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THE QUEBEC ANNUAL REPORT.

The Annual Report on Mining Operations in the Province of Quebec for the year 1911 has just come to hand. Before touching upon its contents we wish to express our appreciation of the manner in which the whole report has been designed and executed. Typographically, it is a vast improvement upon any report yet issued by the Quebec Mines Branch. It is cleanly printed and well edited; and the engravings, while not perfect, are much superior to those that formerly appeared. In general apearance, in tone, and in text, the 1911 report sets a new standard of excellence. To the Minister of Mines, the Hon. C. R. Devlin, felicitations are due. Equally are they due to Mr. S. Dufault, the Deputy Minister, and to Mr. Theo. C. Denis, the indefatigable technical head of the Branch.

The Report opens with a statistical review of the annual mineral production of the Province. In value the yearly output of minerals has risen from slightly over two million dollars in the year 1899 to the respectable amount of $8,679,786 in 1911. Imperfect as the Quebec statistical methods may have been, the growth of the industry has been normal enough to give relative value to the figures quoted. Taking them as they stand, they show that Quebec's mining industry has grown 250 per cent. during the period 1899-1911. During this same period Ontario is the only province that has developed more rapidly in mining. And it is noteworthy that Quebec's expansion has been quiet and regular, with a notable absence of the costly stimulus of a boom.

The total shipments of asbestos during 1911 amounted to 102,224 tons, valued at $3,026,306, or $29.60 per ton. This compares most favourably with the previous year, when the shipments were 80,605 tons, valued at $2,667,869, or $33.10 per ton. Moreover the stock on hand was lighter in 1911 than in 1910, the figures being respectively 33,751 tons and 41,159 tons. Since the world's total production of asbestos, apart from Quebec, was in 1909 only 19,342 short tons, valued at 653,761 tons ,and as there has been no considerable increase since that year, Canada is still easily the largest factor in the market.

The shipments of copper-bearing pyrites, 38,554 tons, were larger than in any previous year save 1899. The Eustis mine, at Eustis, and the McDonald mine, at Weedon, were the only producers. At both mines the iron pyrites contains copper up to 5 per cent., and the sulphur in the ore ranges from 40 to 50 per cent.

Quebec's gold production in 1911 was inconsiderable, being only equivalent to $11,800. Practically all

of this was derived from the hydraulic operations of the Dominion Gold Fields, Ltd., near Beauceville. From recent reports this amount will be largely exceeded during 1912.

No chromite was mined during 1911. Shipments to the amount of 197 tons, valued at $2,469, were made from stock piles.

The small charcoal blast-furnace at Drummondville was the only furnace in blast during the year. Here 665 tons of pig iron, valued at $17,280, were produced.

Mica mining was considerably more active than in 1911. The total value of the mined product was $76,428, an increase of $24,527 over the year 1910.

The shipments of phosphate (apatite), totalled 595 tons, valued at $5,832. No phosphate properties were operated. The mineral was won as a by-product of mica.

Graphite mining showed a marked improvement. The mineral value of the milled product in 1910 was $15,-896; whereas in 1911 the total value was $33,613, and during the current year it will probably be much higher.

The quarrying of building materials and the manufacture of brick and cement attracted considerably more attention last year than 1910. The total value of cement, lime, limestone, brick, marble and granite was 20 per cent. greater in 1911 than in the previous year. The figure reported is $4,925,401, a very substantial sum.

Mining accidents are reported upon by Mr. J. H. Valiquette, who is the Denis' assistant. 7,846 men were employed in mining and quarrying in the province during 1911. Of these, 3,686 were engaged in metalliferous, asbestos, or mica mines; and the remainder in quarries, clay-pits, and brickyards. Only four fatal accidents were recorded—three in the asbestos mines, and one in a stone quarry. Taking 3,686 as the number of men employed in mining proper, the proportion is 0.77 per thousand employed; while for the men employed in stone quarries and clay pits the rate of fatalities is only 0.24 per thousand. The corresponding figures for 1910 were 2.26 and 1.14 respectively. Thus the showing for 1911 is remarkably satisfactory. Mr. Valiquette ascribes the low rate partly to luck, and partly to improved methods of handling, using, and storing explosives.

A report by Mr. Valiquette on the stone quarries being operated in the vicinity of Montreal, a description by Prof. E. Dulieux, of some titaniferous iron ore deposits on the north shore of the Gulf of St. Lawrence, a report on the magnetic sands of the same region also by Prof. Dulieux, and a report on the geology of the Keekeek and Kewagama regions by Dr. J. Ansten Bancroft, are comprised in the volume.

It is patent that the Quebec Mines Branch is doing its utmost to collect and disseminate information as to the mineral resources of the province. The Annual Report is in itself the best kind of evidence that the branch is alive to its duty. It is quite out of the question, however, to suppose that Mr. Denis, with one assistant, can do all, or half, of what is needed. The Government should have no hesitation in giving their hard working Superintendent of Mines an adequate staff.

CANADIAN MICA.

Mr. Hugh S. de Schmid, an official of the Mines Branch, Ottawa, is the author of a new monograph on Canadian mica. This publication takes the place of Mr. Fritz Cirkel's "Mica: Its Occurrence, Exploitation, and Uses," issued seven years ago. Using the same title, and purporting to be a second edition of Mr. Cirkel's work, Mr. de Schmid's volume is fuller and more comprehensive than its predecessor.

The value of Canadian mica produced in 1910 is estimated at $143,409. More than one-third of this total is to be credited to the Lacey mine, Sydenham, Ont., owned and operated by the General Electric Company. The remainder is mined in small quantities by numerous private operators, mainly in Quebec. The peculiar conditions that obtain in the mica market offer inducements only to the small investor.

The report under consideration covers amply the whole field of mica mining in Canada. Mr. de Schmid's analysis of the situation is timely and suggestive. We shall mention here certain conditions that limit the industry.

During his tour of the mica districts three years ago, Mr. de Schmid visited 250 prospects and mines. Of these, 213 were not operating, 138 had not been worked for two years. It is quite obvious, of course, that the majority of these mines and prospects can be worked only on a small scale, and are profitable only when the market is active. Hence the business is carried on sporadically. The operator who can afford to store his mica waits for the market to improve. The prospector who depends upon immediate returns, works only when he can sell at a profit.

The average cost of mining and preparing one ton of thumb-trimmed mica is estimated by Mr. Cirkel at $179. This figure does not include charges for prospecting and exploring; but it is probably exact enough to provide a fair basis of computation.

The value of Canada's annual production of mica is, roughly, $150,000, this estimate being made at the mine. The export value is about twice this sum. The stated price per hundredweight ranges between $19 and $59. But, owing to the lack of systematic grading, the market is unsatisfactory, both to the Canadian shipper and to the purchaser. Hence there is given the Indian mica an advantage that need not necessarily obtain.

Ottawa and Hull are the centres of the Canadian mica trimming industry. Twelve establishments, each employing from 15 to 150 persons, turn out various mica products. By far the greater part of the output is shipped to the United States. Several considerable fortunes have been realized in this department of the business, but there inheres to it the same uncertainty that marks the actual mining of the mineral.

The lack of definite grading, and the absence of standardized methods appear to be potent factors in restricting the development of the Canadian mica industry. While, no doubt, mining will always be carried on in the present method, yet much improvement is needed in marketing the prepared material.

Mr. de Schmid's report gives the reader a full and unbiased accounted of the whole industry. It is particularly suggestive and instructive.

"LAME DUCKS."

Some time ago we had occasion to refer to some superfluous comments on Cobalt that appeared in a Toronto publication. These comments were based upon the diminishing ore shipments from Cobalt. The fact that more silver is being mined and milled was quite overlooked, and Cobalt was spoken of as a dying camp.

This, of course, is transparently wrong. Cobalt is still in its vigorous youth, and is entering into a phase through which every mining camp of its kind passes. Many of the reported failures are being handled successfully by leasing operators. Not a few dead mines have come to life, and practically all the older mines are in sound shape.

It is totally unfair to deal in figures without understanding their true meaning. The gross capitalization of all companies organized to operate in Cobalt is an enormous total. Also it is absurd to debit this total to the camp. Dozens of the companies incorporated never got past the paper stage. Others were promotions without any sound basis. The real test, the test that Cobalt responds to, is that of dividends on invested capital.

Porcupine is suffering from exactly the same kind of criticism as has afflicted Cobalt. Recently lists of thirty or forty defunct or moribund companies have been published. Not only is this newspaper comment unfair, but it is also mischievous in the extreme. At least ten or twelve of the companies mentioned have a good chance of life. That chance is not improved when the mines are given a public burial.

It is high time that the irresponsible mining critic were given his quietus.

THE VALUATION OF MINING PROPERTIES.

At a recent meeting of the Mining and Metallurgical Society of America, in New York, an interesting discussion was provoked by an address by Mr. J. R. Finlay on the above topic. Mr. Finlay said that in their conception of the value of mines, mining engineers had, he supposed, been largely influenced by the views of Mr. H. C. Hoover, who considers that a mine is a limited deposit of valuable ore, and that this ore should be extracted as rapidly as possible in order to realize the greatest profit. Herein the chief factor is that of the time-value of money; not only the money represented by the investment, but the money to be returned by the investment. Hence, Mr. Finlay remarked, it would follow that the true interest of the mine owner is not to perpetuate an income, but to complete a job; not to prolong the life of his mine, but to shorten it by exhausting all profitable ore and getting the money into something else just as soon as economy permits. In other words on the Hoover theory, good economy demands that the ore reserves be ruthlessly slashed by getting out the best ore first, in preference to poorer ore, there being no logical reason why any absolute profit should be sacrificed in order to make a showing of stability. These conceptions, he said, are rather shocking to the average investor, with whom stability of earning power are a sort of fetich. Hoover's style of reasoning, however, is strictly for mining men, or at least for men in a position to appreciate the real facts about a mine. Moreover, it was proposed in the first instance to apply to gold mining alone—a form of enterprise from which some of the ordinary commercial factors have been eliminated since gold can always be marketed without limit at a fixed price. The mere annual income of a mine may mean very little in the problem of estimating its total value. The engineer requires to know the facts about the ore; how much profit is already assured and how much is the ultimate possibility. It then seems reasonable to believe that the real value of a mine lies between a certain minimum and a certain maximum. The speaker did not see any reason why a mining engineer should not expect to understand commercial facts, and he, therefore, proposed to point out the great importance of strictly commercial data. There are, for example, instances in which strictly commercial questions, such as the price of a commodity or the value of money, or perhaps the mere demand for securities, or the value of some commercial strategic point, may outweigh the importance of the ore reserves . A mining engineer may be quite at a loss as to how to weigh some of these facts. Thus undeveloped mineral lands must be valued exactly as unused real estate is valued, namely, at so much an acre, according to the prices fixed by mere trading. There is apparently no other basis. In the case of mines that are going concerns, the factors are assumed to be: (1) The average cost of the product. (2) The average price of the product. (3) Variations introduced by temporary fluctuations in prices. (4) The general tendency of prices in the long run. (5) The expected life of the mine. (6) The interest rate on invested money. Of these factors scarcely one may be fixed with exactness. Of them the one generally considered to be the most difficult

to determine, is the one determinable with the greatest exactness. This is the amount of ore in a mine. The average cost is not easily determined; the other factors are so uncertain that no two men will agree concerning them. Mr. Finlay concluded: "Even past averages of prices apply only to a given term of years, and for each separate term you will get a different average. To project calculations into the future from this unstable base line is dangerously near pure guess work. What I think we sometimes forget is the enormous importance of the guess. In innumerable cases a difference of ten per cent. in the price of the product will make more difference to the value than any possible uncertainty about the life of the mine. This applies to every kind of mine except a gold mine. I have a case in hand now, a very important mine earning well over a million dollars a year. It is surely good for ten years' life, and I believe it is good for twenty years. If it lasts twenty years this mine will be worth, say, $12,000,000; if it lasts only ten years it will be worth $7,500,000. If, however, the price of its ore falls 11 per cent., it will be worth only $7,500,000 if it lasts the full twenty years . If, on the other hand, the price rises 11 per cent., it will be worth well over $10,000,000 with ten years' life. The differences in the price are no more than two men might readily disagree upon. It is a difference for example, about equal to that between 13½c. copper and 15c. copper. How often do we stop to consider these most evident facts? Here is a little difference, well within the possibilities which is more important than six or seven millions of mighty good ore. There are a number of other variables . . . . . My point is, however, that in trying to place values upon mines we should be very cautious not to overestimate the importance of purely technical information. In the discussion that followed, Mr. Robert Peele said that he had constructed a curve of copper prices from 1861 to date and the variations were so great, and apparently there was so little system in the ups and downs of the curve, that he would consider it impossible to predict what the future might bring forth. Mr. E. G. Spilsbury remarked that in making a valuation of a mine an engineer could not arrive at figures that would take into consideration fluctuation in the market prices of metals. He can assume a certain price and then make it clearly understood that profits will fluctuate with the value of the products. Mr. H. S. Munroe pointed out that the question of the price of metals is not to be solved by a study of averages or from curves of past prices, but is determined by economic laws, which are founded upon a very large number of varying conditions, but few of which can be predicted with any certainty.

Mr. W. R. Ingalls remarked that if an engineer is examining a mine on behalf of people who are going into it as a speculation, he might, perhaps, estimate the profits at prices within a considerable range; in the case of copper from (say) 12 to 17 cents; and lead or spelter similarly. If, however, he were valuing a mine on behalf of bankers who contemplated lending money on the security, a more exact valuation would be necessary. The engineer valuing mines must necessarily be something of an economist.

EDITORIAL NOTES.

Mysterious are the vagaries of capital. The Colonial Nickel Company, shockingly soon after birth, has been absorbed by the International Nickel Company. Just who used the gun is not certain.

The Rigaud-Vaudreuil Gold Fields Company reports $20,900 as the result of the June clean-up.

Where the carcass is there will the vultures be gathered together. This is fittingly illustrated in the case of the liquidation of the Electric Steel Company of Canada, at Welland. The receipts were $3,899, and the expenses $3,689, thus leaving a balance of $210 for division among the creditors. The liquidator received for his services $447.15; the legal and court fees represented the major part of the pickings. The dividend was based on a rate of .003305 on the dollar; but no creditor was paid less than one cent on his claim. To some this must have been consoling.

SILVER.

Cyanidation-Amalgamation.—In the Mining Journal for June Mr. T. A. Rickard records some of his observations obtained on the occasion of his recent visit to Northern Ontario, as the guest of the Canadian Mining Institute, by an account of the cyanidation-amalgamation practice at the Nipissing Mines. The description is characteristically concise, and, rather than attempt an abstract, we have ventured to re-print the article virtually in extenso. Mr. Rickard writes:—

"The high-grade mill, in which is treated the picked ore taken from a celebrated mine in Cobalt. This ore, containing native silver and argentite, together with the arsenides of Cobalt and Nickel (6% Ni., 7 to 8% Co., 49% As.), after being crushed to 70-mesh at the sampler is, delivered to the plant with an average content of 2,600 oz. silver per ton. It is fed to a Krupp tube-mill, 20 ft. long by 4 ft. diameter. The charge consists of 3½ tons of ore, 4½ tons of mercury and a 5% cyanide solution. The tube-mill is closed at both ends. Air, to accelerate chemical action, is introduced through a pipe. There is also an ingenious device whereby the excess of air is subsequently expelled. After nine hours in the tube-mill, 98% of the silver has been extracted from the ore, which, in the form of pulp, then passes to a settler, where the amalgam is separated by gravity. Thence it goes to a clean-up pan and drainers. These last are canvas bags for removing any excess of mercury. Meanwhile the pulp and solution, deprived of amalgam, passes to a vat and is fed to Butters filter, the clarified solution going to boxes in which the dissolved silver is precipitated on zinc shaving. This shaving is in the form of a coarse wire, necessary on account of the strength of the cyanide solution. The residue left on the filter is stored, being valuable for its arsenic, nickel and cobalt. As yet no method has been devised for eliminating the arsenic in

this residue with a view to marketing the nickel and cobalt.

