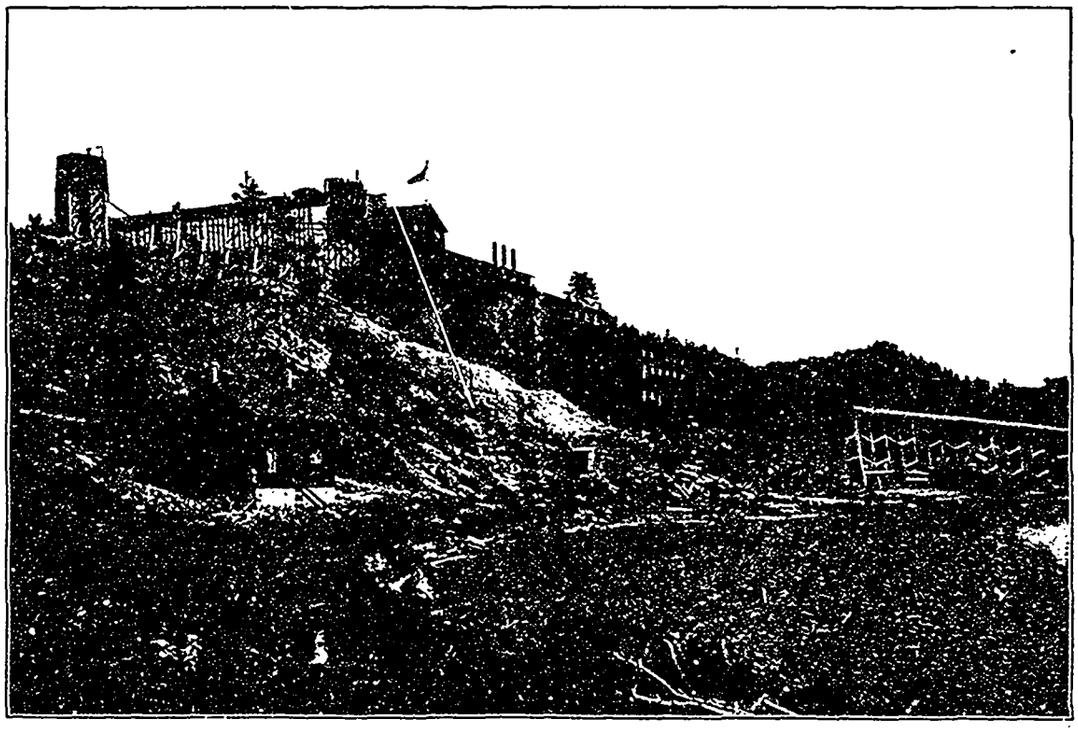
The Generator equipment consists of three 500 K. W. electric generators built by the Canadian General Electric Company, each driven by a cross-compound condensing engine with cylinders 20 inches and 40 inches diameter, 42 inches stroke, speed 90 revolutions, built by Laurie Engine Co. of Montreal.

The building which is 51 feet 3 inches span by 130 feet long is of steel with brick wall filling; the structural work was furnished by

COPPER MINING IN ONTARIO.

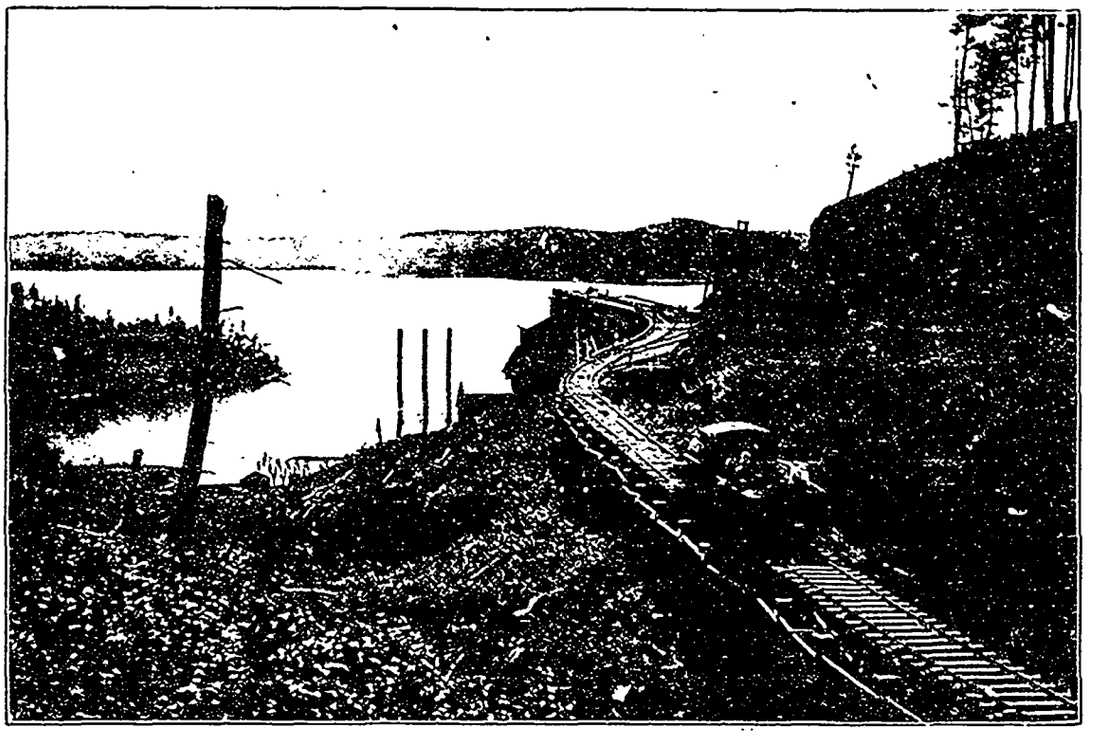


Rock Lake Mining Co., Bruce Mines, Ont.—View of New Concentrating Plant.

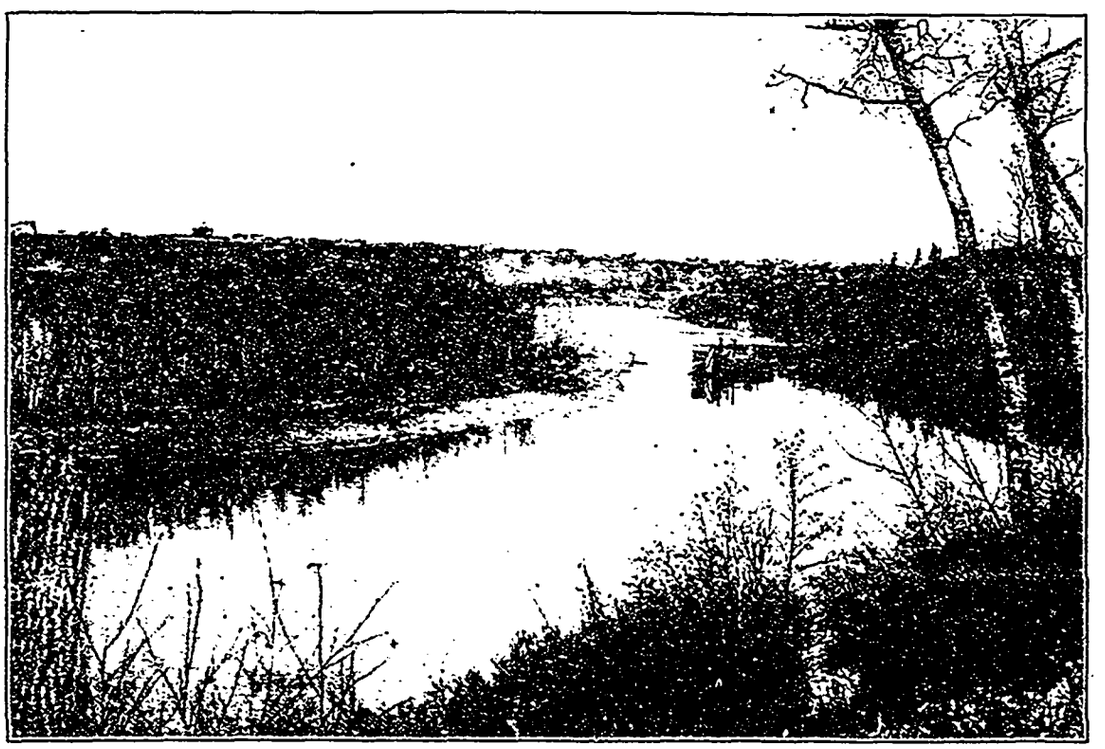


Rock Lake Mining Co , Bruce Mines, Ont.—View showing Concentrating Mill from the West.

GOLD DREDGING ON THE SASKATCHEWAN.