" Meanwhile the amalgam, containing 80% mercury and 20% silver, is placed in retorts, each of which holds 450 lbs. After the mercury has been distilled the silver, still containing 1% mercury, is taken to a reverberatory furnace. Here it is melted in a charge of 25,000 ounces. After 15 hours' exposure to a hot oxidizing atmosphere, without addition of any flux, the molten metal is cast in ingots, each weighing 1,100 oz. silver, which is 999 fine. Two oil-burners afford the necessary heat. The flue from the furnace is provided with a water-jet condenser, whereby 1,000 to 2,000 pounds mercury is arrested monthly. The gases escape at 100 degrees F. While I was collecting these data, a small melt was about to be finished, and I was able to see the bath of molten metal before it was tapped into the rows of ingots. During February, 550,000 ounces of silver were melted in this small plant.

"The richness of the mine product under treatment and the completeness of the metallurgical operations left a vivid impression. Within a small building it was possible to watch the successive stages by which a complex ore of a refractory type yielded its precious content in metal of such purity as to be ready for the mint. The entire process is so expeditious that the silver is delivered at New York within a week of the day when the ore is received at the mill and a cheque for the yield is received concurrently with the shipment. No less than 20 tons of mercury is in use at a given time. The cyanide has a cleansing action upon it; indeed, the use of mercury would be impracticable without the cyanide, for the mercury would become 'sick' or fouled, so as to hinder amalgamation with the silver in the finely-ground arsenical ore. The yoking of syanidation and amalgamation constitutes another remarkable feature. To the practical man, however, the most memorable note is the fact that a consignment of ore is turned into negotiable paper within seven days. It remains to add that Charles Butters devised the process and that James Johnston designed the plant for the Nipissing Mines Company.

"It is planned to erect a mill, embodying a similar process for the treatment of dumps, which contain 80,000 tons of ore assaying 22 ounces silver per ton. The picked stuff will go to the mill above described and the remainder to 40 stamps, four tube-mills, a Butters filter, a Merril press, with smelting of the precipitate in a small blast-furnace."

GOLD MINING IN THE TRANSVAAL.

An extremely interesting and concise account of gold mining in the Transvaal is contributed by Dr. F. H. Hatch to the current issue of The Engineering Magazine. Since 1885, when gold was discovered in the Witwatersrand the goldfield has produced gold valued at over $1,105,000,000, while the production last year represented $170,487,900, or more than double that of the United States, and nearly treble that of Australia. The gold is found in a series of conglomerates, locally known as bankets, of the Witwatersrand system, consisting of a group of sediments some 20,000 feet thick, separated by a great unconformity from the old schists and conglomerates of the Swaziland system beneath it. The "Main Reef Series" of conglomerates has been worked for its valuable gold content, more or less continuously, for a distance of 46 miles. The most individualized bed, especially in the central portion of the Rand is the Main Reef Leader, one of the members of this series. Usually it is of small thickness, but has a comparatively high gold content. An important constituent of the banket is secondary quartz, which has been responsible for widespread sitification, while, in like manner, iron pyrites has caused an extensive pyritisation. This is of both scientific and economic interest, since the gold is in intimate association with and in genetic relation to this mineral. When graphitic carbon is present there is also an intimate relation between it and the gold. Gold is also found in the secondary quartz. Dr. Hatch points out that without doubt the gold has been precipitated in the banket at various periods in its history; yet there is no case on record of a nugget or of a grain or flake of gold which bore on its surface any signs of detrital origin or in any way resembled alluvial gold. It is concluded, therefore, that the gold owes its present position in the banket to precipitation at some period long subsequent to the sedimentation of the conglomerate. The gold content of the banket varies, but the average graded worked by all the mines last year was $6.80. The mines are divided into three classes, namely, (1) Outcrop, (2) Deep Level, (3) Second Deep, or deep deep. The outcrop mines follow the banket down on the dip (average 30 degrees) with incline shafts. The deep level mines sink vertical shafts, which cut the banket at a depth of about 3,000 feet from the surface; the shafts are then turned off on the incline. In respect of milling practice, two important modifications are noted: In some of the new mills the amalgamating tables are assembled, together with the precipitating boxes for the cyanide solution in a reduction house, in which the tube-mill and enriched cyanide solutions are pumped. This enables an increase to be made in the running time. Since the stamps have not to be "hung up" while the plates are being dressed. Again, stamp duty has been enormously increased by the coarse crushing practical and by "by-passing" the fines direct from the rock-breakers to the tube-mills. The weight of individual stamps has also been increased. Thus, at one mill the stamp of 2,000 lbs. is instanced. In conclusion, Dr. Hatch states that while the grade ore mined is diminishing, the annual tonnage crushed is increasing. The gold costs $4.30 per ton to produce, and since the average value of the ore is about $6.80, the average profits are about $2.50 per ton. Respecting the continuation of the gold-bearing banket at depth, Dr. Hatch remarks there is no doubt, and on the assumption that the mines will be worked to a vertical depth of 6,000 feet, and on the development of the new gold-bearing ground at both the eastern and western extensions of the banket, he estimates the continuance of a large gold yield from the Transvaals for a further period of at least thirty-five years.

OBITUARY.

A despatch from Nelson, B. C., announces the death which took place on the 4th July, as a result of a motor accident, of Mr. E. G. Warren, general manager of the B. C. Copper Company, Greenwood, B. C. Mr. Warren was born at Hawkesbury, Ont., in 1874, and graduated from Toronto University in 1896.

THE UNIVERSITY OF TORONTO AND THE MINERAL INDUSTRY

By H. E. T. Haultain.*

(Part II.)

Mineralogy is the science of minerals, and geology is the science of rocks. The basis of the mineral industry is minerals and minerals are found in rocks. Hence, to the popular mind the syllogism is complete; the shortest step is to go to geology and mineralogy for that enlightenment and for that philosophy which will aid the mineral industry. Thus the two handmaidens of the profession of mining engineering are mistaken for the mistress.

In 1856, Dr. E. J. Chapman was appointed Professor of Mineralogy and Geology in the University of Toronto and, at that time, the University stamped its approval of the teaching of mineralogy and geology in advanced education.

The first curriculum of the S. P. S., published in the prospectus of the first session, 1878-79, was as follows:—

(1) DEPARTMENT OF ENGINEERING.

This course is intended to qualify students to prosecute the various professional branches of engineering. During the first two years the course is for the most part common to the students of all three branches (Civil, Mechanical and Mining Engineering). In the course of the second year, however, the student is required to select such one of the three branches which he intends to specially pursue, and the studies of the third year are arranged in conformity therewith.

Subjects of the First Year.

1. Mathematics—Including Plane Trigonometry and Analytical Conic Sections.
2. Mechanics—Elementary Statics and Calculations of Framed Structures.
3. Drawing—Free-hand, Linear and Elementary Projection.
4. Surveying—Chain and Compass. Plotting from Notes.
5. Construction—General Principles and Foundations.
6. Elementary Chemistry.

Subjects of the Second Year.

A.—Common to all Three Branches.

1. Mathematics—Differential and Integral Calculi and Spherical Trigonometry.
2. Drawing—Free-hand and Descriptive Geometry.
3. Physics—Statics and Dynamics, Hydraulics and Optics.
4. Mensuration.
5. Elementary Mineralogy and Geology.

B.—Special Subjects For Each Branch.

Civil—
- Geodesy and Astronomy.
- Surveying-theodolite, Level, etc.
- Construction, Roads and Railways.

Mechanical—
- Machinery.
- Designing.

Mining—
- Crystallography.
- Palaeontology.
- Determinative Mineralogy.
- Blowpipe Analysis.
- Surveying.

Subjects of the Third Year.

Civil—
- Surveying—Railway and Canal Surveying, Hydrography.
- Free-hand Drawing.
- Applied Mechanics—Resistance of Material Structures in Stone, Wood and Iron.
- Hydraulics—Water Supply, Drainage.
- Mineralogy—Determination of Minerals. Minerals of Ontario.
- Metallurgy—Manufacture of Iron and Steel.
- Construction—Bridges, Canals and Harbours.
- Steam Engines.
- Experimental Physics.
- Designing and Estimates.

Mechanical—
- Physics—Mechanical Theory of Heat.
- Free-hand Drawing.
- Applied Mechanics—Resistance of Materials. Structures in Stone, Wood and Iron.
- Machines—Proportions and Parts.
- Motors—Steam and Hydraulic Engines, and Pumping Machinery.
- Mineralogy—Determination of Minerals. Minerals of Ontario.
- Metallurgy—Manufacture of Iron and Steel.
- Experimental Physics.
- Designing and Estimates.

Mining—
- Assaying and Ore-dressing.
- Crystallography, Geology and Palaeontology.
- Mining—Geology.
- Mining Processes Employed.
- Mining Machinery.
- Motors—Steam and Hydraulic Engines, and Pumping Machinery.
- Metallurgy.
- Chemistry.
- Experimental Physics.

From this it will be seen that elementary mineralogy and Geology took their place in all branches of engineering in the first year and the Determination of Minerals and the Minerals of Ontario in the third year.

In addition to the course in Mining Engineering there was a department apparently more closer to the mineral industry.

(2) DEPARTMENT OF ASSAYING AND MINING GEOLOGY.

In this department the student is fully prepared in all the methods of analysis necessary to render him a competent assayist. He is also qualified to survey and report upon the value of mineral lands.

Subjects of First Year.

1. Elementary Mathematics, including Mensuration and Plane Trigonometry.
2. Elements of Natural Philosophy, including Mechanics, Hydraulics.
3. Inorganic Chemistry.
4. Elementary Biology.

*Professor of Mining Engineering in the University of Toronto.

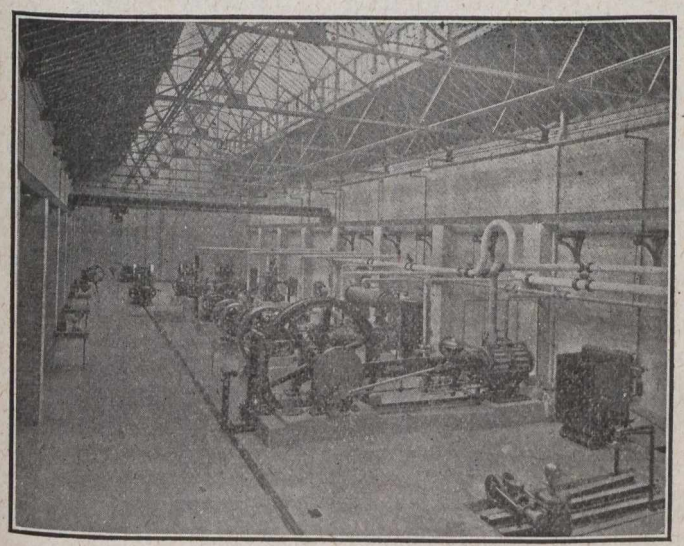
5. Elementary Mineralogy and Blowpipe Practice.
6. Physical Geography, Palaeontology and Geology.
7. Drawing.

Subjects of Second Year.

1. Higher Mathematics, including Spherical Trigonometry, etc.
2. Chemistry, with laboratory practice in Qualitative Analysis.
3. Blowpipe Analysis and Determinative Mineralogy.
4. Geology and Economic Minerals of Canada
5. Surveying and Levelling.

Subjects of Third Year.

1. Quantitative Chemical Analysis.
2. Metallurgy.
3. Assaying.
4. Study of Metallic Veins and Other Mineral Deposits, Mining Calculations, Examination of Mineral Lands.



Thermodynamics Laboratory

It is to be noted that, after this course, the graduate was alleged to be qualified to report on the value of mineral lands, a fallacy from which we are now trying to escape.

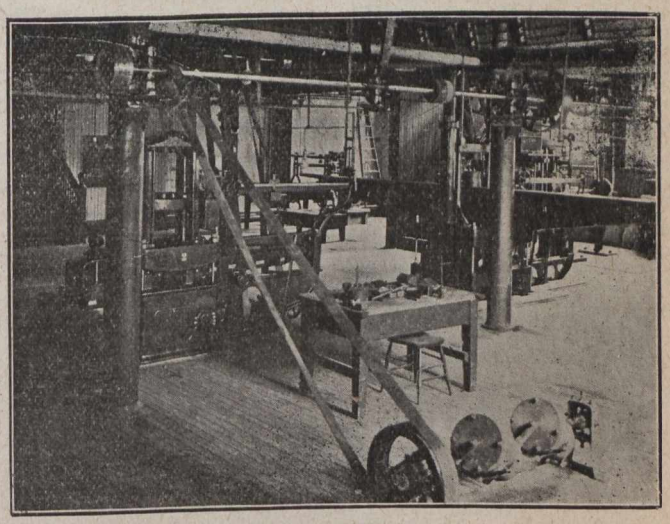
This curriculum in Assaying and Mining Geology remained practically without change until it was abandoned in 1892. In fact the only change that was made appears to have been the substitution of the word "assayer" for "assayist" in 1882. I can find no record of any student having graduated in this course.

In 1892, Mining Engineering, which for several years had been included as a sub-division of the Department of Civil Engineering, appeared as a separate department. The work of this new department differed from the course in Civil Engineering chiefly in the addition of more Chemistry, Mineralogy and Geology, together with some Mining Metallurgy, Ore-dressing and Assaying. Drawing and some other subjects were squeezed, and Hydrographic-survey and Drainage, Sewerage, etc., were dropped to make room for the mining subjects. At this time, also, was instituted an additional and optional fourth year leading to the degree of B. A. Sc. which has been referred to in Part I of this series. For the students in Mining Engineering the subjects of study in the fourth year were Mineralogy, Geology, Metallurgy and Assaying. In connection with this it is interesting to note that there was at this time no professor or lecturer in mining, but there was a professor of Mineralogy and Geology, and a professor of Metallurgy and Assaying, the latter of whom became professor of Geology at a later date. In regard to the details of the curriculum and the amount of time devoted to the different subjects the Calendars are not explicit or specific until a later date; but apparently this curriculum remained much the same for many years, there being from time to time, some increases in the work in Mineralogy, Geology, and Chemistry.

It is of importance to note that in the third year curriculum under the heading of Mineralogy and Geology the sub-divisions are, Economic Geology, Palaeontology, Blowpipe Analysis, and Determinative Mineralogy, **Metallurgy, Mining, Ore-Dressing, Assaying** (the italics are mine); and these four last subjects remained classified in the Calendars under the heading of Mineralogy and Geology for ten years or more. As further evidence of the relative position of men and subjects there appears in the Calendars from 1896 a classification of subjects and instructors from which this is taken.