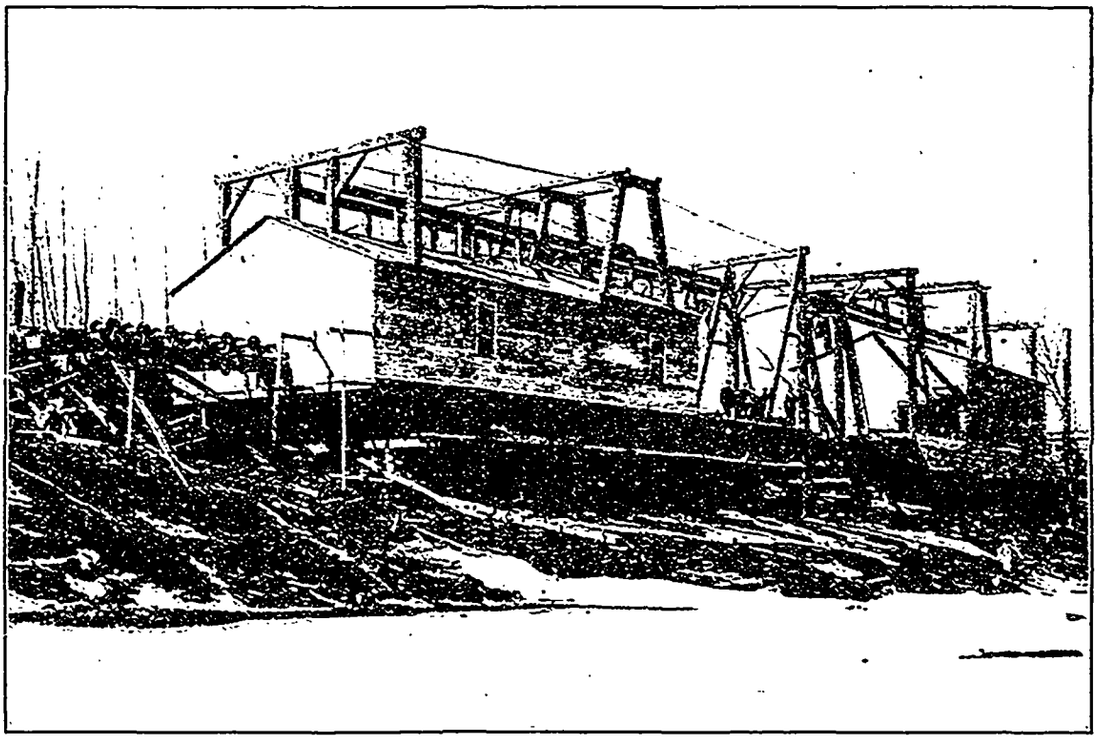
Rock Lake Mining Co., Bruce Mines, Ont.—Showing Railway to Concentrating Mill.



Saskatchewan River looking North, showing Gold Dredge at work.

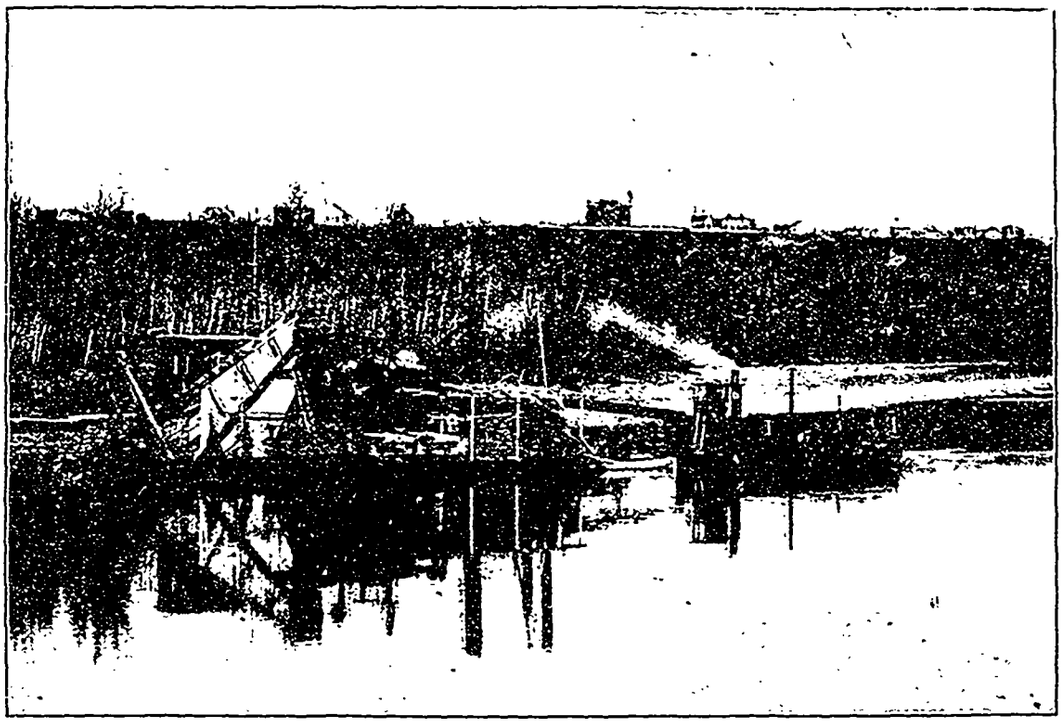
GOLD DREDGING ON THE SASKATCHEWAN.

Washing Gold with a Grizzley on the Saskatchewan.

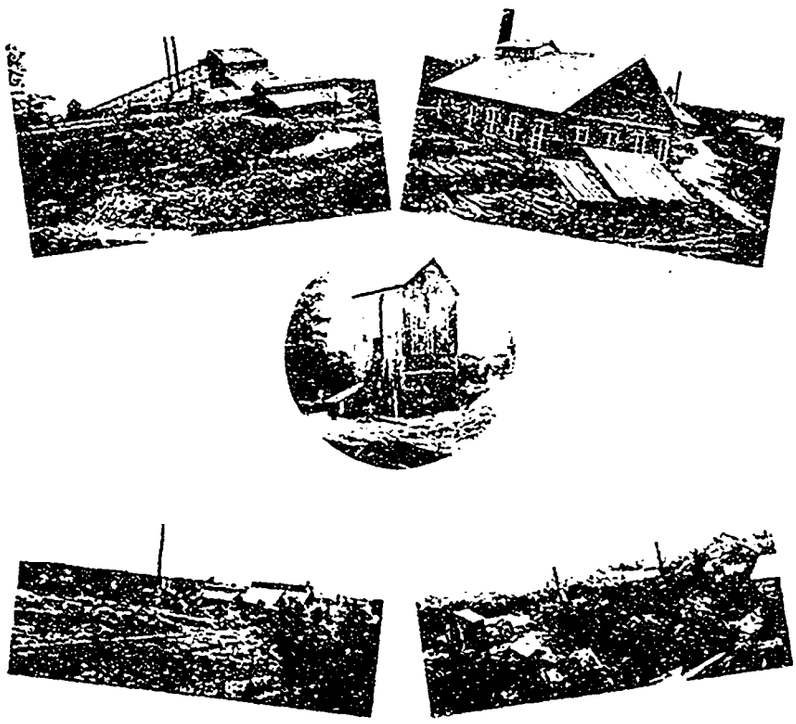


Dredge under construction on the banks of the Saskatchewan, N.W.T.

GOLD DREDGING ON THE SASKATCHEWN.