Subject.	Instructors.
Mineralogy and Geology Paleontology Metallurgy and Assaying Mining and Ore-dressing Milling German	A. P. Coleman, M.A., Ph. D, Professor, G. R. Mickle, B.A., Lecturer. * * * * Demonstrator.

The calendar for the session 1891-92 states that a lecturer in Mining Engineering was to be appointed before October 1, 1891. Apparently this idea was dropped for the time and A. P. Coleman, M.A., Ph.D., was appointed Professor of Assaying and Metallurgy on the staff of the Faculty of the School.



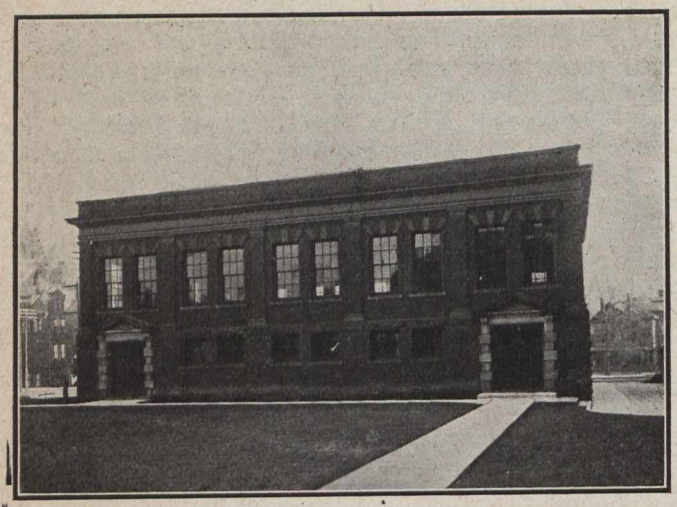
Strength of Materials Laboratory

In 1894 Mr. G. R. Mickle was appointed lecturer in Mining and for some years gave his time for part of the session only.

In 1901 the title of Dr. A. P. Coleman was changed to Professor of Geology. In 1902, T. L. Walker, M.A., Ph.D., was appointed Professor of Mineralogy in the Faculty of Arts of the University. In 1905 Mr. G. R. Mickle was appointed Professor of Mining. In 1907, W. A. Parks, B.A., Ph.D., was appointed Associate Professor of Geology. In 1908 Professor Mickle resigned to take up the position of Mines Assessor with the Ontario Government, and I was appointed Associate Professor of Mining which title was changed to Pro-

fessor of Mining Engineering in 1910. Mr. Geo. A. Guess was appointed Professor of Metallurgy in January, 1912.

Professor Chapman had established blowpipe and assaying laboratories at an early date and also collections of minerals and geological specimens. In 1896 a stamp mill and ore-dressing appliances were installed. along with roasting furnaces and other metallurgical apparatus. Ten years later the fine, large Chemical



The Milling Building

and Mining building on College street was built. In this Professor Mickle had secured excellent accommodations for assaying laboratories, seven rooms in all, a large room for a metallurgical laboratory, and a fine separate building, seventy feet square, to accommodate the machinery for the mechanical treatment of ores. This was a magnificent step forward and the very greatest credit is due to Mr. Mickle for securing it.

I have dealt with the history of the staff and with some phases of the curriculum, and have touched on the

Electrical Engineering Laboratory

growth of the laboratories. I should like to deal at length with the history of the time table and the subdivision of the work of the session among the different subjects.

This is a matter of very serious import. The most difficult result to achieve and at the same time the most important, is a proper balance of subjects. In the School this phase of the problem has been considered paramount. There have been many optional courses, but each course has been carefully balanced in its entirety by those in control. The student can take his choice of courses but he cannot take his choice of subjects. The engineer must be essentially a man of balanced education. This can very easily be understood when we consider what the effect would be if the subject of mathematics were allowed to run to extremes, if the academic mathematics were developed, not to the exclusion of the practical applications, but to such an extent as to destroy the rational perspective. A true perspective is probably of more importance to the young engineer than the inclusion or exclusion of some valuable practical subject. I believe that the great strength of the School has been in the balance attained in its Engineering courses, more particularly in Civil Engineering. The course in Mining Engineering seems to have been somewhat out of the fold and to have travelled by itself, and there has not been preserved to it the balance that obtains in the other courses. The Calendar of 1908-09 gives the course in Mining Engineering as follows:

SUBJECTS OF INSTRUCTION.

I. YEAR.

Lecture Courses.

Algebra
Plane Trigonometry
Analytical Geometry
Descriptive Geometry
Surveying
Statics
Dynamics
Elementary Chemistry
Elementary Mineralogy

Laboratory Courses.

Drawing
Surveying
Practical Chemistry
Determinative Mineralogy

II. YEAR.

Lecture Courses.

Calculus
Spherical Trignometry
Descriptive Geometry
Surveying
Dynamics of Rotation
Strength of Materials
Engineering Chemistry
Organic Chemistry
Optics
Hydrostatics
Metallurgy of Iron & Steel
Lithology
Geology

Laboratory Courses.

Drawing
Surveying
Optics
Photography
Hydrostatics
Practical Chemistry (Qualitative)
Practical Chemistry (Quantitative)
Determinative Mineralogy
Lithology

III. YEAR.

Lecture Courses.

Descriptive Geometry
Surveying & Levelling
Thermodynamics
Hydraulics
Electricity
Theory of Construction
Engineering Chemistry
Analytical Chemistry
Metallurgy
Ore Deposits
Mining and Ore Dressing
Economic Geology
Dynamic & Structural Geology
Heat

Laboratory Courses.

Drawing
Surveying
Heat
Practical Chemistry
Determinative Mineralogy
Crystallography
Assaying

There was at this time no course in Metallurgical Engineering; the course in Mining Engineering was supposed to prepare for both careers. On the face of it this looks like a well balanced course, but an analysis

of the distribution of time shows as follows in the course for the diploma in Mining Engineering:

Mineralogy, including Blowpiping and Determinative Mineralogy and its allied subjects of Crystallography and Petrography	162 hrs
Geology	100 hrs
Metallurgy of Gold, Silver, Lead, Copper, Nickel, etc.	25 hrs
Mining and Ore-dressing	25 hrs

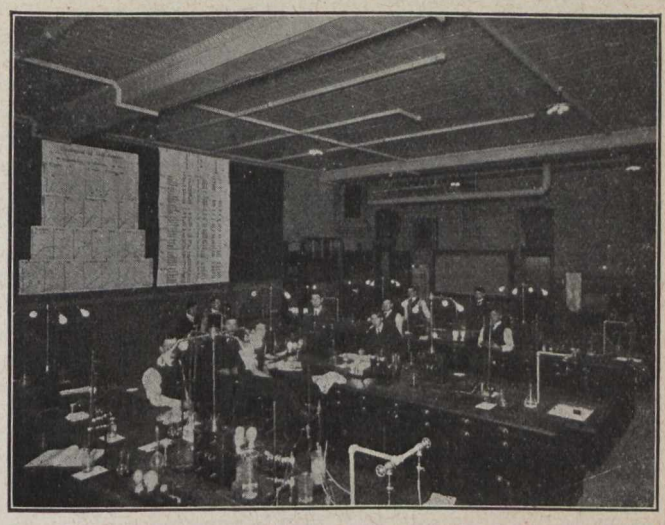
These figures represent the total time given to these subjects in the complete course for the diploma.

The subjects of the fourth year, which is an optional year, leading to the degree of B. A. Sc., are—Mineralogy and Geology, and Metallurgy, Assaying.

In the course of three years leading to the Diploma in the Department of Mining Engineering the total time allotted to Mining was thirteen hours against 262 allotted to Mineralogy and Geology. In the fourth year of this course there was no time allotted to Mining, Mineralogy and Geology divided the year with Metallurgy and Assaying. As a further evidence of the peculiar balance of things, the Calendar shows that in 1908-09 there were in the Departments of Mineralogy and Geology two professors and an associate professor and a lecturer, while in the Department of Mining there was only an associate professor, who was responsible also for the Metallurgy.

The Government blue book dealing with University affairs shows that for that session the appropriation for the departments of Mineralogy and Geology, including salaries, supplies, and apparatus, was the sum of $18,740; and for the Department of Mining, which includes Metallurgy, the sum of $5,004.

Mineralogy is the science of minerals and Geology is the science of rocks. The basis of the mineral industry is minerals and minerals are found in rocks. The attitude of the University of Toronto was to look to Mineralogy and Geology for that enlightenment and for that philosophy which should aid the mineral industry.



One of the Chemical Laboratories

(To be continued.)

ELECTRIC MINING APPLIANCES**

By E. A. Lof.*

The importance of the coal mining industry of the United States can best be realized by reference to the statistics, wherein it appears that the coal production in 1880 amounted to less than 70 million tons, but in 1910 had increased to over 500 million tons per year. The value of this output increased at an even higher rate, due to increased operating expenses. As the mines grew larger and deeper, expenses increased until, in some cases, they could not be operated profitably any longer. This led ultimately to the introduction of electricity for mining operations, and it is now generally conceded that this system is much superior to any other. Almost all new mines are being equipped with electric drive, and a very large number of old mines are changing over to this system. Not only does this reduce the cost of working, but it also offers a much safer and reliable operation.

Advantages of the Electric System.

A single generating station can be used for feeding a whole mining district, resulting in a much improved load-factor and a corresponding reduction in the cost of power. The station can be centrally or most economically located with regard to water and fuel supply. Large, modern, steam-turbo generator units can be installed, resulting in a most efficient generation and continuity of service.

Power may also be purchased from existing transmission systems or available water powers may me developed and the energy transmitted to the mines. This latter method is now actually being carried out at some large coal fields, where the water supply at the mines is undesirable for use in boilers. If the distance over which hydraulic power has to be transmitted to the mines is not too great, a saving may also be accomplished by the use of water power, especially if a good market price is obtained for the coal, which would otherwise be consumed at the mine.

The economy with which electric power can be distributed to the various points in a mine surpasses all other methods. The electric system eliminates long and expensive steam and air lines, with which the danger of breakdown and the difficulty of keeping up the necessary working pressure increases for every extension to the service. Electric distribution, on the other hand, is most simple and flexible. Very large districts can be efficiently supplied, and additions or alterations can at all times be made without the least difficulty.

A most efficient application of motors to the different mining machines is readily accomplished. They can be direct connected, or geared to the driving shafts, thus reducing the friction losses and repair charges to a considerable extent, while, on the other hand, the cost of belting and countershafts is entirely eliminated. Individual motors can be substituted for driving conveyors, scrapers and other machinery in breakers and tipples, which formerly were equipped for group operation by means of inefficient engines. In motor-driven breakers, the saving in belting alone is considerable.

Operation with the electric system is very simple, and results in a materially increased output of a mine.

* Power and Mining Engineering Department, General Electric Co., Schenectady, N.Y. ** From the School of Mines Quarterly, Columbia University.

Perfect control is at all times possible. Simple, automatic, safety devices can be installed, and indicating or recording meters can be provided in the different circuits as desired, and the performance of every individual machine ascertained. This is a very important point, as it is possible to maintain the machinery in the best operating condition. Any excess consumption of power can at once be detected and the defect remedied, while also an accurate record can be kept of the cost of the different operations.

Both alternating and direct current are used for mining work, generally depending upon the particular conditions of the project. For smaller installations, with short distributing lines, the direct-current system can be used, the direct-current motor being well adapted for the operation of hoists, mining locomotives, blowers, etc. When, on the other hand, power has to be distributed over greater distances, as in larger mining districts with scattered shafts, the alternating-current system will generally be found more advantageous. Due to the possibility of using a higher voltage, a more economical distribution can be obtained. The simplicity of the squirrel-cage induction motor makes it especially suitable for the severe service met in mining work. The absence of slip rings and sliding contracts eliminates sparking, with the accompanying danger of firedamp ignition. For the operation of mining locomotives or other machinery requiring it, direct current can readily be obtained by motor generators or rotary converters, so that in general it can be said that the alternating-current system offers many advantages for mining work.

The advantages of electric lighting are too well known to need comment. In many mines in which the electric system has not been utilized for power, it has, however, been used for general illumination, and with the introduction of reliable and efficient miners' lamps the electric system should be still further appreciated.

Hoisting.

The electric motor affords an ideal method of applying power to hoists, due to its rotary motion and high torque characteristics. Its use for this purpose has numerous and well defined advantages as compared with steam and air systems. Complete control is afforded over the hoist when running, enabling the operator to work much quicker and with greater certainty. The ease with which brakes can be operated electrically makes it possible to manipulate the hoist with the greatest precision, the mechanical brakes being used only for holding the load. In certain circumstances, energy may be returned to the system by employing a system of regenerative braking, so designed that the weight of the descending skip may be utilized to drive the motor as a generator, and thereby feed back an appreciable amount of current into the distribution system. Power consumption is thus considerably reduced, besides obviating excessive wear on the brakes which would otherwise have to absorb the energy.

The application of steam engines to hoisting has many serious disadvantages, among others that due to the intermittent service generally required, which necessitates certain precautions in resuming the operation of a steam hoist after it has been at rest. If water collects in the cylinder, it must be thoroughly drained before starting to hoist, to avoid the danger of blowing out a cylinder head. In cold weather the operation is frequently complicated by excessive condensation, or the formation of ice. In the electric system, these difficulties are of course entirely eliminated.

Objections to air-operated hoists are numerous, and compared to them the electric system offers many important advantages besides a lower cost of operation. The number of hoists that can be served from a central compressor plant is limited, owing to the expense of piping. Extensions of an electric system can be made with less difficulty and at less expense and protective devices, insuring a safe and reliable operation, are readily installed. Complicated valve mechanisms, cooling water for compressors, and reheaters for the engines, make the air system objectionable, while likewise its efficiency decreases in a very short time, due, to leaky valves, pistons, and air mains, unless extreme care is taken to guard against these losses, which in turn necessarily increases the charges for repair and maintenance. The characteristics of the electric hoist motor are such that its speed is automatically limited to a pre-determined value, without the use of auxiliary devices, thus reducing to a minimum the possibility of a runaway when lowering unbalanced.

It has been estimated that the annual cost of operating an electric hoist is much less than that of an equivalent compressed-air hoist, and that the saving realized by the use of electric hoists will pay for the complete installation in from five to six years. For isolated hoists, the maximum demand of power is greater for the compressed air system. This is a very important item where power is purchased and the peak-load is penalized; here the economy in the use of an electric hoist with equalizing fly-wheel sets will be still further marked. Where compressed-air systems have been installed this fact has nevertheless generally been recognized, and the reasons for choosing the air system has been mostly a matter of first cost, in that some of the old machinery could be retained, which would not have been the case had the electric-hoist system been selected.

For driving electric hoists, shunt-wound, direct-current motors are very largely used, owing to the wide range of speed control which can be obtained economically with this type of motor. In many of the later installations, however, the polyhase induction motor with a resistance rotor control has been applied to this service with entire success; simple and thoroughly reliable controllers can readily be provided to secure the variations in speed required for mine hoisting.