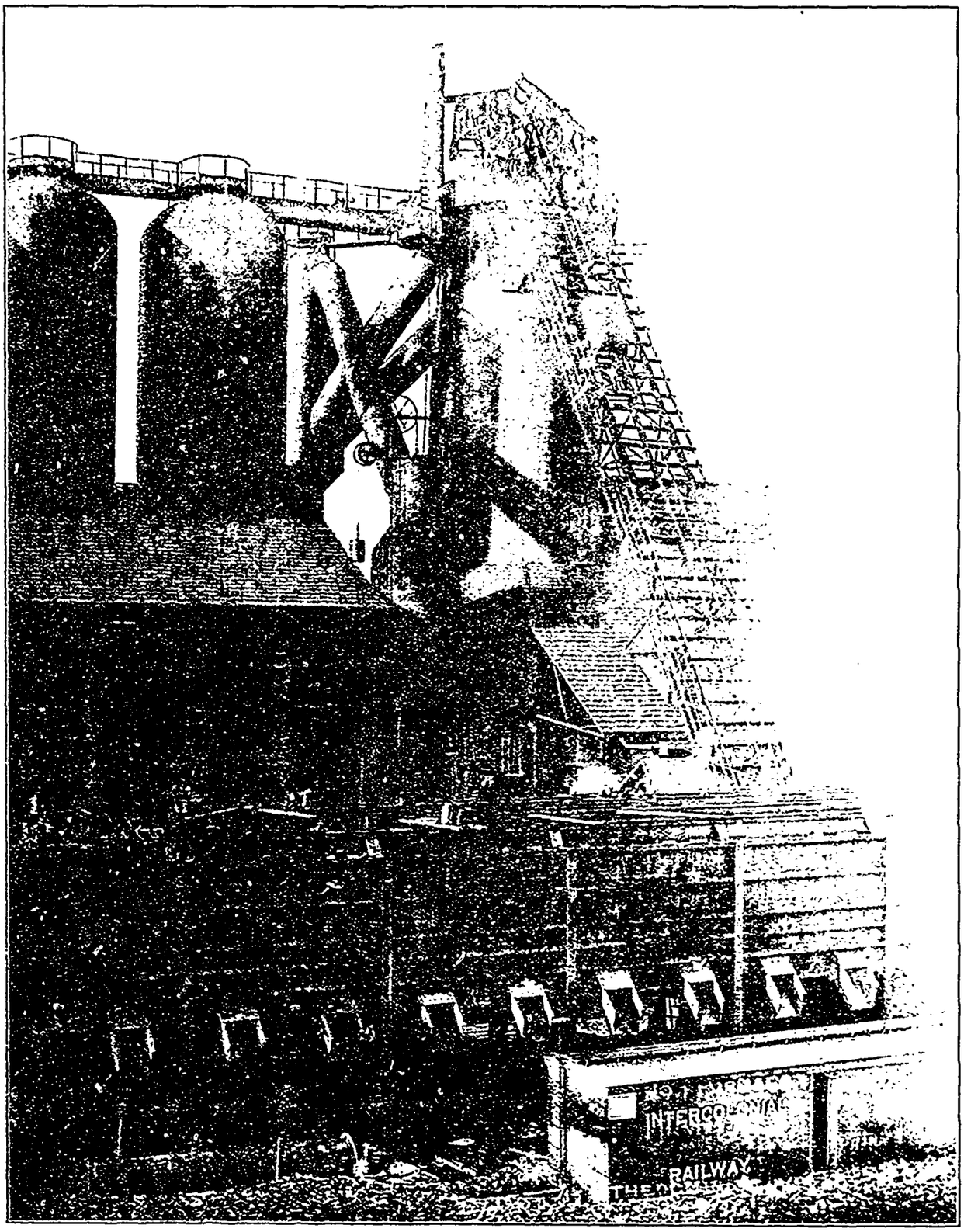
Showing the type of Dredge working on the River.



ARSENIC REFINING IN ONTARIO.

Showing Mill, Refinery and Mine Buildings of the Canadian Gold Fields, at Deloro, Ont.

STEEL-MAKING IN CAPE BRETON.



DOMINION IRON AND STEEL COMPANY, SYDNEY, CAPE BRETON.
View of New Furnaces, Skip Hoist and Bins.

the Dominion Bridge Company of Montreal The electric machinery is commanded by a 15 ton crane, also designed and built by the Dominion Bridge Company. The switch-boards, booster and electric appliances, all of the latest type and the entire equipment of the electric power station was furnished by Canadian manufacturers.

The metal from the furnaces is taken in 25 ton ladle cars to a motor-driven pig-casting machine, which was built by the Heyl-Patterson Company, Pittsburg, and which has a capacity of 1,600 tons per 24 hours. Or hot metal may be taken in the ladle cars direct to the open hearth furnaces which are as above stated 10 in number and of 50 tons capacity. They are of the tilting type. These are arranged in continuous rows, metal may be poured into the furnace from pouring side or cold pig and stock may be placed in the furnaces by two Wellman-Seaver charging machines.

The product of the furnaces which is estimated at 1,400 tons per day, will be tapped into 50 ton ladles from which it is poured into the moulds on cars and transferred to the stripper building where moulds are removed and ingots deposited in the pit furnaces. Open hearth building has span of 65 feet with lean-to 37 feet wide, 832 feet long.

The gas from the open hearth will be partly from producers of the latest improved type and partly from the coke ovens. A 1,000,000 cu ft. triple lift gas holder is located adjacent to the furnaces and is so constructed as to give a working pressure of 5 inches column of water.

COAL MINING AND TRADE.

Another of those terrible calamities which seem to be inseparable from coal mining at the Coast occurred in the recent explosion in the Extension mine belonging to the Dunsmuir Company. It is recognized among mining experts that all coal mines in the Cretaceous formation are peculiarly liable to accidents of this kind owing mainly to the tender and friable character of the coal, its dry and dusty nature and the large quantity of gas which the seams of the new formation contain. Here we have a combination which is both difficult and dangerous in the highest degree and if to this be added the irregularity in thickness of the seams, which often vary from two feet to ten or twelve feet in thickness and the consequent difficulty of maintaining uniform airways and roads, it will be seen that the mining engineer who has to cope with these conditions enjoys no sinecure. What impresses one most is that in spite of the remarkable strides which have been made of late years in elucidating a coal dust theory and the vast improvement made in the equipment of all well regulated mines, explosions, at any rate at the coast and in similar mines, do not appear to be less frequent. This is a matter which demands serious consideration and can probably only be explained on one of two grounds. First, the carelessness of the miners themselves who have been the cause of many of the most disastrous explosions, through tampering with their lamps, and secondly, the much larger areas which are sought to be recovered from a single winning in coal mines of to-day. The former is a matter in which little or nothing can be done beyond exercising the strictest supervision and endeavoring to impress upon the workmen themselves how heinous is the offence of the man who interferes with the very means which are provided to insure his own safety and that of his fellow workmen. Indeed it is largely a matter of education, and we have no doubt that as miners become more enlightened and especially as they are made better acquainted with the character of the forces with which they have to deal, they will gradually become more careful and thus one of the most prolific causes of explosions will be greatly modified. The other matter is one which will have to be considered upon a different basis altogether. In the endeavor to develop large mines and secure a maximum output from a single shaft there is no doubt that of late years the areas sought to be recovered have been greatly increased until it is more than doubtful if they do not exceed the safe limit. This subject was fully discussed in the Old Country a few years ago and practical men were anxious to induce the government to include in the "Mines' Regulation Act" a clause limiting the area which could legally be worked from one winning. This was defeated by the mine owners, who claimed that with the improved appliances now in use and the large amount of capital being expended upon mines, it was possible to secure absolute safety so far as ventilation was concerned for a larger area than any yet attempted, and so the matter fell through, but in the opinion of the best judges it was thought then and is still believed that there should be more frequent openings to the surface when large areas of coal are being recovered and while the practice of to-day, calling for numerous splits in the air is a great advance upon the old theory of a single current, there is a limit to the efficiency of even this improvement and in any case it is greatly impaired by the enormous distance which the air has to travel in some of our modern mines. If instead of bringing the return current back to within a few feet of the point from which it started, there were another shaft at the extreme end of the workings it would be far easier and safer to ventilate a large mine. It will be seen that the question thus resolves itself into one of economic conditions and if it is a question of capital outlay as against the safety of the workmen we have no doubt as to what the result will ultimately be. If, however, to the advantage to the workmen which would accrue from the methods suggested, we also add the greater immunity from danger which the property of the mine owners would enjoy, it seems to us that the argument is unanswerable and that on all grounds it would be well that this matter should receive the most careful consideration, not only of mine owners themselves but of all whose duty it is in any way to regulate the conditions of mining in the interests of the workmen as well as of capitalists.

The full discussion of the subject of an export coal trade for Canada which has taken place in these columns has attracted general attention and has stimulated the efforts of our Nova Scotia friends to investigate the conditions of the coal market in Europe. The Dominion Coal Co. have sent their assistant manager to the Old Country to open up negotiations for an English trade and in addition have already shipped several carloads of coal to Norway. It is not necessary for us to go over the ground again as doubtless our readers who were interested in the subject, will remember that in thoroughly threshing out the matter we arrived at the conclusion that there is a market in London alone for 2,000,000 tons of Nova Scotia coal a year if the same could be laid down at about 14s. a ton, and as the shipping companies had offered to undertake the transportation of a large tonnage for $1.50, this would leave $2.00 for the coal f. o. b. Cape Breton, a price upon which a handsome profit could be made. We sincerely hope the efforts of the D. C. Co. may be successful as we are convinced that if a trade is established there will be no difficulty in holding it, but it would be a mistake to quote the present f. o. b. price as the only possible chance of holding this market, is at a comparatively low figure. It is true the D. C. Co. have almost ruined themselves by selling to the Everett Gas Co. at about $1 25 but there is no reason why $2.00 should not be considered a satisfactory and remunerative price. In addition to the English market, which we think will lie chiefly in the Thames, there is no reason why the Mediterranean should not be largely supplied with Canadian coal. The greatest obstacle to overcome will be the fact that all around the

Mediterranean coast, briquettes are used very largely in consequence of their greater cleanliness and portability, and we yet hope to see the manufacture of this commodity established on a firm basis in Nova Scotia, as we are satisfied that it would solve the problem of a large export trade not only with the Mediterranean but with the West Indies and South America. No doubt the reason that the matter has been allowed to stand over is because at present there is a market for all the fine coal which is being made and this will continue so long as the coke ovens of the Dominion Iron and Steel Co. are not fully supplied but there will ultimately be a surplus which could not be treated more profitably than by this process. The *Maritime Mining Record*, which is well posted on the coal trade of Nova Scotia, admits that our contention of a few months ago to the effect that a new market would have to be sought for any coal produced by the Dominion Coal Co. in excess of 2,000,000 tons a year, is already verified, and in view of the considerable development also being made by other companies it becomes more than ever a matter of absolute necessity to establish an export trade.