Where the source of supply is alternating current, as is almost invariably the case, and it is desired to use a direct-current hoist motor, a motor-generator flywheel set is generally employed as a medium. This system is generally known as the Ilgner system and employs the Ward-Leonard control driven by a shunt-wound, direct-current motor, receiving power from the alternating-current supply system through an induction motor-generator set to which is coupled a heavy flywheel. The speed of the hoist motor is controlled by varying the voltage of the direct-current generator, which is separately excited from an exciter mounted on the shaft of the set. One generator is therefore necessary for each hoist motor, although one induction motor may drive two generators. In order to permit the flywheel to take care of the peaks, and equalize the load, the speed of the set must be varied according to the demand of power and this is accomplished by an automatic regulator connected in the secondary circuit of the induction motor. In its most common form this regulator consists of a water rheostat. The resistance is varied by means of movable electrodes suspended from an arm mounted on the shaft of a small induction

motor which is set on the top of the rheostat tank. The regulator motor is connected in series, either directly or through series transformers, with the induction motor of the flywheel set. It is adjusted so that its torque opposes the weight of the electrodes, which are partly counterbalanced to reduce the size of the regulator motor to a minimum, and to permit adjustment of the regulator for different values of the line current. When this exceeds the value for which the regulator is adjusted, the torque of the motor overbalances the weight of the electrodes, lifting them, thus inserting resistance in the rotor circuit of the induction motor of the set. This causes it to slow down, and allows the flywheel to assist in driving the generator during the peak load.

Where it is desired to drive the hoist by a polyphase induction motor, the simplest system is the one in which the motor is simply direct-connected or geared to the hoist drum, without the use of any equalizing set. The motor is always of the phase-wound type and the speed is controlled by a rheostat which is connected by means of the collector rings to the secondary or rotor circuit. It is generally of the liquid type on account of the heavy currents involved, and consists of a sheet-iron tank divided into two compartments; the upper contains the electrodes and the lower contains coils for cooling the salt water which is kept circulating continuously from the cooling tank to the rheostat compartment by a centrifugal pump. The resistance is varied by changing the level of the liquid in the upper tank, and this in turn is done by operating a weir or gatevalve, which permits water to flow out and lower the level if the resistance is to be increased and vice versa if it is to be decreased. The gate is manipulated by levers conveniently located for the operator.

The power taken by this system is constant during the period of acceleration, but the efficiency for this period is very low. No power is returned to the supply system during retardations, but only when lowering the empty skip, and the power consumption for small movements of the cage or skip is very large. On the other hand, the efficiency during the period when the hoist is running at full speed is high, and no power is consumed while the hoist is at rest. The efficiency of the complete cycle of operation decreases rapidly with a decrease in the time during which the hoist is driven at full speed, while it increases with an increased rate of acceleration.

With the Ward-Leonard system first described, the power consumed during acceleration is much less than with the induction-motor hoist and a considerable part of the energy stored in the revolving parts of the hoist is returned to the system during periods of retardation, and also when lowering the empty skips. When the hoist is running at full speed, however, the efficiency is lower, and it must also be taken into consideration that the losses in the motor-generator set must be supplied during the time when the hoist is at rest. It follows, therefore, that the Ward-Leonard system is more advantageous for short lifts, in which case the period of acceleration is a large percentage of the total hoisting cycle, and the time during which the hoist is idle is a minimum.

The induction-motor hoist system, previously described, is however objectionable on account of the fluctuation in the power demand, to overcome which a converter equalizer is sometimes added. Such a combination includes a rotary converter connected on the alternating current side to the supply system, and on the direct-current side to a motor driving a large flywheel. A regulator actuated by the line current controls the direct-current motor field, so that when the power taken by the hoist drops below the average, the field is automatically reduced, causing the flywheel set to speed up and absorb power from the supply system and store it in the flywheel. When the load on the hoist motor exceeds the average, the operation is reversed, the flywheel set slows down and power is returned to the system through the rotary converter.

Either of the two flywheel equalizing systems here described can be used where the supply is direct current; in the first system by substituting a direct-current motor for the induction motor, and in the second by omitting the rotary converter, but retaining the motor flywheel set.

Haulage.

The most efficient and satisfactory method of haulage is by electric mine locomotives. Actual experience has shown that the cost of hauling is from 50 to 75 per cent. cheaper by electric locomotive than by mules. A consideration of the number of mules and drivers required to perform the same work as a locomotive makes this evident.

The direct-current, two-motor locomotive is now generally recognized as the standard type for mine work. There are two general forms of this type; in one the side frames are placed outside of the wheels and in the other the side frames are placed inside the wheels. For a given track gauge, the outside frame allows maximum space between the wheels for the motors and other parts of the equipment, renders the journal boxes more accessible, and gives somewhat more space for the motorman at the operating end. The inside frame restricts the space between the wheels available for motors and other equipment, but allows for the minimum overall width—a construction very desirable in those mines where props are set close to the track, or the space outside the rails is otherwise limited. The wheels being outside the frame, in case of derailment this type is somewhat more readily replaced.

For hauling cars between the working face of rooms and the entries, gathering locomotives are now recognized as the most efficient. In general construction, gathering locomotives are similar to those for main haulage, except that they are usually lighter and are provided with cable reels. The reel is driven through a double reduction gearing by a small, vertical, series-wound motor, the reel being supported by the motor frame and turning on a ball-bearing between the main gear and the top of the motor. The reel is equipped with about 500 ft. of flexible, heavily insulated cable. The inner end of this cable is connected to a collector ring on the upper side of the reel, and the outer end is fitted with a copper hook for attachment to the trolley wire.

On leaving an entry, the cable is hooked over the trolley wire, and as the locomotive moves forward the reel motor is overhauled and acts as a series generator, its counter-torque being sufficient to produce a tension on the cable which causes it to pay out evenly, and drop along the roadbed without kinks. Owing to the braking effect of this counter-torque, the reel ceases to rotate the instant the locomotive comes to a standstill. As soon as the locomotive starts back and slackens on the cable, the motor action comes into play and the reel winds up the cable. The operation of the reel

is entirely automatic; there are no switches or shifting levers for the motorman to handle, and he is therefore free to devote his entire attention to running the locomotive.

For gangways in which the grade is so steep as to prohibit the use of the cable-reel locomotive, the combination type is preferably used. This locomotive is of the same general construction as the reel type, with the addition of a hoisting drum and steel cable, by means of which the loaded cars are pulled up the slopes and then delivered to the main tracks in the regular way. As this type of locomotive can also perform the duties of the direct haulage and cable-reel types, it is often considered indispensable in mines where a limited number of locomotives are to handle the entire output.

Mining locomotives can also, if desired, be equipped with alternating-current motors. They are of the same general construction as the direct-current locomotives and are equipped with two three-phase induction motors. Their operation requires two overhead trolley wires, with the track rails constituting the third leg of the three-phase circuit. To collect current, two separate trolleys of the standard mine type are used, these being mounted on opposite sides; but for certain conditions a double trolley, two poles on a common base, can be furnished. As the induction motor is inherently high-speed, a double gear reduction is used.

Pumping.

For mine work, two classes of pumps are generally used, main pumps and auxiliary pumps. The former are generally of the stationary type and are used for pumping water out from sumps into which it collects, either by gravity or through the auxiliary pumps. Main pumps are of either reciprocating or centrifugal type, driven either by direct-current or by induction motors. It has been the custom to use centrifugal pumps for low heads and large amounts of water, but recent practice has indicated that these pumps will operate very efficiently and satisfactorily for heads of 1,500 ft. and over. The ability with which they can handle muddy and sandy water makes them preferable for mining service, and the smaller space they occupy is well worth considering. They are readily driven by direct-connected, polyphase induction motors, thus eliminating the friction losses of a gear drive.

Auxiliary pumps for raising water from scattered points in a mine on a lower level than the main pump, are mostly of the portable type, although they may be stationary. They are generally driven by direct-current motors, fed from existing trolley circuits. Among such auxiliary pumps, the portable set is of interest. The pump and motor are mounted on a truck of the same gauge as the mine tracks, so that it can readily be hauled by a locomotive to any place in the mine and immediately put into service.

The sinking, or dip pump, may also be mentioned. This type is generally used for pumping out flooded mines. It is designed to be lowered vertically in a shaft and is either mounted on a float or is suspended from the hoisting cables, so as to float on the surface of the water. Squirrel-cage induction motors should preferably be used for these pumps, as they are liable to be entirely submerged, which however will not cause any harm as there are no collector rings nor moving contacts.

Air Compressors.

The air compressors found in mining service are, as a rule, utilized for providing compressed air for air drills. Large air compressors are generally located at some central point in the mine, from which piping is run to the various places where compressed air is required. They are generally of the reciprocating type, due to the high pressure required for drilling, about 80 lb. per sq. in. As they require a comparatively low speed, and are characterized by steady load and low starting torque, the synchronous motor is especially well adapted for driving them. The possibilities that these motors offer for improving the power factor are also of importance in their selection.

Drilling.

The problem of making a satisfactory electric rock-drill has been studied for many years, and many more or less successful devices have been invented. The latest development along this line is the motor-operated rotary-hammer drill. The mechanism of the drill consists of two parts, a revolving helve containing the hammers, and the chuck mechanism for holding and rotating the drill steel. A flexible belt connection between the motor and the drill permits a variation of speed to any desired degree, so that all the advantages of hand drilling can be obtained without the disadvantage usually incident to machine drilling. The drill mechanism is totally enclosed with a heavy cast-steel casing which protects the working parts from any foreign substance, and is of sufficient strength to withstand the severe strains to which a drill is subjected in mining service.

The striking mechanism consists of two steel hammers guided by a revolving helve. As the helve revolves the hammer is thrown outward by centrifugal force, and at each revolution strikes a blow upon the projecting head of the drill-steel cap which delivers the energy of the blow to the drill. After delivering the blow, the hammer rebounds into the chamber within the helve, where it is completely cushioned upon air which it traps. During the period of recoil the hammer passes the projecting drill-steel cap, as the helve is continuously revolving. The hammer is again thrown into striking position by centrifugal force, during the remaining portion of the revolution.

The drill steel is kept rotating by means of a heavy worm-gear reduction, driven from the helve shaft. A rugged slip-friction cone is mounted on the worm-gear shaft and serves to protect the gears from undue strain in case of a sudden sticking of the drill. When not striking rock, the blow from the hammer is absorbed by buffer plates, which also retain the steel in the chuck while backing out of deep holes in broken and uneven ground.

The motor is fully enclosed and splash-proof, capable of successful operation in wet places, and is reinforced throughout with particular reference to the requirements of rock drill service. The drills can be equipped with either direct-current or three-phase, alternating-current motors. The power required for its operation is about 1½ to 2 horsepower.

The above electric drill has been on the market for only a comparatively short time, and is not as yet extensively used. The "electric-air" drill, however, has been in general use for a number of years and has proved very satisfactory. It is really an air drill driven by pulsations of compressed air created by a duplex air pulsator actuated by a standard electric motor. The air is never exhausted, but is used over and over again, playing back and forth in a closed circuit.

The drill consists simply of a cylinder containing a moving piston and a rotation device, with no valves,

chests, buffers, springs, side rods or pawls. The cylinder is larger, but the stroke is shorter, making the weight of the drill unit about the same as that of a corresponding air drill. The pulsator is a vertical, duplex, single-acting, air compressor with opposite cranks, but with no intake or discharge valves nor water jackets. It is geared to a motor, either direct or alternating current, and mounted on a wheeled truck for easy handling. Two short lengths of hose connect the pulsator with the drill, each running from one pulsator cylinder to one end of the drill cylinder.

The ordinary air or steam driven rock-drill takes a full cylinder of air or steam at full pressure at each stroke, and exhausts it at practically full pressure. No advantage, therefore, is taken of the expansive properties of the air or steam. The electric-air drill, however, operates on an entirely different principle. The closed system comprising the outfit is filled with air under a low pressure, which is simply a transmitting agent between the piston of the pulsator and the piston of the drill itself. The object of slightly compressing this air is to give it a greater density for the transmission of the pulsations imparted to it by the pulsator. In fact, the air in the system may be considered as a cushion between the pulsator and the drill, the pressure in the air simply giving the requisite tension. Practically the only loss of power is that consumed in overcoming the friction of the mechanism, as hardly any loss takes place between the pulsator and the drill.

Coal Cutters.

The cutters used in coal mining are generally of three types, the disc, the bar, and the chain type. Of these ,however, the chain type seems to be most extensively employed in the country. The chain is driven by an electric motor and the whole mechanism is mounted on a truck; the whole machine is automatically moved sidewise from one side of a room to the other, thus completing the cutting in one operation.

The motor is especially designed for this work, and is of the multipolar, vertical, shunt-wound, direct-current type, equipped with a ventilating fan. The armature is built on a spider, making shaft replacements simple and economical. The controller and the interlocking reverse switch are of ample size, mounted on a slate base. The machine is so arranged that electric power can be used for unloading, moving to position at face, loading on truck and moving about the mine,, making a large saving in time and labour over other designs. By the use of an adjustable friction clutch, through which the feed gearing is operated, all danger of overstrains and breakages is removed. The power truck is unusually strong and convenient, requiring the movement of one lever to throw the propelling mechanism in or out of clutch.

Ventilation.

The proper ventilation of deep coal mines is of the utmost importance. Fan blowers of comparatively low speed, or high-speed, low-pressure air compressors are used. For driving fan blowers, either direct-current or alternating-current motors can be successfully used. Where the distribution is by direct current, the motors can be either of the shunt or the compound-wound type, the latter being preferred for very large fans of which the starting torque is great. With an alternating-current system of distribution, induction motors are often used, their advantage being their high starting torque and the possibility of speed variations for changing the air supply. This latter point, however, is not of great importance, as actual practice has shown that the losses in the rheostatic motor control are about the same as the losses due to a mechanical shuttering of the fan. Where fans can be entirely shuttered, the starting torque is not very large; and considering the rather bad effect that an induction motor has on the power factor of a system, the use of synchronous motors is greatly preferred. Where fans are installed in remote places, induction motors would possibly be more advantageous on account of the little attention they require. If possible, the motors should be direct-connected so as to avoid the use of belting, thus insuring more reliable operation and economy in the required space.

On account of the high speed required by centrifugal compressors, synchronous motors are not so well adapted and induction motors would be preferable for this service. Where a compressor is of large capacity and can be installed in the generating station, it may be driven by an efficient steam turbine, eliminating the generator and motor losses.

Breakers and Tipples.

The various auxiliary machines used in breakers and tipples, such as crushers, picking tables, screens, conveyors, etc., are preferably driven by polyphase induction motors, either direct-connected to driving shafts or to individual machines. The absence of commutator troubles, due to the severe vibrations in this service, makes such motors preferable to direct-current motors. The entire omission, or reduction in the number of belts formerly used in this kind of work naturally results in increased efficiency and consequent decrease in operating expenses, while at the same time it greatly improves the safety and reliability of the installation.

Dredges.

While the early types of steam-driven dredges were partly successful, their operation was rendered expensive by the scarcity of available fuel and the cost of handling it. With the rapid development of hydro-electric plants and large central generating stations, together with the increased distances to which electric current could be economically transmitted, it was found that the electric motor afforded a compact, easily controlled, and highly efficient substitute for steam drive; separate motors could be applied either directly or with short belts to the various units of the dredging machmery, and a larger percentage of the input power was thereby directly applied in useful work.

Where many changes were necessary in the type of motor originally applied, before satisfactory results were obtained, motor drive has indisputably proved its superiority to steam drive in cost of both power and maintenance. The modern dredge can now be supplied with motors especially designed for heavy duty, and capable of running continuously without danger, and requiring a minimum of attention.

The standard form of dredge used to-day is the continuous-chain, close-connected bucket type, ranging in capacity from 3 to 13½ cu. ft. The speed of the bucket line varies from 50 ft. (with 18 to 25 buckets) to 75 ft. (with 35 to 50 buckets) per minute, depending upon the condition of the ground. For the operation and control of the bucket line, a variable-speed motor is used. This is located on the lower deck and is belted to a driving pulley, which is generally situated in the rear of the pilot house on the upper deck. The duty imposed upon this motor is severe, as it must operate under conditions calling for power varying from ap-

proximately 75 per cent. overload down to 25 per cent. of its rated capacity.

To keep the dredge in place, move it about, or hold it against the bank when digging, head lines are used, being controlled from the forward end, and generally operated by a 6-drum winch driven by a variable-speed motor. The winch motor, while of smaller capacity, must be of the same rugged construction as the digger motor. It is equipped with a suitable controller and resistance to permit continuous operation at from one-half to full-load speed. It has been found advisable to equip the motors for this service with solenoid brakes, by means of which the motor can be brought to a standstill almost instantly. It is then ready for the reverse operation without the usual reversing of the motor through the controller. This latter method is bad practice, as the sudden reversing of the motor in this way causes a heavy strain on the windings, and may result in a burnout.

The high and low-pressure pumps for supplying water to the screens and sluices are generally operated by a separate motor, direct-connected to each pump. The high-pressure pump is operated by a 720 or 900-r.p.m. motor, and the low-pressure pump with a motor operating at 600 to 720 r.p.m.; each motor is mounted on the pump base and is direct-connected to the pump by a flange coupling.

For driving the primary pump, when priming the large pumps, or for supplying water on the table during the clean-up, a 10-h.p., high-speed motor, direct-connected to a centrifugal pump, will insure economy and efficiency in operation, as the motor, when used intermittently, will consume current only in direct proportion to the work done.

For the operation of either shaking or revolving screens, a constant-speed, belted motor of from 25 to 50-h.p. capacity is usually required, and is generally installed on the upper deck. This motor is similar to that operating the winch and the bucket-line, but is equipped with a small reversible controller, with sufficient resistance in the armature circuit to bring it to full speed in about one minute.

For driving the conveyor belt of the stacker, a 25 to 50-h.p., constant-speed motor, similar to the one used on the screens, is required, located at the end of the ladder, and either belted or connected by silent-chain drive.

Mine Telephones.

Pre-eminently important from the mine operator's viewpoint, in considering telephone service in a mine, is the saving of time and the facility with which orders and messages may be orally despatched to employees stationed in various departments of the workings. The savings to be effected by the use of mine telephones are numberless, and may be readily appreciated when considering the variety of characteristic accidents, such as explosions, water freshets and landslides, which make mining a hazardous business. Mine officials frankly say that the presence of this protection is worth the initial cost of the system, which is repeatedly earned by its reliable performances at just such times as those mentioned. The operation of almost every mine is dependent upon a variety of these uncertain conditions, rendering it almost impossible to anticipate a temporary suspension of work in advance of its actual occurrence. The fact that the superintendent of a mine may remain in his office and be in direct talking communication with every corner of the entire mine system at all times is of such paramount importance that it seems unlikely that any mine owner will conscientiously avoid giving this matter serious consideration.

The cost of constructing the underground line for a mine telephone system is usually less than for surface systems, because no poles are required and there are no holes to dig. A mine telephone system does not require an expert to install, and about all the work required of the mine owner is the placing of the instruments to advantage and stringing line-wire to these points. This single feature of construction is quickly done by running wires through the drifts and down the shafts on standard wood brackets equipped with common glass insulators. In a large number of mines, rope haulage is used to convey ore to the surface. Where such is the case, a metallic signal line is usually run along the side of the entry to transmit signals to the engineer, usually located at the surface. If such a condition exists, it is necessary only to connect any required number of bridging telephones to the circuit, provided by the haulage strand and the signal wire, In this case no expense is incurred beyond the first cost of connecting them at each station. The expense of maintenance is usually very light, because lines under ground are not subject to atmospheric conditions that are present outside, and trouble from lightning is, of course, unknown.

Although ordinary, iron line-wire has been used with success in some mines, the safest construction can be furnished at little additional cost by substituting rubber-covered wire for all underground circuits which are in any way subject to moisture or dampness from contact with fresh earth or with timbers. In some conditions it has been considered good practice to use lead-covered cable; providing the installation warrants the expense. In any event, this part of the equipment should not be slighted, and the best is always the cheapest. By installing cable an increased degree of certainty is assured.

Lighting.

The electric system of lighting, for general illumination, is too well known to need any comment. The problem of making a satisfactory miner's hat lamp to supersede the present oil lamp, which will always remain a constant source of danger and discomfort, has for many years been the aim of a number of inventors, and numerous designs of more or less value have been put on the market. One type, which has just been developed, promises to be a great improvement in this line.

This lamp consists of a miniature tungsten unit operated from a light, portable, storage battery. It is rated at one mean horizontal candle-power, but by an effective reflector, as high as 5 c.p. is obtained in the beam of light at a distance of 4 or 5 ft. The lamp socket consists of a hard, moulded compound, unaffected by moisture, acid or gases, which completely encloses and protects all metal parts. The steel reflector, which is enameled both inside and outside, is also supported from the lamp socket. The complete lamp is compact, light in weight, and mechanically strong. It is designed to replace the old type of oil lamp, now in general use, without any modification to the cap.

The storage battery is portable, designed to be carried either on a belt or from shoulder straps, or by a handle, as a lantern. The cell is protected by a japanned steel case with an acid-proof moulded cover. The terminals are brought out through an acid and moisture-proof receptacle, from which an armor-braided,

rubber-insulated cable connects to the hat lamp. The battery has a capacity of 10 ampere-hours, and is of sufficient size for operating a lamp 12 to 14 hours. When used as a hand lantern, the lamp socket and reflector are removed from the cap receptacle, and inserted into the receptacle on the side of the battery.

HYDRAULIC MINING IN BEAUCE COUNTY, QUEBEC

Between the years 1875-1885 gold to the value of over two and a half million dollars was recovered from the gravels of the Chaudiere River and its tributaries. The gold-bearing area is included in a stretch of country extending for 20 miles long by 10 wide from the Des Plantes River, below the village of Beauceville, to Trout creek, above Chaudière Falls. Hydraulic operations were initiated in 1882, but were discontinued in 1884. Rather over two years ago the Champs d'Or Rigaud-Vandreuil acquired the mining rights over 72,000 acres in the Seigniory Rigaud de Vandreuil, and under the direction of Mr. Fritz Cirkel prospecting, by drilling and shaft-sinking methods, was inaugurated. The result of this work proved, so Mr. Cirkel asserts, the existence of workable gravels along the upper Gilbert River, the lower reaches of the Des Plantes River, and the lower Ruisseau des Meules creek. After due consideration and investigation a site on a lower reach of Ruisseau des Meules was selected for the establishment of plant and machinery. The equipment includes a mechanical elevator (capacity 3,672 cubic yards per 24 hours. This elevator is electrically driven, the power being generated at works 1½ miles distant, situated on the line of the Quebec Central Railway. A sluice box, the length of which is 850 feet, has also been built. The water supply for hydraulicing operations is conveyed a distance of 7½ miles from Fortier and Carter lakes, the main outlets of which have been dammed, thus providing for the storage during the summer season of 30,000,000 cubic feet of water. The elevation of the lakes in relation to Ruisseau des Meules creek is 335 feet. The ditch from the lakes to the workings in part cut through solid rock. For the first 3,200 feet the grade is 1 to 800, and for the rest 1 to 600, affording a head of 275 feet. The ditch, it is estimated, will carry 2,000 miners inches. The length of the pipe line (of wrought iron) is 2,600 feet from the penstock to the works below, and 3,500 feet to the end of the sluice box. Three giants (4-inch nozzles), one employed for driving, another for cutting, and the third for stacking tailings, are in use.

The First Run at Beauce

The gold is prevailingly confined to the gravels' beds directly overlying bed-rock. These beds range from two to nine inches in thickness and consist of a yellow sandy-clay material containing pebbles of the country rock. The beds are overlain by (in ascending order) heavy boulders, 2 feet; fine blue clay, 1 foot; glacial boulder clay, 10 to 12 feet; "bouldery" gravel, 3 to 4 feet, and, on the surface, drift-material, 10 feet. Usually the gold is concentrated near bed-rock; although nuggets ranging in value from $12 to $27 were found last year above the glacial boulder clay.

A part of the ground, notably that on which the plant is situated, is covered with tailings from earlier opera-

tions. This, notwithstanding, a trial clean-up last summer, yielded results equivalent to 37 cents per cubic yard from 2,600 yards of tailings. A second clean-up

Hydraulic Plant at Beauce

in August, 1911, from 16,600 cubic yards, representing in part tailings and in part virgin ground, yielded 42 cents per yard.

The width of the pay alluvial immediately in front of the elevator is 100 feet; at 300 feet distant, it is 16.5

Drill Prospecting at Beauce

feet; and at 1,800 feet from the elevator, as so far ascertained, the width is about 400 feet. The large nuggets hitherto found have been obtained either from bed-rock or from the gravel immediately overlying it. At the last clean-up the largest nugget recovered represented a value of $292.50, while other nuggets recovered at the same time were valued at $171.60, $98.47, $76.93, $43.39, $35.22, $30.17, and $18.16, respectively.

THE PRESERVATION OF MINE TIMBER.

The United States Forest Service has recently issued a bulletin containing much valuable information, on the above subject. Timber, as is well known, is exposed to destruction from many sources, the chief of which, however, are decay and insect attack. Natural decay may be combated. While, under certain conditions peeling and seasoning often increase the durability of timber, chemical preservatives are said to yield the better results. Before treatment, however, the timbers should be peeled, preferably seasoned, and cut and framed to their final dimensions and form. Since the sawing and cutting of treated timber will more probably leave untreated surfaces, which will be subject to insect attack. The several preservative methods are described and discussed. Of these, there is first the application of two or three coats of hot creosote or some similar preservative. This has the advantage of being tolerably effective and inexpensive; but the effectiveness is dependent on the seasoning of the wood before treatment, otherwise checking may later expose untreated portions to fungus attack. Care must, moreover, be taken that the preservative penetrates all checks, knotholes, and covers all surface inequalities. This method is advised when there is no great amount of timber to be treated, or when it is necessary to restrict the initial cost to the lowest possible figure. The main disadvantage of the method is that the penetration of the preservative is not sufficient to insure the protection of the timber for any considerable period. A more effective, but more expensive process is that known as the "open tank method." The timber is first immersed in a tank, of suitable capacity, containing the preservative, the charge being then heated to a sufficiently high temperature to drive off a portion of the air and moisture contained in the wood. The maximum temperature, in the case of creosote oils, should not, however, exceed 220° F.; and, if an aqueous salt solution is used, should be kept slightly below the boiling point of the solution. Following the hot bath the timber is again immersed in the preservative, now at a lower temperature; or it may be left in the hot liquid, which is allowed to cool.

A third method of treatment is that of pressure, which, because of the difficulty of impregnating certain species of wood by the open tank method, is usually preferred. The essential feature of the pressure process is that reliance is placed on atmospheric pressure to secure penetration of the preservative. Woods that may be treated satisfactorily by the open-tank method are thoroughly seasoned lobcolly, pitch pine, and seasoned yellow pine. Heart Douglas fir is impregnated with difficulty.

In the matter of apparatus and costs, the open tank is cheaper than the pressure plant to instal, but the unit cost of handling timber is higher. The equipment in the former case merely consists of an uncovered tank provided with a device for submerging the timber. The tank may be so arranged to permit of the building of a fire beneath it, but if a supply of steam is available, the provision of coils is advised in preference. Such a plant, with a treatment capacity of 100,000 cu.

ft. may be erected at a cost of from $1,500 to $2,500. The cost of a pressure plant is, of course, dependent on its capacity, but as a rough guide, a plant, it is estimated, with a capacity of 750,000 cu. ft. per annum, will cost from $12,000 to $20,000. The cost of treating timber by the open tank method is usually from 3 to 4 cents per cubic foot; and by the pressure system from 2 to 3 cents, exclusive of the cost of the preservative, which is the important item. This latter may range from 12 cents to $2.40 per set of timber, according to the character of the preservative employed and the method of application. Thus coal-tar creosote, the price of which is given at 8 cents per gallon if applied by brush, will represent a cost of 12 cents to the set; if impregnation methods are followed, the cost per set is increased to $2.40. Employing avenarius carbolineum the cost for brush treatment is $1.05, while impregnation with zinc chloride costs per set 52 cents only.

The results, among others, of experiments demonstrated (1) that the life of untreated timber was from 1 to 3 years, while that of brush treated timber was given 3 to 4 years. (2) Brush treatment with avenarius carbolineum was somewhat more effective than similar treatment with coal-tar creosote. (3) The condition of timber treated by the open tank process with sodium and magnesium chloride, although not comparing favourably with that of timber similarly treated with other preservatives, was better than that of the brush-treated timber. (4) Open-tank treaetments of green timber with zinc chloride proved fairly effective, but the tests indicate that better results will be secured with seasoned material. (5) With few exceptions, none of the impregnated timbers showed signs of decay after from 3 to 4 years' service. (6) Mine timbers impregnated with zinc chloride and creosote oils have given the best results, and so far no difference in their durability has been noted. It is concluded that not only will proper preservative treatment result in a direct saving in money, but less timber will be required for any given working. Furthermore, the use of treated timber makes it possible to utilize many of the inferior, and more rapid growing species, which, while possessing most of the requirements of high-grade structural timber, lack durability. For treated timber of these species has in many cases proved more serviceable than high grade untreated material. Thus in our own provinces of Alberta and British Columbia, Douglas fir which is now extensively used, may be replaced by treated hemlock, larch, or western pine, the higher grade timber being thereby conserved for purposes to which it may be utilized to greater profit.

CORNISH TIN MINING

(From a London Correspondent.) London, July 6th, 1912.

The tin mines of Cornwall are famous all over the world, and it is an oft-told story of how the industry goes back to the Roman times. It was, however, in the sixteenth century that the first charter was granted to tin-getters and the mineral has been got out continuously ever since. Copper is also found, and figures show that from 1726 to 1855 the copper ore produced in Cornwall and the sister county of Devon realized over $250,000,000. Some silver has also been won. The names are recorded of more than 1,600 Cornish mines that have been worked at one time or another. Just when the industry appeared to be on the verge of extinction the big rise in tin started. Many of the old mines were revived, and fresh capital poured in. Much elaborate plant has since been erected. Upon the whole the industry is not a good one nowadays, and it is left to a few mines to keep the banner of prosperity waving, and it is an old saying that whatever the price of tin Dolcoath (the premier Cornish tin property) has been able to make a profit.

The Dolcoath mine, after a long and prosperous career during very much of the eighteenth century, was shut up in 1783. After that, however, the steam engines introduced into Cornwall by Boulton and Watt now came to the assistance of those mines which, owing to their increasing depth, were severely handicapped, both as to pumping and winding.