We notice from an Eastern paper that the D. C. Co. contemplate installing electric haulage in their new mines. This is a matter of interest because of the remarkable success which for the last eight years has attended the use of endless rope haulage by this company, and although no doubt they would be governed by the best obtainable advice in any change of this kind which they may institute, we doubt whether the conditions prevailing in Cape Breton are so favorable for the use of electric haulage as of other systems. The reason for this is that their mines are all on a slight grade, varying from 5 to 7 per cent. and with a load and the grade against the load it is doubtful whether any system is as cheap or efficient as endless haulage. Certainly not where a large tonnage has to be hauled up main deeps. Upon a dead level or a very slight grade, electric haulage is all right and can be seen in satisfactory operation at many of the largest mines on the continent. It is therefore useful upon the levels and side roads of a mine but owing to the large amount of power which would have to be generated it is certainly not as economical upon the main deeps. Where all the coal rises to the crop as in mountainous districts or at any rate where the winning is to the crop for many years, it is a totally different proposition, as in that case the main entry is on the level and with all the roads running to the rise the system of electric haulage is easier and cheaper. With the deep works however which prevail in every mine of the D. C. Co. it is doubtful whether the present system can be improved upon. The experiment, if made, will be watched with interest by all practical miners.

The *London Intelligence* has compiled from official records the following statement of minimum and maximum average calculated values of coal at the pit's mouth in different countries for the last eighteen years.

	Minimum		*Maximum*		*Range*	
Country.	S.	D.	S.	D.	S.	D.
United Kingdom..	4	9¾	10	9¾	6	0
United States.....	4	5	6	5½	2	0½
Germany.....	5	1¾	8	10	3	8½
France.....	8	3¼	9	11¾	1	7½
Belgium.....	6	5¼	9	11¼	3	6
Spain.....	5	7½	8	10¾	3	3¼
Austria.....	4	10	6	6¼	1	8¼
Hungary.....	7	9¼	9	0	1	10¾
Japan.....	5	11¼	8	9½	2	10¼
British India.	3	8½	5	2¾	1	6¼
New South Wales.	5	5	9	6	4	1
New Zealand.....	10	0	11	4	1	4
Queensland.....	7	1	10	1	3	0
Victoria.....	8	6	28	0	19	6
Natal.....	8	6	12	0	3	6

From this, one or two very striking lessons are to be learned. First, that the two greatest coal producing countries in the world—Great Britain and the United States—are also the producers of the cheapest coal, the exceptihn being British India, where the low cost of production is due to employment of Coolie labor. Another very important feature is that the fluctuation in the price of coal in the United States is less than in any other country, a feature upon which too much stress cannot be laid, as cheap fuel with limited fluctuation in price is undoubtedly the keystone upon which commercial success is built On the other hand the extreme fluctuation in the price of coal in Great Britain explains why the Old Country is subject to alternate periods of extreme depression and extreme inflation of trade, all of which goes to show that if Canada is to become a large industrial country, especially to compete with the United States, as seems inevitable since they are our nearest competitors, we shall have to strive for the ideal condition which prevails there in respect to this most important matter. It is further obvious that here is an important pointer with respect to our export trade, for while it would be easy to export coal to Europe when the average selling price of British coal is in the neighborhood of 10s. it will be a very different proposition when the price gets down towards 5 or 6s. as it undoubtedly will in times of depression and this is why we contend that the wisdom of the Canadian producer would be shown in endeavoring to secure long time contracts at moderate prices, otherwise by the time we had established a trade and made all necessary arrangements for transportation we might find that the price of the British commodity had fallen so low that we should be cut out. We commend this to the careful consideration of Canadian exporters who are seeking to build up foreign trade.

The visit of Sir Christopher Furness to this country may have important results in the near future, especially as he has come on the invitation of such influential men as Sir Wm. Van Horne and Mr. H. M. Whitney. What the ultimate result will be it is impossible to tell but owing to the important associations of Sir Christopher in the Old Country there is no doubt that he is able to carry into effect any scheme which meets with his approval. There are two ways in which his vast influence may be used to benefit Canada. The first and probably more immediate object of his visit is to consider the possibilities of coal transportation across the Atlantic, but we are loth to believe that nothing more than this may follow, and without being too optimistic we should not be surprised if the long cherished hope of a line of steamships between Sydney and some British port is not shortly to be realized. With 25,000 tons of steel already exported to England and with the prospect of continuous coal exportation there is surely plenty to justify the serious consideration of such a scheme, especially as under the preference tariff the exportation by English manufactures of their products, is steadily increasing. There is no reason why, in many of these staples, there should not be a steady return trade. Of course so far as the Furness line is concerned their action would probably be dependent upon this, as they run mixed cargo boats and would hardly be likely to entertain an export trade only. If the day comes when a large export coal trade is established in Europe, we are convinced that the ultimate solution of transportation lies in fast coal boats running directly between Cape Breton and European ports, specially designed for the trade, returning light, but that stage has not yet been reached and there is room for an arrangement with such a line as that controlled by Sir Christopher Furness, at any rate in the earlier stages of the trade.

Great activity is noticeable in the Crow's Nest Pass, both in connection with railway construction and coal mining. The Great North-

ern have over 2,000 men at work constructing their line from the International boundary by way of Elko to Fernie. The line is located throughout and the right of way is now being burned. The contract calls for the completion of this branch, which on Canadian territory will be about 80 miles in length, by the end of 1902. After crossing Tobacco Plains the line intersects the Crow's Nest Pass line at Elko and proceeds up the west bank of the river Elk to Fernie, where it crosses to the east bank and is continued up Coal Creek to Fernie mines. This will give two outlets for coal, by the C.P.R. and G.N.R. A branch is also being built up Morrissey Creek which will connect with the Crow's Nest Railway to serve the mines located there. At the mines, under the management of Mr. Thos. Stockett, who has just come in as engineer to the Great Northern Railway, every effort is being made to develop the capacity to something like the tonnage which the American market requires. Mr. J. J. Hill's demand is for 10,000 tons daily, and as the present capacity of the mines at Coal Creek and Michel only reaches 1,200 tons a day, there is a very large margin to fill. Meanwhile, in order to supply this deficiency, the Great Northern have made offers for the coal produced in the Blairmore district. At present the only mine operating here belongs to Messrs. Frank & Guibault, with a capacity of 200 tons a day. It was thought this mine would shortly yield a large output, but the results are very disappointing, as the coal appears to have no depth, being located on the side of a limestone mountain and so subject to interference that its continuity is doubtful. Other properties, however, are being opened up and will soon be ready to ship coal. In view of the development which is likely to take place in British Columbia in the near future and the increased demand for coal, it is to be hoped that the C.P.R. will shortly operate the coal areas which they have acquired in the Pass, for with a total production of 1,200 tons daily after four years' operation, it is certain that the Crow's Nest Pass Coal Co. will for years to come be totally unable to supply the demand even if they confine themselves to Canadian trade, but with Mr. J. J. Hill in control of their stock, building railroads as fast as he can in order to supply the American market, it is certain that British Columbia will run short unless further provision is made. In this connection it is gratifying to notice that the result which we have always predicted in the event of competition in Crow's Nest coal, is already being realized, for the opening of the Blairmore coal field has given the public good screened coal at 30 per cent. less than the price charged by the Crow's Nest Coal Co, and it is confidently asserted that the coke which they will shortly put upon the market will be sold at $3.50, as against $4.75, the price charged by the above company. In coal production as in railway transportation there are some advantages in competition, and in view of the continual lowering of the standard value of B. C. ores, the urgent necessity for cheap fuel becomes more apparent every day.

The Progress of Mining and Metallurgy.*

By Dr. James Douglas, New York.

If we go back a little more than half a century to 1840, when the first industrial census was made, we find that there were scattered throughout the length and breadth of the land, from Maine to the wilderness of Wisconsin, 804 iron blast furnaces, making 256,100 tons of pig iron or one pig per diem per furnace and 706 bloomeries and forges, making small quantities of wrought iron direct from the ores, or converting some of the pig into malleable iron. These little furnaces and bloomeries and forges were not worked by trained metallurgists, but by farmers and back-woodsmen, who had to produce a local supply of iron, owing to the distance from a market and the difficulty of transportation, and who, wherever there was wood from which to make charcoal and water to give them blast, and a small or large deposit of rich iron ore, employed that mechanical ingenuity, self reliance, and adaptiveness which have always been such marked characteristics of the American character to supply their wants. They were not in any sense educated metallurgists, but they possessed that same spirit which has converted into shrewd geologists, of a rough and ready type, and into skilful, practical, if not theoretical, metallurgists, hosts of men from every walk of life who have drifted from the East across the Missouri, and become, as prospectors, the pioneers and real developers of our Great West. And had it not been for the infusion of this same temper into the builders of our magnificent modern metallurgical establishments, we would not be setting the pace to the world to-day. Had our Fricks and Thompsons and Carnegies been willing only to follow precedents and foreign tradition, and had they been hidebound by the teachings of the schools, our output of iron and steel would not stand first on the list of the world's production. But even as the backwoodsman of the early decades of the last century turned from his plow and his axe to make iron in his own way, so our great iron masters, not being hampered with overmuch reverence for the past, have fearlessly expanded their furnaces, applied new mechanical contrivances, enlisted electricity, and in many other ways applied the inventions, which they have been willing enough to accept from abroad, on expanded and often new lines.