In 1799 Dolcoath once more became a mine in being and has never ceased production either of copper or tin since, although it has had its times of slump. Dolcoath was worked in the eighteenth century to a depth of 160 fathoms and produced copper to the value approximately of $6,250,000. From 1799 to 1836 dividends were paid out of profits on copper to the amount of $787,705. After this the returns fell off and the bottom workings, over 200 fathoms below adit, were given up and remained under water until 1846. The position then became so critical that Lady Basset, who had succeeded her father, Lord de Dunstanville, as the owner of the estate, employed Captain Joseph Vivian, then manager of North Roskear Mine, to inspect and advise as to the future working. He recommended draining the deeper levels, and the resumption of development below. This was the most interesting event in its history. Acting on the advice of these experts, the water was drained to bottom, resulting in the discovery that where the copper failed, tin began to be produced, and this ancient copper mine has ever since remained a tin mine.

But a copper mine is not provided with the plant essential to the efficiency of a tin mine. Some six years elapsed before Dolcoath adventurers began to reap the profits of their new outlay on stamps and dressing floors. From 1852 onwards till near the end of the century the mine continued to return enormous quantities of tin and generally to show handsome profits. It was a cost book company and, unfortunately, the system of finance was not judicious. At the same time, for instance, that dividends were being paid the bankers of the company were receiving as much as $6,000 a year for overdraft and commission. Credit was taken for supplies from merchants and discount for cash was sacrificed. There was no reserve to fall back on in a rainy day. As will happen, the rainy day came. A run of ground occurred by which a number of men lost their lives and it was evident that a spirited outlay was needed if the mine was to be saved. Then those shareholders who had clamboured for big dividends were not prepared to find the money to carry out work which should have been done long before and found, and to do this it became necessary to reconsti- paid out of previous profits. Fresh capital had to be

tute the company under limited liability. That transformation was accomplished in 1895, and a new financial regime commenced.

From 1799 to 1895 the minerals sold were as follows:

Copper ore	$11,642,285
Tin ore	17,860,895
Arsenic, silver cobalt, etc.	115,795
Total.	$29,618,975
The dividends on copper, 1799 to 1836, were	$ 787,705
" " tin, 1853 to 1894, were	3,780,940
Total.	$4,568,645

It is believed to be without precedent that a mine of this extent, and one which has weathered such changes of fortune, should have remained for three generations under the control of successive members of the same family, the present able manager, R. Arthur Thomas, being a grandson of the late Captain Charles Thomas, who was appointed manager nearly seventy years ago.

What Dolcoath has achieved since it became a joint stock enterprise in 1895, with a nominal capital of $1,750,000, in $5 shares, is shown by the fact that in the last sixteen years the black tin sold realized a sum of nearly $11,250,000—$11,184,239 to be exact—and the shareholders received a total of $1,477,060. The dividend total has already been raised to well over $1,500,000.

Dolcoath must not be judged solely on its dividend record. Had the policy always been to distribute profits up to the hilt—as it, apparently, was in the old days—the company's record under limited liability would have made a much better showing. Instead of this, a reserve fund was built up, and new works have been carried out, which are of the greatest importance to the stability of the mine. Chief among these new works is the Williams shaft, the largest and deepest shaft in Cornwall, if not in the British Isles. This has been completed only quite recently, and the full benefit of it has yet to be felt. It is a vertical shaft 3,000 feet in depth, and has, with its equipment, cost the company well over $500,000. Electric haulage, electrically worked pumps and tilting bottom cages for automatically unloading are features of this important piece of work. Three cross-cuts connect the old mine workings with the new shaft, but eventually this shaft will be treated as the centre of a new mine, and levels will be started in new ground on the lode at the bottom of the shaft.

In addition to the sinking and equipment of the new shaft the ore treatment plant has been undergoing reorganization. Old stamps have given place to new and electric power has been adopted in this connection also. The Cornish stamps have been dismantled and Holman's pneumatic stamps installed, additional vanners have been procured and sundry other additions to the dressing plant have been made. All these changes and additions have been effected without materially interfering with the regular production of the mine.

PERSONAL AND GENERAL

The resignation of Mr. Waldemar Lindrgen, chief geologist of the United States Geological Survey, is a great loss to that service, but a corresponding gain to the Massachusetts Institute of Technology, to whose geological department he will be now attached.

Mr. H. Westergaard, recently of Johannesburg, has accepted a position with the Canada Sluphur Ore Company, Queensboro, Ont.

Mr. Kirby Thomas, mining engineer, 20 Broad street, New York, spent several days in Toronto last week.

Mr. J. M. Clark, K.C., has gone to England.

Mr. Frank C. Loring, mining engineer, Toronto, is in London, England.

Mr. W. L. Bell is now superintendent of the British Columbia Copper Company's smeltery at Greenwood, Boundary district, B.C., having two or three months ago succeeded Mr. F. J. Longworth in that capacity.

Mr. M. S. Davys, managing director of the Silverton Mines, Ltd., operating the Hewitt-Lorna Doone group, in Silverton camp, Slocan district, has again arrived in British Columbia from England. Before returning to the Old Country he will spend several months investigating development conditions at his company's mine, and will also look into the concentrating-mill requirements, with a view of arranging for the provision of concentrating facilities in place of those heretofore possessed at the leased Wakefield mill, which has been destroyed by fire.

Mr. W. J. Elmendorf is now practising as a consulting engineer, with headquarters in Victoria, B.C.

Mr. E. Hibbert, superintendent of mines for the British Columbia Copper Company, whose method of breaking down very large quantities of ore in that company's Mother Lode Mine, in Boundary district—using as much as 11 tons of explosive at one time—has attracted considerable notice; he has lately been giving attention to the underground exploration of mineral claims in Voigt's camp, where the company holds a large group under option of purchase and on which five diamond drills are being used, as well as ordinary development of the copper-ore occurrences being done.

Mr. Edwin C. Holden, of the University of Wisconsin, Madison, Wisconsin, U.S.A., who is professor in charge of a party of students spending the summer at the Bunker Hill & Sullivan mines, Kellogg, Idaho, early in July paid a visit to Nelson, B. C., to renew old friendships and acquaintances, he having some years ago been on the engineering staff of the Ymir Gold Mines, Ltd., at that time operating a gold mine, 80-stamp mill, and cyanide plant near Ymir, Nelson mining division.

Mr. Frederic Keffer, of Greenwood, B.C., has been appointed acting general manager for the British Columbia Copper Company, Ltd., in place of the late Mr. E. G. Warren. In the summer of 1896, Mr. Keffer went to the Boundary district of British Columbia to prospect several mineral claims, among them the Mother Lode, which was partly developed by the Boundary Mines Syndicate. In May of 1898, the British Columbia Copper Company was organized to acquire the Mother Lode, and Mr. Keffer was its first manager. Six or seven years later, the company, having meanwhile built up an important copper mining and smelting industry, at his own request, Mr. Keffer was re-

lieved of the business management and allotted the duties of geologist nad mining engineer, which have ever since kept him fully occupied. Now the president of the company has directed him to be acting manager. It is not known in the West who will be appointed general manager, but meantime the company is mining and smelting copper ores to the full capacity of its smeltery at Greenwood.

Mr. A. G. Larson, of Vancouver, B.C., in his capacity as consulting engineer, recently examined the Lucky Jim zinc mine, at Bear Lake, Slocan district. Deep-level development work is being done in the Slocan Star mine, near Sandon, as advised by Mr. Larson, who regards the prospects favourable for permanent mining at several properties in Slocan district.

Mr. A. F. McLaine, president of the Traders National Bank, Spokane, Washington, has been re-elected president of the Rambler-Cariboo Mines, Ltd., which company owns one of the most important and productive of the Slocan mines.

Mr. B. L. Sackett, formerly of the Granby M. S. and P. Company's engineering staff at its smeltery at Grand Forks, B.C., and who went thence to the Cerro de Pasco Mining Company's property in Peru, is stated to have been appointed to a position with the Granby Company at its Hidden Creek mines, Alice Arm camp, Observatory Inlet, B.C.

Mr. Alex Smith, who returned to New Denver from Toronto in the spring, and who has been manager of the Surprise mine, near Cody, Slocan, for years, recently completed a long raise from the extension of one of the Last Chance tunnels to the old workings of the Surprise. The bottom of the old workings is about 300 feet from the surface, and the distance driven in making the connection is between 800 and 900 feet. Ventilation having been provided for, stoping, ore will now be practicable.

Mr. Frederic R. Weekes, mining engineer, of New York, has spent the summer at Voigt's camp, near Princeton, Similkameen, B.C., in the interests of clients who are providing money for development of mineral claims there held under option of purchase.

Mr. Roscoe Wheeler, superintendent of the Hedly Gold Mining Company's 40-stamp mill and cyanide plant at Hedley, Similkameen, B.C., has been visiting other stamp mills, investigating their milling practice and gold-saving appliances.

Mr. Thomas Horne has resigned as manager of the McGillivray Creek Coal and Coke Company's coal mine, in Blairmore district, southwest Alberta. He intends visiting Scotland. Mr. George Kellock, who hase been for some time with the International Coal and Coke Company, which operates the adjoining property to that of the McGillivray Creek Company, has been appointed successor to Mr. Horne.

Dr. Henry M. Payne, who last May left New York for Alaska and Yukon, to visit the Klondike and other gold fields in the North, is expected to return south about the end of the summer.

Mr. J. L. Retallack, managing partner in the syndicate owning the Washington mine, Slocan, B.C., is quoted in the "Annual Report of the Minister of Mines," recently issued, as having stated concerning the Washington mine: "The total amount of development carried out in the past two or three years is approximately 3,000 feet. We have developed in this mine about 40,000 tons of concentrating ore, containing, say, 5 to 6 per cent. lead, 20 to 25 per cent. zinc, 2 oz. of silver to the unit of lead, and 0.25 oz. silver to the unit of zinc. We are awaiting the provision of transportation and milling facilities to be able to turn this ore to profitable account."

Mr. Raymond Brutinel, who is associated with a number of important coal and other undertakings in Alberta and Northern British Columbia, has returned to Canada from Paris, where he spent the winter.

Mr. J. M. McSween, formerly interested in the development of the oil shale resources of New Brunswick, is now general manager of the Arminus Chemical Company of Mineral, Va.

The National Steel Car Company, Limited, was organized in July, with a capital of $6,000,000, consisting of $3,000,000 of 7 per cent. cumulative preferred shares and $3,000,000 ordinary shares. The present issue comprises $1,500,000 preferred and $2,000,000 ordinary shares, all of which have been subscribed. The head office of the company will be in Montreal, and works will be established at Hamilton. The company will be under the management of Mr. Basil Magor, formerly president of the Magor Car Company of Passiac, New Jersey.

TECHNICAL LITERATURE

COAL.

Coal Mining in New Zealand.—The Colliery Guardian prints an abstract of the report, just issued, of a Royal Commission appointed last year by the New Zealand Government to enquire into various questions connected with safety and health in mining, with a view to legislation thereon. Respecting the prevention of accidents, the Commission suggest that to meet the requirements of local conditions a committee, consisting of the mine manager, the inspector of mines, and a nominee of the miners should be appointed for each mine, with power to make, alter and from time to time to amend special rules. It is further recommended that Government inspectors of mines be required to pass a special examination, higher than that of mine manager before appointment; that inspectors should have summary power of prosecuting in all cases affecting the safety of workers in mines, and be given power to withdraw men from dangerous places in mines. There are numerous recommendations regarding the employment of deputies and workmen. It is held that a coal miner should have experience in coal-hewing and timbering before he has charge of a place; also that the minimum age at which a miner shall be put in charge of a place be 21 years. High pillar-working has been such a fruitful source of accident, that the Commission recommend that the lifts in pillar workworkings be restricted to 10 feet in height, and that the inspector of mines shall determine the height at which the remaining coal shall be taken out, subject to the right of appeal from his decision. Respecting timbering, it is advised that the maximum width of

boards and cut-throughs, where the board-and-pillar system is followed, should be 12 feet and 9 feet, respectively, for a distance of two yards when opening out or breaking away; thereafter that the maximum widths be 18 feet and 12 feet, respectively. The use of all three-cornered bars or caps in set timbering be prohibited, and no timber should be withdrawn except by lever and chain or by blasting.

In respect of haulage, a number of provisions are made, the chief being the prohibition of chains on all but face jigs, and the substitution of wire rope therefor. In other directions the Commission, it is evident, have endeavoured to bring the New Zealand enactments in line with the new Coal Mines Act of Great Britain, although some of the requirements would appear to be even more rigorous. Thus, the suggestions of the Commission that the use of electricity should be prohibited in any place in a mine where the proportion of inflammable gas in the air exceeds 0.5 per cent. seems to be excessively severe. The Commission concludes that no new Mines Act is necessary in New Zealand, and that all the recommendations of the Commission can be made operative by means of amendments to the Acts now in force.

Accidents from Explosives.—The annual report of H. M. Inspectors of Explosives (Great Britain) for the year 1911, just issued, states that the number of accidents by fire or explosion during the year was 515, causing, so far as is known, 56 deaths and injuring 548 persons. The total number of accidents shows an increase, namely, 515 against 450, and is above the average (401.1) for the last ten years.

Monel Metal and Corrosion.—Mining Science states that recent experiments made at the laboratory of the Board of Water Supply, New York, indicate that monel metal possesses about the same resistance to corrosive action as the better known bronzes, while it had the additional advantage that it presented the least change in appearance as result of the corrosive action. Specimens of several bronzes, monel metal and steel were weighed and imbedded in rich earth, which was kept wet for six months by periodical additions of very dilute solutions of corrosive salts. At the end of the test period all of the specimens were unearthed, scrubbed, dried and weighed to ascertain the comparative loss from corrosion. The percentages of loss were as follows: Phophur bronze, 0.19; tobin bronze, 0.11; monel metal, 0.12; Parsons manganese bronze, 0.12; Munts metal, 0.33; steel, 1.04.

The Danger of Coaldust in Mines.—On the occasion of the recent annual meeting of the Institution of Mining Engineers, the president, Mr. W. E. Garforth, took as his text for his presidential address the danger of coaldust in mines and the means that might be taken to minimize this danger. It is a subject on which he is eminently qualified to speak; in fact, Mr. Garford is the recognized authority on coaldust problems. Referring to the series of experiments conducted at Altofts, he stated that these demonstrated the efficiency of the stone dust remedy, "stonedust" being "argillaceous shale" dust. The experiment confirmed, moreover, the opinion that an explosion would continue to be propagated wherever there was a full supply of coaldust, and great destruction would result, but that it would rapidly die out on roads where stonedust was present in abundance. The positive action of the stonedust in limiting the extent of the explosion by rendering the coaldust non-explosive, results also in decreasing the amount of deleterious gases formed. Inasmuch as it is estimated that 80 per cent. of the deaths in a colliery explosion are caused by carbon-monoxide poisoning, the importance of preventing the distillation of coaldust and the formation of poisonous gases cannot be overestimated. But the proof of the value of stonedust would be of mere academic interest unless the remedy can be easily and cheaply applied, without interfering with the health of the workmen or inducing any fresh danger. At the Altofts collieries the method has been in use for three and a half years. There stonedust is strewn wherever there is coaldust; that is, on all the mechanical haulage roads, the neighbourhood of junctions where tubs bump against each other, etc. Twelve and a half miles of such roadway have now been treated. The stone is very finely pulverized on the surface, sent down to the workings and distributed by hand by boys with their backs to the ventilating current to prevent unnecessary inhalation of the dust. Near the pit bottom and main junctions the first dressing of stonedust is sufficient to fill up all the ledges and crevices. It is not then so easy for more coaldust to be deposited. Where screens are situated near the downcast pit and coal dust is carried into the mine from the surface extra heavy dressings are applied. Directly the stonedust surface is overlaid with a film of coaldust, a brush or "brush-rake" is passed over the surfaces exposing fresh stonedust, but without fresh dust being used. When this surface has again been overlaid by coaldust, then a fresh dressing of stonedust is applied. Much of the coaldust dislodged by the stonedust falls to the ground and is overlaid by the excess of the stonedust falling from the roof and sides. This system of frequent stone-dusting is carried out wherever the deposit of coaldust is rapid. On the ordinary haulage roads the dressings of stonedust do not need to be so frequent, and the system is modified accordingly. But in all cases as soon as a roadway loses the grey appearance of the stonedust and assumes a darker shade of coaldust, fresh stonedust surfaces are exposed or the stonedusting is renewed. Many ways of applying stonedust have been tried, but none have proved so successful as applications by hand. Experience, moreover, has shown that a small proportion of the stonedust should consist of coarser particles to give it sufficient body to enable it to be thrown with the requisite force against the upper ledges of a roadway, thereby displacing the coaldust. The application of stonedust by compressed air jets leaves something to be desired in that generally the coaldust is not removed by the stonedust, is deposited irregulrarly.