Looking at the field of mining and metallurgy to-day, the prominent features of our progress have been, first of all, the large scale on which we work, and secondly, the very extensive use of machinery, which is a necessary concomitant to large production and extensive operation. The large scale on which our continent is built and the corresponding size of its natural resources have unquestionably stirred the immagination of the people and excited their energies. It is true that had we not possessed the natural resources, we could not have made the progress, but there are other peoples who have possessed resources and allowed them to lie idle. Whence, therefore, our success? I think it is due to the mechanical instinct of our people which has always driven them to use their wits rather than their hands, and therefore to apply machinery to all the arts of life—whether they be large or small, wherever possible. The high average cost of labor has made the use of machinery a necessity, even when working on a small scale, and has thus coincided with and stimulated the national instinct. And once machinery supplants hand labor, the impulse to work on a large and ever larger scale is irresistible. The Yankee after all has been the creative genius of our continent, and we are all indebted to him for the infusion of some of his characteristics. Now, the orignal Yankee was a mechanic and turned his talent to making wooden nutmegs and wooden clocks. He continues, as a mechanic, to make clocks, but it will probably be a German chemist who will make artificial nut megs. The result of this Yankee infusion is that, as a people we are more given to mechanical contrivances than synthetical chemistry.

Among the mechanical factors which have helped to create our existing metallurgical industry, the railroad must be placed first. Through its agency, and aided by the steamer, ores can be brought to fuel, or fuel to the ores, and through this concentration of crude material at favorable localities, works of greater magnitude can be erected, than the supply of crude material in any single district could feed. The formation of our continent facilitates not only the construction and equipment of railroads on a large scale which minimizes both original outlay and operating cost, but permits of the adoption of changes in obedience to the demands of progress, in a manner which it would be impossible to imitate in most foreign lands. A train can run from New York to San Francisco without once entering a tunnel or losing sight of daylight, and therefore structural changes to meet increased traffic can

*Excerpted from an address delivered before the School of Mines and Metallurgy of the university of Missouri 30th May 1901.

be made with less disturbance than in most other countries. Another advantage which we possess is that the railroads abroad were in great measure built through, or to connect, large and populous cities and running through populous districts, when the art of railroad building was comparatively in its infancy. With us the great expansion of our railroad system has taken place when we had the world's experience to guide us. It has been no small gain to us that our active industrial life really commenced contemporaneously with the advent of the railroad; that it has been built upon the railroad as a substructure, instead of the railrord serving, as it has done abroad, as a mere adjunct. Taking the railroad as a part of our great mining and metallurgical machine, and looking upon transportation as a mere branch of productive industry, it is interesting to follow, say Lake Superior ore, from the mine back to the mine as steel rail, for by doing so we get a clearer conception of the all important part machinery plays in the cycle of our mining and metallurgical operations. The railroad which connects the Mesaba Range with Lake Superior, and the huge trains in which it is hauled from Bessemer to Pittsburg, are as much mining machinery as the steam shovels by which the softer ores are handled, or the hoists by which the deeper ores are raised to the surface. And once the ore reaches Pittsburg, it is by machinery that it is raised to the furnace top, by magnificent steam blowing engines that the blast is created, by electricity that power is transmitted to every department of the mills from one central power plant; by machinery, that the liquid cast iron is handled in the mixer between the blast furnace and the converter; by machinery, that the converter with its fifteen tons of steel is handled with as much ease as a teacup, that the Bessemer ingots are rolled into rails while still hot, that the rails are straightened, cut, loaded on cars, and again returned to the West whence the ore came, without the intervention at any point of hand labor, except as the agent of the brain, in directing these tremendous mechanical and physical forces. To such an extent has labor been eliminated that it is generally understood that every man employed about the iron mines in every capacity delivers four tons of iron ore per day; and the production of our large steel works to-day represents only about one man power, including the clerical force, to between two and three tons of steel.

Do not misunderstand me. I do not wish to imply that we are the only people that use machinery, or that we were the first to make all these applications of it. Still less that we have been great inventors of great processes. We did not construct the first railroad; we did not build the first large blast furnace; we were not the first to apply hot blast to them. We did not invent the Bessemer converter with its beautiful dependance of chemical on mechanical forces. We did not invent the Siemens-Martin openhearth process, nor suggest the basic lining, nor invent the dynamo But we have applied Faraday's great discovery more widely than any of our neighbors. We now build blast furnaces so much larger than theirs that one single Duquesne stack turns out annually as much as the 804 little furnaces did per diem or per annum in 1840, and we drive our furnaces at a greater speed even—though we shorten theirlives. We get more blows out of our converters, and more work out of our rolling mills. We con do all this, not because we understand better than our rivals the law of electricity, or have studied more accurately the chemistry of the blast furnace, but because nature has supplied us with an abundance of material to work upon, and because we live up to the principle, which after all is not a contradiction of the old maxim that, whatever our wits find to do we do with all our might.

The same is true in the metallurgy of other metals. The invention of all others which has helped in the development of our copper resources—the adoption of the pneumatic method in modified converters —was worked out abroad, not here, but for one ton of Bessemer copper made elsewhere we make 100 in this country. So likewise the electrolytic method of refining copper was proposed, used and substantially perfected in Europe, but works are considered there of large size which will turn out 10,000,000 pounds a year of refined copper, whereas we have more than one with a capacity of 100,000,000 pounds.

In all these instances our progress has been mainly due to the employment of mechanical and physical forces as auxiliaries to chemical and metallurgical processes to a greater extent than our rivals, and therefore I feel as if it were superfluous to even argue that a knowledge of mechanics and physics is as absolutely necessary to the miner and the metallurgist as an acquaintance with mineralogy or the principles of chemistry and metallurgy. I use the word "physics" in its widest sense. Familiarity with the laws of heat is essential if we would use economically steam or hot air as motive powers. Electricity is doing our work under ground and above ground; striking our drills; cutting our coal; propelling our cars; pumping our water; hoisting our ore; moving our machinery in every department, generating heat for the decomposition of our more infusible chemical compounds; decomposing our solid and liquid compounds in our many electrolytic operations; transmitting the power from localities where it can be cheaply generated to far distant localities where alone it can be economically used; lights in mines, and works serving our ends and purposes in a hundred ways, but destined, as we learn more accurately and wisely how to use it, to be of still wider service in the future. But not only have we harnessed electricity to our mining and metallurgical machinery, but we use air and water under pressure to an extent that makes it necessary that a mining engineer or a metallurgist, if thoroughly equipped, should be acquainted, not only with the laws, but likewise with the application of aerostatics and hydraulics.

Now, gentlemen, from what I have said you will gather that, as essentials to success as miners and metallurgists you must possess not only a knowledge of what was formerly supposed to be all that was necessary, namely, of mathematics, chemistry, mineralogy and geology, but you must be acquainted also with the fundamental principles and facts of mechanics and physics; for the educational equipment of a successful miner and metallurgist to-day is as much more intricate than it formerly was as the magnificent steam engine with which he will hoist his ore, is more complex than the windlass or horse-whim, with which the primitive miner worked. As I have always said, without machinery —and machinery of the very highest type, we could not handle the quantities, without which our large organizations could not be supported If we compare, for instance, the 125,000 tons of iron made in 1840 with the 14,000,000 tons made to-day, you have a standard by which you estimate the difference between the past and the present.

But while the applications of the principles of mechanics have alone enabled us to work on such a gigantic scale, the demand for quality has meanwhile become quite as exacting, and quality can be attained only by the application of chemical analysis to the elucidation of chemical laws. As professional men you will have to do, therefore, with the extremes of large masses and extremely minute quantities, the quality of the large mass being dependent upon the presence or absence, and the play of extremely minute quantities, of certain foreign bodies. To determine the existence of these and to explain their effects, you must be more or less familiar with chemistry and its allied branches. Thus if you are to handle ores and metals in bulk, you can do so only through a knowledge of mechanics; if you ar to secure uniformity in quality, you can do so only through the agency of chemistry. It is not so many years ago that even some of the largest metallurgical establishments in this country worked by rule of thumb, without the aid of a chemist. But since the introduction of the Bessemer process, in which the making of good steel depends on the presence or absence of minute quantities of silicon and phosphorous; and since the peculiar properties conferred on steel by minute quantities of nickel, magnesium, aluminum and other

metals are being taken advantage of, metallurgical works without a chemist, or a metallurgist without a knowledge of chemistry, has become an anachronism.

Horror at mastering such an appalling volume of knowledge, as would have to be acquired, if all the facts, phenomena and theories of all these sciences had to be packed into the brain of a metallurgist and miner, might well deter any of us from undertaking the task of qualifying ourselves for creditably filling the humblest place in the ranks of the profession. The utmost that we can do is to familiarize ourselves with the main priniciples of the sciences I have referred to, so that when we come to occupy, as I hope most of you will do, prominent positions in our corner of the industrial world, you will at least be able to map out the lines on which work is to be done, and to be able to judge, whether the technical specialists whom you employ, are fit to do the work which you have assigned them.

Notes on some work recently done in the Mining Laboratories of McGill University.

By J. B PORTER, Ph.D., M. Inst. C.E., Professor of Mining and Metallurgy.

(Being a paper read before the March Meetings of The Canadian Mining Institute introducing certain papers presented by Student Members)

The Canadian Mining Institute and its predecessor in this Province, the General Mining Association of the Province of Quebec, have for many years consistently pursued a policy of giving every encouragement in their power to young men engaged in the study of mining.

Bona fide students of Mining and Metallurgy are admitted to the Institute at a nomial fee as student members, and valuable prizes are annually offered for their competition The policy is in fact even more liberal than this, for the ordinary meetings have for several years been open to our students regardles sof membership, and it is not now necessary for even the competitors for prizes to join the Institute, although we of course wish them to do so.

The fruits of this policy are to be seen in our Transactions, in which there are a number of excellent papers written by students of one or another of our Mining Schools; and any one who has attended the meetings of the last two days must have noticed the large number of young men who have been present. Today we have them with us in even greater force than before, and all of our members who are interested in educational work and in the future of our Institute, must be greatly encouraged by these evidences of their desire to listen to our papers and discussions, and to take part, so far as possible, in our proceedings.

In view of this I trust that I may be pardoned if I cast the few words I am about to say, more in the form of an exposition of our methods of teaching than is justified by the title of what our secretary has been pleased to call my "paper". As an additional reason for what I am about to do, I beg to call attention to the fact that the remainder of this session is to be devoted to the student papers submitted in competition for this year's prizes Surely no professor could have a better excuse for talking "shop."

McGill was the first of the Canadian Universities to institute a regular course in Mining Engineering. This was announced in 1871, and the first graduates were given diplomas in 1873 It is interesting to note that only three Americian Universites preceded us in this matter, Columbia School of Mines in 1867, Massachusetts Institute 1868, and Lehigh in 1871.

At first Massachusetts Institute alone had laboratories and the others—including of course McGill— made no attempt at any labor atory teaching except that of Chemistry and Assaying.

As time went on the others acquired more or less complete mining laboratories, but at McGill the growth was in other directions, and up to five years ago the only mining apparatus available was what my predecessors, Dr. Harrington Mr. Carlyle and Mr. Hardman, had got together with their own hands. It is the more to their credit that, in spite of such meagre facilities, these gentlemen turned out a lot of mmmg engineers, who have carried the name of McGill well to the front in both Mining and Metallurgy, not only here in Canada, but, as Mr. Bell said last night, in the United States, Mexico and South America, and I may add in Australia and Africa as well.

In the meanwhile not only the Mining Schools in the States had secured equipment, but two strong Mining Schools in Canada (Kingston and Toronto) had developed courses and equipped laboratories.

At last, just about five years ago, Sir William Macdonald turned his attention to our profession, and soon after announced his intention of giving McGill a mining equipment of the first rate.

I had the honor to be appointed the first Macdonald Professor of Mining and Metallurgy, and to me fell the task at once very interesting and extremely arduous of designing a laboratory, securing and installing the apparatus and organizing the methods of instruction.

Laboratory teaching in Ore Dressing and Metallurgy may be of three kinds:

1st Purely theoretical with small apparatus, requiring methods of work similar in scale to those of the chemical laboratory. Such work is extremely useful, especially in getting at fundamental principles, but if only this type of study is carried on, the student is likely to get a very incomplete conception of his subject.

2nd. Highly practical work on a scale of "almost 12 inches to the foot", as Professor Richards calls it. The best example of teaching of this sort is probably found at the Camborne School of Mines in Cornwall where the school owns a mine and a dressing works, and each student is required to do quite a good deal of real work as a set part of his course.

3rd. A combination method in which so far as possible the good features of the first and second are joined.

We have tried to lay out our laboratories on this third plan, and as we are at last really in working order I may be permitted a moment to explain what we do, or at least try to do, for our students.

I shall not describe the laboratories, for I trust that you will visit them and see for yourselves. Even the members who visited us last year, will find if they come again many additions, especially to the accessory apparatus that is so essential to the successful use of all laboratories, whether educational or merely experimental.

Neither shall I detail our course, which we fully set forth elsewhere, but I may say in this connection that we strive first to ground our men thoroughly in the essentials of all engineering, namely Physics, Mathematics, Surveying, Drawing, etc. We then give them elementary theoretical courses in Engineering, Mechanics, Chemistry, Geology, Mineralogy, Ore Dressing, and Metallurgy; each course of lectures being demonstrated and confirmed by laboratory work.

After these have been mastered, we have a field school in surveying and a six weeks' summer school of practical mining, which we hold in some one of the large mining districts.

Finally, after all of this preparatory work, we give our men one final year of advanced work in the especial subjects of their profession.

In this year they do their most serious mining laboratory work. First, they witness and to a certain extent help in a stated number of standard operations, a stamp mill-run coarse concentration on jigs, slime concentration on tables and vanners, and a day at each of the roasting furnaces, and several days at the water jacket smelter.

These large tests are paralleled and checked by a number of little runs made by the individual students, who put through complete tests on 50 and 100 lb. lots, using simple apparatus, such as the miner's pan

and hand jigs so far as possible, but when necessary making use of working models of the larger machines.

As soon as these tests are completed, each man is required to take up some one comparatively large problem in ore-dressing or metallurgy and the remainder of the year is devoted to working this out to a successful conclusion.

As an illustration of this final work I may name the following as some of the subjects of the current year :

1. The comparison of different methods of crushing, as affecting the proportion of fines.
2. The losses of value in the different classes of slimes resulting from crushing of various gold and silver ores.
3. The effect of different degrees of crushing and grinding and of other variations in treatment, on the recovery of values in gold and silver amalgamations.
4. The comparison of Wilfley and Frue concentrators on ores of different sizes and kinds.
5. The magnetic treatment of various Canadian ores with a view to their concentration, or the elimination of impurity.
6. The effect of washing on several kinds and sizes of Canadian Coals.
7. The leaching of concentrates and tailings from certain Canadian gold mills.
8. The electrolytic refining of certain metals.

I might extend this list, but enough is given to show the wide choice offered the men and the practical bearing of their work.

In each case, the theoretical side must be worked up, and small scale experiments made, leading to and culminating in one or more fairly large tests ; and it is very satisfactory to note that our equipment is sufficient thanks to Sir William Macdonald's munificence to enable all of these operations and more to be conducted at once without serious interference.

Most of this work results in nothing very startling, for our chief duty is to teach young men the elements of their profession, and there is little time left for advanced research ; but even in this matter of fact work, valuable data are constantly accumulated and occasionally new results and new combinations are obtained. Furthermore, as we get our educational work more and more in hand, we are beginning to find time to do a little experimenting ourselves. This second function of an experimential laboratory is scarcely less important than the first, but must come after it. As time goes on, I trust that we shall be able to make the McGill laboratories of very great value to Science, to the Mineral Industry, and perhaps even to the individual mining engineer. As a mere taste of what may be done, I shall now give some details of a few of the more advanced researches that have been carried out, or are being carried out under my charge.

1. In conjunction with one of the officers of the department of Physics, Mr H. M. Tory, we have experimented on the melting points of gold, silver, copper, etc. and thanks chiefly to Mr Tory and my late Assistant Mr Yuile, extremely interesting results have been attained, especially in the exact determination of high temperatures. Degrees of heat as high as 1100 or 1200 centigrade have been measured and re-measured with an accuracy and ease probably never heretofore attained.

2. The concentration of Molybdenite, which so far as I know has never heretofore been attempted, has been quite successfully accomplished, and a high grade concentrate obtained from very low grade rock by a somewhat unusual series of crushing, jigging and sizing operations. The process is probably not commercially applicable to the particular ores on which we experimented, but might well be used on similar ores occurring in larger quantity or in more favourable situations.

3. The concentration of Chromite. This mineral is valued for its $Cr_2 O_3$ and its price in the markets of the world enhances very much as the tenor of chromic oxide increases, the critical point being 50% in most cases. The concentration of chromite on jigs is an old story, but there are in this Province many chromites which jigging fails to raise above 45-48%. We find that a judicious combination of magnetic separation with jigging or other gravity separation, raises the $Cr_2 O_3$ several percent above the result obtained from either alone, and in the cases of ores which fall below 50% without this treatment, but rise above 50 by means of it, the extra cost will no doubt be more than met by increased values.