The frequency of the renewal of stonedust dressings will depend on local conditions, and it is necessary to clean up the excess of mixed dust from time to time. During the first twelve months practical application of stonedust in mines at Altofts the cost was ascertained to amount to only one-eighth of a penny (one-quarter of a cent) per ton of coal raised; and since then this cost has been materially reduced.

Stonedusting will undoubtedly prove of great benefit in those mines where electricity is installed. There is no objection to the use of stonedust where electricity is used, even if falls of roof occur resulting in injury to cables and open sparking; no explosion would result where the stonedust is properly applied, inasmuch as the stonedust would be present with the coaldust and form a non-explosive mixture.

LEAD POISONING.

Mr. James O. Clifford contributes an extremely valuable and illuminating article to the last issue (July 6th) of the Mining and Scientific Press on plumbism, its systems, effects and prevention. It is a subject that is worthy of greater study than has been heretofore given to it in this country, and we would commend Mr. Clifford's conclusions to the attention, in particular of lead mine operators and miners in East and West Kootenay, where this industry is an important one, and the disease not uncommon. Of the symptoms of plumbism, one of the first is the peculiar anemic appearance of the patient, accompanied by a disagreeable metallic taste in the mouth, a feeling of sickness, and there is a tendency to vomit, disturbed digestion, poor appetite, obstinate constipation, and a sense of fatigue disproportionate to the energy expended are additional symptoms, while a severe pain develops in the abdomen, accompanied by vomiting, swelling of the gums and severe headaches often accompany these symptoms. The effect of lead poisoning varies with the constitutions of the individuals attacked, but common results are: Lead blindness, temporary loss of hearing, smell and taste; stimulation into activity of neurosal tendency, loss of teeth, accompanied by serious ulceration of the mucous membranes of the mouth; continuous headache, dizziness, sleeplessness, tinkling in the ears, and weakening of will and intellect; chronic constipation, and paralysis of the hands and feet. In consequence of the structural changes of organs for which it is responsible, lead poisoning may be an immediate or contributary cause of death. In the prevention of plumbism cleanliness of the individual and work places is of prime importance. Lavatories with a sufficient supply of hot and cold water should be provided, and daily bathing encouraged. In dusty atmospheres, respirators should invariably be used. Food should not be eaten at any time or at any place until after the face and hands have been washed, and the mouth and throat rinsed thoroughly with an alkaline mouth-wash such for example as 0.2% solution of sulphite of soda. The use of alcoholic liquors and tobacco should be prohibited. Employees should never begin the day's work without first partaking of food. Perfect ventilation should be established in all places where there is danger of dust of fume. Employees should take care to keep the bowels open. Proper foods rich in fats, (and in this milk is included), have an unquestionable preventive value. The most effective protection against the disease are cleanliness and sobriety. Medical examination of employees once or twice monthly should be made compulsory. It is stated that some companies provide tabloids containing 5 grains of hyposulphite of soda to be taken by employees once daily.

Attention is directed to the regulations in force for the protection of employees in the lead industries, notably those of Great Britain, Germany and France. In Great Britain, in particular, the regulations are rigid and include a provision that employers shall provide respirators for men engaged in such work as cleaning flues, while disregard of the rules by employees is punishable by law. This is an important provision for, as is well known, the main difficulty in the endeavour to protect employees from diseases is to ensure their cooperation in the measures provided to that end.

GRANBY COMPANY'S HIDDEN CREEK MINES

(From the "Annual Report of the Minister of Mines," British Columbia, 1911.)

The following report on the Hidden Creek Mines, at Goose Bay, Observatory Inlet, B.C., was made by Mr. Donald G. Forbes, mining engineer, of Victoria, B.C., who, acting under instructions from the Hon. the Minister of Mines for British Columbia, made an examination of the property.

"The Hidden Creek mines, owned and operated by the Granby Consolidated Mining, Smelting and Power Company, are situated in the eastern foothills of the Burniston range of mountains, which rise to an elevation of 5,710 feet, and at this point separate Portland Canal from Observatory Inlet. Goose Bay can be reached from the town of Prince Rupert by steamer in about ten hours. The Dominion Government telegraph line to Stewart passes through the property, and an office has been opened at the landing with a resident operator, appointed by the Dominion Government.

"**Geology.**—The rock formation in which the orebodies occur may be best described as an argillaceous schist; it has been subject to very considerable alteration, and in some places the fissile structure of the argillaceous bands has disappeared and the rock appears to be massive. This rock formation can be traced for several miles along the shore of the inlet to the adjacent islands, and extends nearly to the summit of the mountains to the west of the property, where the Coast granites are found. The ore-bodies are at some points cut by intrusive dykes, but these dykes have no influence on the nature of the ore, nor on its commercial value.

"**Description of Ore.**—The ore consists for the most part of massive iron-pyrites, with some pyrrhotite, chalcopyrite and a little bornite, containing small quantities of gold and silver. In some portions of the orebodies both iron and copper pyrites occur in a quartz gangue, while some lime and a little alumina can be found associated with the ore at most points. The gold and silver vary with copper contents of the ore; with a two per cent. copper, together they equal about $1 per ton, and increase in about the same proportion as the copper content advances.

"**General Characteristics of Orebodies.**—Two main orebodies have been proved to exist on the property; both appear to dip to the west, or toward the main range of mountains. Sufficient exploration work has not yet been done to definitely determine the extent or nature of these deposits. At present the eastern orebody, known as No. 1, looks as if it would prove to be a large lens; it has been proved for a length of more than 700 feet in a north and south direction, and its width, with both the northern and southern ends of the workings still in ore, is not less than 180 feet. The No. 2 or western orebody appears to be in the form of a chimney, roughly 500 feet in diameter, but, like No. 1, its limits have not been definitely determined.

"**Development Work.**—A considerable amount of

open-cut work has been done on the surface of both orebodies, at an elevation of from 600 to 900 feet above the sea-level, and several short tunnels have been driven. These workings were all covered with snow and could not be inspected at the time of my visit. This work definitely proved the existence of large bodies of ore, but was of little value for economic mining or in determining the value of the orebodies; it had therefore been decided to drive a working tunnel into the hill at an elevation of 530 feet above sea-level, to cut both deposits.

"**The 530-Foot Level.**—This level has been driven from the southeast side of the hill and has cut the two orebodies, known as No. 1 and No. 2.

"No. 1 orebody was cut at 355 feet from the portal of the tunnel, and the tunnel passed out of ore at 555 feet, and was continued northward through country rock, No. 2 orebody being cut at 805 feet.

"Development has been vigorously pushed forward on No. 1 orebody; the best ore has been located by surface work to the south of the main tunnel, and it has been proved in that direction, at this level, for 600 feet, the faces of the drifts being still in ore. Diamond drills have been extensively used in prospecting work, and, where the drill-holes have afterwards been drifted out, the assay value of one from the drifts has corresponded as nearly as could be expected with the assay results obtained from the drill cores.

"Considerable diamond-drill work has been done below this level, and tends to show that the orebody exists and maintains its value to the next level (elevation 385 feet), while one hole, No. 12, has been carried down at an angle of 45 degrees, to sea-level and left off in 11 per cent. copper ore.

"In No. 2 orebody drifts Nos. 4 and 5 have been driven north and west from the main tunnel; the face of No. 4 is still in ore, while No. 5 broke through to the surface, all in ore. Drill-hole No. 16 is also in ore, thus proving an ore chimney of considerable size, the actual limits of which have not yet been determined. Development work is still being pushed forward, and is at present being confined principally to No. 1 orebody, 60 men being employed underground.

"**The 385-Foot Level.**—This level is being driven with a view to cutting both orebodies, and will be used as the chief working tunnel, the ore from the upper workings passing through it to the crushers and bins, which will discharge at 100 feet above sea-level to the conveyors of the smelting plant, which it is proposed to erect near the beach at Goose Bay.

"**Ore Reserves.**—At the present early stage of development it is not possible to give complete and exact estimates to the 'ore in sight' in the mine and its value, but it may be safely stated that there is available for extraction above the 530-foot level not less than 4,500,000 tons of ore, containing 1.8 per cent. copper and a combined value of $1 in gold and silver. The management also states that it has sufficient 4 to 5 per cent. ore 'in sight' that could be sent to a custom smelter, to more than repay the expenditure on the property, in the event of a smelter not being erected. Up to date no ore has been shipped by the present company. Ten cubic feet of ore in place are reckoned to the ton.

"**Mining.**—The cost of extracting ore from these mines should be very moderate; the ore is massive in character and the country rock very solid, so it will be practicable to remove nearly all the payore between the levels, only sufficient being left in place to keep them open. Very little timber will be required, except for chutes. The ore varies much in toughness, in some places drilling and breaking well with machine drills, while in other parts progress is slow.

"**Machinery.**—The present machinery equipment of the mine consists of a 14 x 22-in Rand duplex air-compressor, driven by a Pelton wheel, and a small electric generator driven by a turbine, used for lighting purposes, both of which are located at sea-level. At the mine, a small hoist, used on surface tramway to bring supplies from the 385 to the 530-foot level, a drill sharpening machine and one diamond-drill, and as many rock-drills as the capacity of the compressor will allow, are in use. A small sampling-mill is being erected. Plans for the erecetion of a smeltery and converter plant, having a capacity of 2,000 tons of ore a day, are being considered, but it is probable that the whole plant will not be erected at once.

"Sufficient water power for all purposes is available for the greater part of the year, but an auxiliary steam plant will be required during the winter months, for the creeks, being glacial, run low for several months in winter.

"Sufficient timber for mining purposes can be obtained in the neighbourhood, but being all spruce and hemlock it makes poor fuel, and coal will be probably used for the steam plant.

"The property being situated close to salt water, the working conditions are as favourable as can be obtained in this province, and I consider the property a mine of great promise; in fact, the best that I have seen in British Columbia for many years.

"My thanks are due to the management, who placed their plans and the data they had collected at my disposal for the purposes of this report.

"The following results were obtained from samples handed to the Provincial Government assayer. The samples were taken with a view to showing the class of ore in No. 1 and No. 2 orebodies, and were not intended to represent the average value of ore in the mine:—

SAMPLE OF ORE	Gold, oz. per ton	Silver, oz. per ton	Copper, per cent. wet assay
No. 2 orebody, No. 4 drift...	trace	0.40	1.87
No. 1 orebody, No. 10 drift..	"	0.44	1.76
No. 2 orebody, No. 6 drift...	"	5.56	8.62
No. 1 orebody, No. 2 drift...	"	1.50	7.50

(Note.—It should be remembered that the foregoing report deals with conditions as Mr. Forbes found them when he visited the property last winter. Since then six or seven months' development work has been done. While the management is confident there is more than 5,000,000 tons of ore already "in sight" in the mines, and a fair proportion of this containing more than two per cent. copper, it has not been found as a general result that the ore contains more than $1 in gold and silver to the ton of ore, not even where the copper content is comparatively high. While there has been authorized by the directors of the company an expenditure of $300,000 on surface works, including construction of docks and tramway, and a dam and other work in connection with a hydro-electric power generating system, it is not intended to this year proceed with the erection and equipment of a smeltery. Much underground development is being done in the mines, though, and this expenditure is in addition to that above-mentioned in connection with surface work.)

MOTHER LODE GOLD MINE, SHEEP CREEK, NELSON MINING DIVISION.

The Mining Journal of London, England, publishes in its issue of May 25th the following contribution from its correspondent, Mr. Alexander Gray, of Montreal, Que., who, being on friendly terms with the principal owners of shares in the Mother Lode Sheep Creek Mining Company, is in a position to obtain information concerning its affairs:

"The mill of the Mother Lode mine started crushing on May 6, and in view of the interest attaching to the Sheep Creek field, a few particulars may be welcome. The mine, which is controlled by the Hollinger group, is in charge of Mr. William Watson, who states that the developments show a gross value of more than $1,000,000. The mill is of Merrill design, and is a model in point of compactness and substantial construction, the flow-sheet being calculated to obtain a high extraction. The automatic tram delivers the ore to a 20 x 10 Blake crusher, thence to a 350-ton bin. From there the ten 1,250-lb. stamps take it, the crushed product passing to the first classifying cone, where they get two products, the underflow going to the tube-mill. The overflow is by-passed and rejoins the re-ground product from the tube-mill. Then there are plates, a Frenier pump, a second classifying cone from which the underflow is returned to the tube-mill, and after that a Dorr thickener. The underflow from the thickener is taken by two Aldrich slime pumps, and the overflow goes to the collecting tank. Merrill metallurgical practice is pursued through Pachuca tanks in series. More Dorrs, mechanical agitation and Merrill slime presses, Merrill classifying presses, Merrill precipitating presses, thence to the refinery, where the lead method is employed. The details of Merrill practice need not be reiterated. The mill, in its way, is a model of neatness and efficiency, in which Mr. Frank C. Languth, of the Merrill staff, takes justifiable pride. The 10-stamp mill is rated at a daily capacity of 70 tons, and assuming a recovery of $14 a ton and averaging 26 working days, a net profit of $25,000 per month is expected. Power is obtained from the company's hydro-electric plant, and low working costs are anticipated."

It should be added that if Mr. Gray is correct in the statement that a recovery of $14 a ton is expected, he appears to have omitted working costs when calculating expected net profits. E. J.

CANADIAN MINING INSTITUTE, WESTERN BRANCH.

The thirteenth general meeting of the Western Branch of the Canadian Mining Institute was held at Greenwood, Boundary district, B.C., on Thursday, June 27. In the unavoidable absence of the chairman, Mr. R. R. Hedley, the chair was taken by Mr. Frederic Keffer, of Greenwood, an ex-President of the Institute.

Ballotting for the election of chairman and other members of the branch council for the ensuing year resulted in the unanimous election of Mr. M. E. Puncell, of Rossland, superintendent of the Consolidated Mining and Smelting Company's Centre Star group of mines. Others elected members of the branch council, and the ex-officia members, are as follows:—W. H. Armstrong, S. S. Fowler, Chas. Graham, Thos. Graham, J. Cleveland Haas, Robert R. Hedley, John Hopp, Frederic Keffer, Thos. Kiddie, A. G. Larson, F. Chas. Merry W. F. Robertson, R. H. Stewart, O. E. S. Whiteside, W. R. Wilson and W. E. Zwicky.