In this connection I may say that the late Director of the Geological Survey was very hopeful of valuable commercial results in this matter and a few weeks ago he secured from me a report, which he proposed to print in the forthcoming volume of the Survey. We had planned an extended investigation of chromite ores from various districts, and while I have no doubt that the new head of the Survey will carry out his share of the proposed work, yet I shall be greatly obliged if any members of the Institute will help me by sending in lots of chromite rock. Samples for this purpose should not be less than 100 lbs. in weight, and should be delivered free of expense and accompanied by full information as to locality, etc. Under these circumstances I shall be pleased to work upon them at my first convenience, and to include the result of my experiments in the series.

4. The magnetic separation of blends and galena. One of the serious problems in ore-dressing, in certain districts, is the separation of the above minerals. which often occur together. It is possible to dress the mixed ore so as to produce a fairly clean galena and often also a fairly clean blende, but there is usually a large middle product carrying enough of both to make the stuff worthless as a source of either. Sometimes the precious metal contained is sufficient to justify the saving of this material in spite of the zinc penalty, but often it is not, and the product is thrown away.

We find that in some cases this middle product can be separated into commercially clean blende and equally clean galena. In other cases, it can be divided into two portions, one high in lead and low in blende, and the other just the opposite. The magnetic permeability of these two minerals is unfortunately variable in different cases, and it would be too much to say that all blendes and galenas can be separated or even bettered by magnetic treatment, but, unquestionably, there are many cases where very good results can be obtained at a small cost.

5. The magnetic separator in which these last named experiments are made is a special experimental machine of unusual magnetic power and of great range of adjustment, recently built for us by the Wetherill Company. With it a great many very interesting operations are possible that are far beyond the power of ordinary machines. I will merely name a few.

(a) We have secured some very interesting results in the separation of titaniferous iron sands into portions, one of which is far lower in titanium than the other.

(b) We have separated rare and, in certain cases, valueable minerals contained in a great bulk of other and worthless rock. In this way Monazite has been secured and several other separations have been accomplished. In this work I have again to refer to the late Director of Survey, who in this and the next named tests gave us great assistance, securing samples for our work and aiding us greatly by his advice and still more by his broad and stimulating sympathy.

(c) Finally for this paper, but not I hope for our laboratories we have recently obtained some very striking results from the treatment of hydraulic black sands and others non amalgamable residues. It is not practicable to give details at the moment,

but on some samples, obtained for us by the Geological Survey concentrations to one fiftieth or even less have easily been affected and yet nearly every particle of the gold has been saved Some figures are, I believe, to be published in this connection in the forthcoming volume of the Geological Survey.

In closing, I thank you for your attention to these very random notes. I should like also to say that the Mining Department at McGill is always more than ready to receive suggestions as to new problems to attack or old ones that may be attacked in a new way. We are also always very grateful for lots of ore on which we can work.

I cannot of course promise to work on everything that is sent in and often even the most interesting things will have to wait for time and the man, but something can be done each year and, as we more fully master the routine portion of our work, the number and value of our investigations should be largely increased.

GRANBY CONSOLIDATED.

The present number of the "Review" had been made up before we received the "Nelson Tribune" containing a three column comment upon our article on the Granby Consolidated Mining Company published in our August issue. We will reply to this article very fully in the next "Review."

COMPANY NOTES.

Bosun Mines —Writing under date 3rd October, secretary advises:—Telegram from manager reports 80 tons galena shipped during the month of September, smelter returns yielding $3,436. Cable adds, "Mine development shows marked improvement."

McDonald's Bonanza —A cablegram has been received from Dawson stating that the final clean-up for the season has given 448 ozs. of gold, value, $6,750.

Yukon Goldfields.—Cablegram from the company's representative at Dawson City, Yukon :—"Adams Hill United—August output, $7,500."

Klondyke Consols —The manager's cable.—"Output from 28th August to 10th September—Eldorado, 401 ozs., Bonanza, 692 ozs.; Hunker, 97 ozs." (Office note—Total, 1,190 ozs., of the value of £3,925. At the average rate of working expenses, 29 per cent., this shows a profit of £2,787 for 12 days' working.)

Le Roi No. 2 —Shipments last month amounted to 2,732 tons, yielding 1,258 ounces gold, 3,300 ounces silver, 68.8 tons copper. Estimated value, $49,000. Net profit after payment of all expenses, $19,000. Average number of men working, 75. Expect to fill force to 130 men by October 15.

Mikado Gold.—October 10. Mikado Mine (Lake of the Woods district), Ontario. During the month of September the yield was 239 ounces from 893 tons, and 127 ounces of bullion from 543 tons of tailings by cyanide.

Canadian Copper.—The mining operations of this company at Copper Cliff, Ont., have been greatly enlarged during the year, and the daily output of six mines is now over 1,200 tons. About 1,500 men are employed in the mines and smelting works, and the pay-roll is almost $30,000 a month.

Nova Scotia Steel and Coal Company.—This company, whose steel works are at New Glasgow, is paying considerable attention to the development of its valuable coal areas at Sydney Mines in Cape Breton. Hiram Donkin, C E., late resident manager of the Dominion Coal Company, is now in the employ of the company, and is preparing plans and specifications for the construction of a large shipping pier at North Sydney. It will be 67 feet high and 500 feet long. It is to be equipped with apparatus of the latest design for the handling of coal; 600,000 tons, it is predicted, will be the company's output next year.

Baltimore-Nova Scotia Gold Mining.—This company, successors to the Guffey Jennings Company, at Caribou, N S., is installing a large air compressor and drill. Development work may be continued on a larger scale than ever under the general superintendence of L. W. Getchell The treasurer of the company is A. S. Dunham, of Boston.

British Columbia Copper —What is called a phenomenal smelter record for a single blast furnace was established October 1st, when the Greenwood plant put through 484 tons. Of this amount there were 432 tons ore and the balance 12 per cent. coke. The furnace was built with a nominal capacity of 225 tons per diem, but owing to the self-fluxing character of the ore the daily average comes nearer 390 tons.

Vermilion Forks Mining and Development.—This company recently ordered of the Rand Drill Company, of New York, a Davis calyx drill and is about to begin prospecting its coal lands on the Similkameen. The outfit includes a class F drill, for drilling a 3¼-in. hole 300 feet; a 7-H. P. vertical engine, an 8 H. P. horizontal locomotive boiler, pumps, hose and necessary fixtures. The outfit has a total weight of 6,300 lbs., and is mounted on two wagon trucks. An expert driller from Idaho will superintend boring operations. Arthur Hickling, of Princeton, is managing director of the company.

Northwestern Development.—At a meeting of the provisional board of directors of the Northwestern Development Syndicate, Limited, a company recently organized in Nelson, a bond was taken on the Camborne and Oyster free milling gold properties in the Fish River camp, Lardeau. These properties have been under development by the Rosenberger Prospecting Syndicate with, it is said, most gratifying results. While no work has been done at depth, all who have seen the properties are agreed that the surface showings are most remarkable, both as to size of ore bodies and values. The Camborne group comprises nine claims and covers more than a mile of a large auriferous lode, which is exposed in different places on each claim, and at every point of exposure carries gold values, some places being very rich. One ore body 32 feet wide averages $10 gold per ton, and another 10 feet wide averages $28 per ton. The main vein shows in places a width of 100 feet. On the Gold Finch the uppermost claim, are four parallel veins of solid quartz, which have been opened up at many different points and are shown to contain gold values throughout.

NEW COMPANIES.

BRITISH COLUMBIA.

Chieftain Copper Mines of British Columbia, Ltd.—Incorporated 5th Sept , 1901. Authorized capital, $1,000,000, in shares of $100.00 each.

Clover Leaf Mining and Milling Co.—Head office in Cranbrook, B.C. Capital, $75,000. (Extra provincial company.)

Crow's Nest Oil and Coal Company, Ltd.—Incorporated 23rd Sept., 1901. Authorized capital, $200,000, in shares of 10 cents each.

Duncan's Mining and Development Co., Ltd.—Incorporated 9th Sept., 1901. Authorized capital, $40,000, in shares of $1.00 each.

Great Dane Mines, Ltd.—Incorporated 3rd Sept., 1901. Authorized capital, $200,000, in shares of 10 cents each.

Northwestern Development Syndicate, Ltd.—Incorporated 23rd Sept., 1901. Authorized capital, $1,000,000, in shares of $1.00 each.

Ophir Lade Mining Syndicate, Ltd.—Incorporated 31st Aug., 1901. Authorized capital, $120,000, in shares of $200.00 each.

Slocan Republic Mining and Development Co.—Incorporated 5th Sept., 1901. Authorized capital, $1,500,000, in shares of $1.00 each.

ONTARIO.

Black Eagle Gold Mining Co., Ltd.—Incorporated 6th Sept., 1901. Frank Peterson, Rat Portage, Ont., Mine Manager.

The Canadian Oil Refining Company, Ltd.—Capital, $100,000. Head office, Petrolea. H. A. Jamieson, W. D. Todd, Warren, Pa.; E. R. Clarkson, Hamilton; John Kerr, James McCort, and Ed. E. Crant, Petrolea. To manufacture, buy and sell petroleum-oil and other products of petroleum-oil lands.

The Consolidated Mines Company, of Lake Superior, Ltd.—Capital, $1,000,000. Head office: Port Arthur. M. A. Myers, C. W. Stone, of Warren, Penn.; F. N. Gibbs, A. M. Wiley, and Herbert Shear, of Port Arthur.

Rob Roy Mines, Ltd.—Incorporated 9th Oct., 1901. Authorized capital, $120,000, in shares of 10 cents each. Head office: London, Ont.

Standard White Lime Co., Ltd.—Incorporated 2nd Oct., 1901. Authorized capital, $300,000, in shares of $100.00 each. Head Office: Toronto.

Standard Mining Co. of Algoma, Ltd.—Incorporated 2nd Oct., 1901. Authorized capital, $40,000, in shares of $100.00 each. Head office: Sault Ste. Marie, Ont.

Tilsonburg Oil and Gas Developing Co., Ltd.—Incorporated 9th Oct., 1901. Authorized capital, $99,000, in shares of $1.00 each. Head office: St. Thomas, Ont.

QUEBEC.

The Natashquan Iron Co.—Capital, $100,000. Head office: Montreal. Robert C. Smith, K.C.; Jeffrey H. Burland, W. McLea Walbank, Frederick H. Markey, James C. McArthur, Charles A. Barnard of Montreal; John G. Turriff, Ottawa; Robert Stephen Clease, of Shrewsbury, England, and Walter H E Jackson, of London, England. For the purpose of acquiring, developing and exploring certain iron or mining properties in the vicinity of the river Natashquan, in the Province of Quebec, and the acquisition of patents for magnetic iron ore separators to be used in connection therewith.

Quebec Asbestos Co., Ltd.—Capital, $100,000. Head office: Sherbrooke. H. W. Mulvena, J. H. Walsh, A. H. Anderson and John W. McGeary.

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE HON. THE COMMISSIONER OF COLONIZATION AND MINES,

PARLIAMENT BUILDINGS, QUEBEC, P. Q.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents anuually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

SCHOOL OF MINING,

KINGSTON, ONTARIO.

AFFILIATED TO QUEEN'S UNIVERSITY.

The Following Courses are offered

1—Three Years' Course for a Diploma in

(A) Mining Engineering.
(B) Analytical Chemistry and Assaying.

2—Four Years' Course for a Degree B.Sc. in

(A) Mining Engineering.
(B) Chemistry and Mineralogy.
(C) Mineralogy and Geology.

3—Courses in Chemistry, Assaying, Mineralogy,

and Geology for degrees of Bachelor of Arts (B.A.) and Master of Arts (M.A.)
For further information see the Calendar of Queen's University.

4—Post-Graduate Course for the Degree of

Doctor of Science (D.Sc.)
For further information see the calendar of Queen's University.

Next Session begins October 3rd,
. . . 1900 . . .

Matriculation Examination held at Queen's University, Sept. 20th.
Unmatriculated Students admitted to Special Courses.

The School is provided with well equipped Laboratories for the study of Chemical Analysis, Assaying, Blowpiping, Mineralogy, Petrography and Drawing. In the Mining Laboratory the operations of Crushing, Amalgamating, Concentrating, Chlorinating, Cyaniding, etc., can be studied on a large scale.

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

Dr. W. L. GOODWIN,

DIRECTOR

SCHOOL OF MINING, KINGSTON, ONTARIO.

THE SNOW STEAM PUMP WORKS,

MANUFACTURERS OF

Steam Pumps, Pumping Engines and Hydraulic Machinery.

General Agents for Canada, DRUMMOND, McCALL & CO., Montreal.
Local Agent F. R. MENDENHALL, Rossland, B. C.

Pumps Kept in Stock at Montreal and Rossland.

MONTREAL...

PIPE FOUNDRY CO.

LIMITED.

MANUFACTURERS OF...

CAST IRON
WATER AND GAS **PIPES**

OFFICES:

CANADA LIFE BUILDING

MONTREAL.

WORKS: LACHINE, QUE. PRICES ON APPLICATION.

The Montreal Car Wheel Co.

. MANUFACTURERS OF .

Works:
LACHINE,
Que

CHILLED WHEELS

Offices:
CANADA LIFE
BUILDING.

For Railroad, Electric Car, Street Railway and Lumber Truck Service, Etc.

THOMAS J. DRUMMOND, General Manager.

MONTREAL.

CANADA IRON FURNACE CO. Limited

MANUFACTURERS OF

Brand:
"C. I. F."
Three Rivers.

CHARCOAL PIG IRON

ALSO MAKERS OF PRESSED AND REPRESSED BRICKS.

Canada Life Building

MONTREAL.

PLANTS AT
RADNOR FORGES, QUE.
LAC A LA TORTUE, "
THREE RIVERS, "
CRAWDY'S PILES, "
MIDLAND, ONT.

GEO. E. DRUMMOND, Managing Director and Treasurer.

THE DOMINION WIRE ROPE CO. LIMITED

MONTREAL, CAN.

Manufacturers of **"LANG'S" PATENT WIRE ROPES**

FOR COLLIERY AND GENERAL MINING PURPOSES.

ALSO BEST STEEL WIRE ROPES FOR ALL PURPOSES.

ALSO

SOMETHING NEW...

SOMETHING TO LAST...

The Wearing Surface of Hemp.

The Strength of Wire.

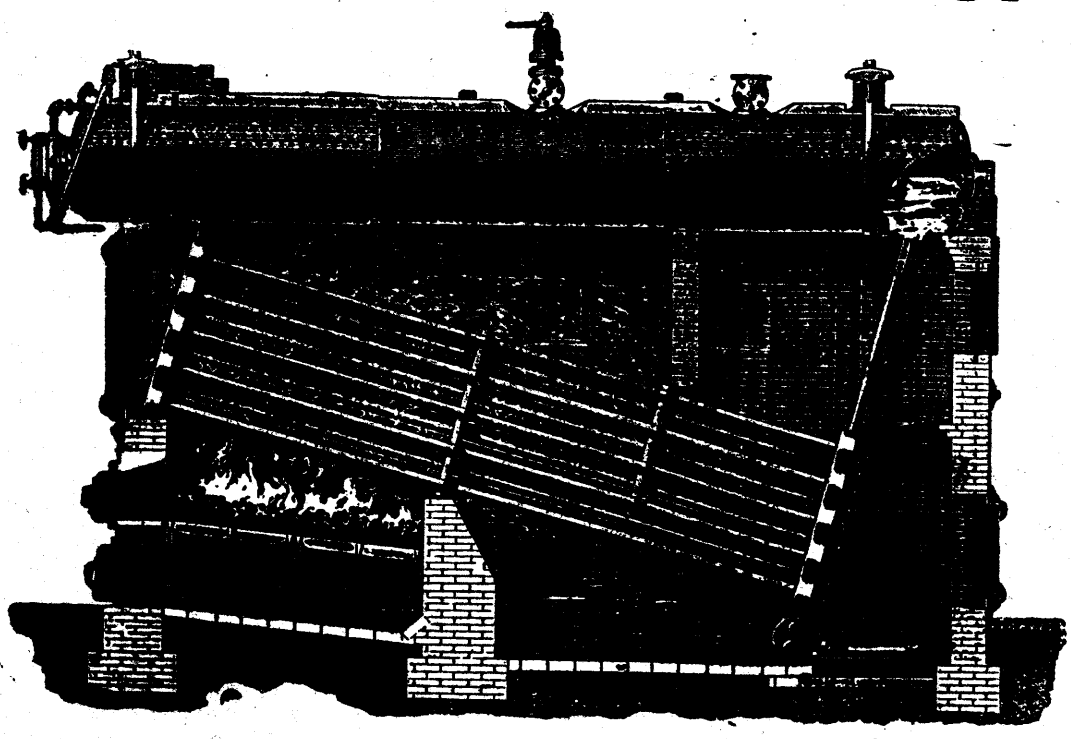
The Flexibility of Manila.

UNEXCELLED FOR TRANSMISSION AND PILE DRIVING PURPOSES

BRANCH OFFICES: Vancouver, B.C. Rossland, B.C. Winnipeg, Man. Toronto, Ont. Ottawa, Ont. Halifax, N.S.

CATALOGUE ON APPLICATION.

THE BABCOCK & WILCOX



WATER TUBE

STEAM . . .

BOILER . .

was first patented by Stephen Wilcox, in 1856. Over **3,000,000 H.P. now in use.** Has no equal for MINES, RAILWAY, SMELTERS, ELECTRIC LIGHTING or other power purposes.

Large book "STEAM" sent free on application.

BABCOCK & WILCOX, LIMITED, ENGINEERS AND BUILDERS.

Head Office for Canada: 202 ST. JAMES STREET, MONTREAL.