The chief subject before the meeting was "The Copper Mining Industry of British Columbia," in connection with which there was read one paper giving historical, statistical and general information concerning the industry—mining and smelting—as a whole. The historical notes gave the sinking of the Old Shaft, down the coast from Skidegate, Queen Charlotte Islands, as the first officially recorded attempt at copper mining in the province; then, copper ore was discovered at Sooke, Vancouver Island, in 1864, and near Howe Sound, on the mainland, in 1865. An excerpt from the "Report of the Minister of Mines, 1874," gave information relative to copper ore on a branch of Jarvis Inlet, and one from the Report for 1877 of the "Howe Sound Copper and Silver Mine." Discoveries in Nelson district, at Stump Lake, between Kamloops and Nicola, in Boundary district, in Rossland camp, and at Mount Sicker, on Vancouver Island, respectively, were all mentioned. The first production of copper on record was in 1894, probably from the Silver King mine, near Nelson; in 1895 Rossland commenced to produce copper; in 1898 the Coast district, and in 1900 the Boundary were added to the producing districts. Production of other parts of the province has been comparatively small thus far. Total production of copper to date is 452,281,365 lb., of which 63,000,000 lb. was produced in eight years to end of 1901, 180,000,000 lb. in five years 1902-6, and 209,000,000 in five years 1907-11. By districts, the production has been:

Boundary, 301,574,000 lb.; Trail Creek (Rossland), 84,201,000 lb.; Coast, 49,821,000 lb.; Nelson, 13,363, lb.; other districts, 3,322,000 lb. Smelting of copper ores was commenced at both Nelson and Trail in 1896, at Van Anda (Texada Island) in 1899, at Grand Forks in 1900, at Greenwood in 1901, at Boundary Falls in 1902, and at Crofton and Ladysmith, both on Vancouver Island, in 1902.

Other papers read were as follows: "Notes on Copper Mining in the Coast District," by Mr. W. M. Brewer; "Notes on Method of Handling Ore on the Surface at the Centre Star Mines, Rossland," by Mr. M. E. Purcell; "Consolidated Mining and Smelting Company's Copper Smelting Department, Trail," by Mr. Jas. Buchanan, and "Notes on Copper Mountain Camp, Near Princeton, Similkameen," by Mr. Frederic Keffer. The secretary read a report on the Granby Company's Hidden Creek mine, on Alice Arm, Observatory Inlet, made for the Provincial Department of Mines by Mr. Donald G. Forbes.

ASBESTOS.

The U. S. Geological Survey has published a bulletin on asbestos, containing the following hints on prospecting for this mineral: Asbestos occurs only in ancient crystaline rocks of Paleozoic or earlier age, and the rocks in which it is found are almost invariably of igneous origin, peridotite altered to serpentine being by far the most important. The conditions to be chiefly observed are the purity of the serpentine, its flexures and the presence of granite. The purer the serpentine the more likely it is to form asbestos, while the more abundant the fractures, especially if the serpentine be intruded by granite, the more likely it is that the circulating magmatic waters will have formed asbestos.

SOME NOTES ON MODERN GOLD MILLING

No subject in relation to ore-dressing or milling practice is at present more prominent than that having to do with the possible supercession of stamps, and even of amalgamation in favour of step reduction, fine grinding and direct cyanidation. There can be no doubt that for certain classes of ores in which the values recoverable by amalgamation fall below a given percentage, preliminary amalgamation is not economical. But it is quite impossible to establish an arbitary standard or rule: the question is essentially empirical, and each case must be determined on its individual merit, having regard to the economic conditions obtaining and the physical characteristics of the ore. In Ontario, for example, no one would soberly advocate the abandonment of amalgamation as a process for the treatment of the Porcupine gold ores. These are essentially free-milling, and, therefore, ideally amenable to amalgamation treatment. It is a question, however, whether step reduction, employing tube-mills, will not here give a better return than stamps, while, of course, the initial cost of equipment and installation is greatly in favour of the former.

The gold ores at Long Lake, near Sudbury, afford an example of the other extreme. Here the attempt to amalgamate proved inefficient, the percentage of gold recovered being practically negligible, and the process was abandoned absolutely in favour of direct cyanidation by which means an economic and adequate extraction averaging 90 per cent. of assay value, has been obtained. But between these two extremes, in the case of either of which the problem is relatively simple, there is a wide range; and it is in relation to the treatment of ores of a semi-refactory, or worse, nature that the real interest centres.

In an article on gold mining in the Transvaal, which we have reviewed elsewhere, Dr. F. H. Hatch makes the statement that some metallurgists advocate the total abolition of the amalgamation process in connection with the treatment of the gold ores of the Rand. But that there is a great divergence of opinion on this and other points respecting present-day practice in South Africa is evidenced by the recently published views of Mr. H. Stadler, engineer of Research Work to the Mines Trial Committee, of Johannesburg, who manifestly not only disagrees with this standpoint, but shows that in a large degree the innovations of late years, especially as regards fine grinding, have been based on "utterly wrong principles," and have actually resulted in an increase in reduction costs. As his conclusions have a general application, they will bear summarizing:

(1) The higher extraction claimed for finer grinding has, in consequence of mistaken deductions, been grossly exaggerated. (2) Any classifier with its overflow velocity well adjusted, acts as an efficient concentrator in which the specifically heavier pyritic particles are preferably retained in the underflow. The abandonment of the old proved Spitzkasten in series, in favour of cones in sets, is, therefore, deprecated. (3) The profit resulting from higher extraction by finer grinding is practically nullified by forfeiting the good effect which a high percentage of extraction by amalgamation has on the total extraction. Besides the advantage of quick realization of profits, a high extraction by amalgamation has far-reaching effect on total extraction, consequent on the lowering of gold contents left in the final pulp for cyanide treatment. Thus assuming it were possible to obtain an amalgam extraction of 90 per cent. from a low grade ore, say 5 pennyweights, the low residue value (.5 pennyweight) would make the cyanide treatment altogether unnecessary. (4) Grinding finer than the plus 200 mesh, he considers mere waste of energy and money. Mr. Stadler's main point is that the employment of tube mills for grinding considerations, in other words, that they should not be required to undertake that part of the crushing duty which may be more efficiently performed by stamps. It has been proved experimentally that the mechanical crushing efficiency increases with the coarseness of the screen mesh. The advantage, however, of a high amalgam extraction, obtained by double amalgamation before and after tube milling, is so marked that to forfeit this advantage by crushing so coarsely that no amalgamation before tube milling is possible is not advisable. The use of fine battery meshes will, therefore, be advantageous, even at a cost of a probable loss in daily tonnage treated.

There can be no doubt that these conclusions are sound in the main, though exception may be taken to the infallibility of certain of the statements advanced.

THE MINING AVERAGE.

Apropos of the recent organization of the Canadian Mining & Exploration Company, to which we recently made editorial reference, the report of the mining and investment department of the U. S. Smelting, Refining & Mining Company, is interesting as indicating the investigation that must necessarily be undertaken, the energy and work required in sifting the chaff from the grain, before such effort can expect to be rewarded. Thus, exclusive of proposals rejected offhand, the company in question had under consideration 921 properties. Of these, so states the report, "an examination by the office nearest the property concerned, coupled with the knowledge of the geology and working costs of the respective districts, was sufficient to warrant the rejection of 749." Field examinations were made in respect of the remaining 144 properties, 28 of which proved worthy of more careful investigation. Only one of this number was acquired. Nevertheless the acquisition of one meritorious property might readily represent an excellent year's work. And, after all, the proportion of 1 to 921 is nothing out of the ordinary, when one considers the usual ratio of good to worthless mines in nearly any established camp.

According to a bulletin recently issued by the United States Geological Survey, the graphite mining industry in that country has experienced nearly, if not quite as many, vicissitudes as that of our own. Thus it is stated that there are to-day in the United States more abandoned graphite mines and mills than there are in operation, and, again, "the number of times that some of these properties have changed hands in the course of a few years evinces a record of misrepresentation and disappointment that can hardly be equalled in any other branch of mining." In the United States, as in Canada, the rock on which the industry has split is the process of concentration, the techniology of which with respect to the treatment of flake-graphite is still to be perfected. There have been notable advances of late,

however, and one or two of the new mills in the Buckingham district, in particular, have made very creditable records.

The Mining and Engineering World (Chicago) draws attention to the fact that one hundred and eleven American mining companies have to date paid dividends aggregating the prodigious sum of $730,592,965, and representing $61,695,539 over and above the original combined capitalization of the undertakings. Of these companies, fifty-two belong to the United

It is announced that gold to the value of about eight million dollars will be coined in pieces of five and ten dollars, at the Royal Mine at Ottawa during the present year. Canadian gold coins have been in circulation for some little time past, but are not likely to replace paper currency in popular favour. The project of coining silver dollars has been wisely abandoned. In this hot weather it would have been a heavy affliction, and, at all times, a burden to the rich.

The Secretary of the Interior of the United States is accused of being "vague and indefinite" in expressing an opinion on whether or not the Bureau of Mines should tackle metallurgical problems of a "local and private" nature. But what are "local and private" problems? The solution of any problem that will aid an individual enterprise will benefit the mineral industry as a whole. This surely is axiomatic. There is, however, a happy medium between work that may be legitimately undertaken by Government in the general interest, and that infringing unduly as the purlieu of private enterprise. Such competition is unfair; and the Government official honestly keen to render his service efficient does not always know when or where to draw the line. Nevertheless, broadly speaking, officialdom is right in acting on the old, well-worn adage of the "greatest good to the greatest number."

Some experiments have been conducted recently in Scotland to ascertain the oxygen consuming power of a naked flame. These tests showed that a lamp burning oil consumed 1.13 cubic feet of oxygen and produced 0.78 cubic feet of carbonic acid per hour. The same lamp when burning tallow consumed 2.49 cubic feet of oxygen and gave off 1.74 cubic feet of carbonic acid in an hour. A miner's tallow lamp, consuming 17.4 gms. of tallow per hour, averaged, with uniform flame for 15 minutes, 2.3 candle power, while a lamp consuming 13 gms. paraffin wax per hour gave 1.6 candle power.

The deepest gold mine in the world until lately was that of the New Chum Railway Company at Bendigo the shaft at which is sunk to a depth of 4,120 feet. This record has since been surpassed by another gold mine, the Victoria, in the same district, whose workings are down 4,600 feet. Again in Brazil, at the Morro Velho mines, a vertical depth of 4,926 feet has been attained. In the United States, the deepest gold mine is the Kennedy shaft, 3,500 feet, in California. The world's deepest mine, however, is No. 3 shaft of the Tamarack Copper mine, which is down 5,222 feet or only just short of a mile. In Canada, the deepest workings are probably those at the Eustis mine, in the Eastern Townships.

The New British Mines Coal Act.—The Colliery Guardian notes that in addition to the various changes brought about by the new Coal Mines Act in Great Britain, the new regulations regarding the use and storage of explosives in coal mines, came into force on July 1st. The main features of the new order are the more detailed restrictions respecting the use of explosives in mines, the standardization of cartridges, the regulation of the size of rock-drill bits, precautions to be taken in the case of miss-fires, especial provisions for firing mines and regulations in the case of sinking operations. In firing mines, for example, it is required that only an efficient magneto-electrical apparatus shall be used for shot-firing or in sinking pits, not even a primary battery being permissible. The other regulations are equally stringent. Thus, each large mine must receive the daily supervision of a separate duly-qualified manager, who must enter records on a perplexing variety of forms, while there are also provisions as to countersigning and posting of reports. There are also new provisions as to plans. The new ventilation standards make a heavy call upon the judgment of the manager, both as regards the organization of his staff and the specific compliance with the Act in respect of measurements. Under the head of Shafts, provision is required for increased dimensions, of two means of egress, the fencing of shaft bottoms, etc. Under the egresshead of Haulage, very exacting requirements are specified, while for timbering, underground telephone communication, the use of electricity, the removal of coal-dust and other details, new regulations have been made. Finally, more rigid inspection is demanded. Two inspections must now be made during each shift, and no place must remain uninspected for more than five hours at a stretch. In short, the lot of a colliery manager in Great Britain would not appear to be a particularly enviable one.

Microscopical Investigation of Coal-dust.—At a recent meeting of the Manchester Geological and Mining Society, a paper was read by Mr. James Lomax, a recognized authority on this subject, of which the following is a summary:—

"It is now generally acknowledged that coal is the product of terrestrial vegetation of long ages ago, and through being able to get material which contains plant remains in a petrified condition, we can almost with certainty demonstrate to what type, or classes of plants we owe our coal-seams. This is certain in the dominant types. This being so, we are enabled, in combination with impressions of fossil plants, to account for the material we should expect to find composing a coal-seam. It is also acknowledged that many coal-seams give off a large amount of inflammable dust according to the stratificial conditions, such as depth from the surface, moisture, etc., and also the method of working. This holds good to the majority of so-called bituminous coals, but not so with the anthracites. Therefore, there is some reason or cause that some seams give off more inflammable dust than others. This is mainly through the conditions under which the vegetable debris was laid down and the class or types of plants from which it was derived. If we look around us and pick up a few fossil plant impressions, or, better still, visit some museum well stocked with coal measure fossil plants, what do we find That at least one-half of these belong to the lycopodaceous family, whilst the remainder consist of at least five different kinds—Equisetinae (Calamites, etc.), Pteridosperms (Lyginodendron, etc.), Gymnosperms (Cordaites, etc), and Filicinae (the true ferns), the last being both small in size and quantity. That being the case, we should expect a seam of coal to be composed of the remains of the dominant types of the time

SPECIAL CORRESPONDENCE

ONTARIO

Cobalt, Gowganda and South Lorrain.

ORE SHIPMENTS FOR JUNE.—The shipments of silver ore from the Cobalt district came from three sources Cobalt, Gowganda and New Liskeard in the month of June. According to the official list as compiled by Mr. A. A. Cole, the shipments totalled:

Cobalt Proper—	
Buffalo	123.48
Cobalt Townsite	199.20
Chambers Ferland	32.00
Cobalt Lake	134.85
Coniagas	117.54
Crown Reserve	49.03
Drummond	20.74
Hudson Bay	31.60
Kerr Lake	30.37
La Rose	274.96
Lost and Found	15.00
McKinley-Darragh	202.81
Nipissing	227.91
O'Brien	31.25
Temiskaming	95.52
Trethewey	77.26
	1,663.52
Gowganda—	
Millerett	20.00
New Liskeard—	
Casey Cobalt	43.85

This was shipped as follows: 33.07 per cent. to Canada, 65.59 per cent. to the United States, and 1.34 per cent. to Germany.

The Lumsden.—It has been made public recently that high grade ore is being mined on the Lumsden property in south-east Coleman. The management has long known of the existence of this high grade, but the shoots have been short and it had been determined to keep the matter secret until some degree of permanence was assured. The discovery was first made on the 300-foot level, but the same ore shoot has now been located on the 250-foot also. The ore is very high grade. The main shaft is down to the 400-foot level in the diabase, and here so far nothing has been located. The property is owned by Mr. John Lumsden, of Ottawa, who is to date considerably out of pocket by his Cobalt venture.

The Majestic.—The Cobalt Majestic, one of the wildest flotations of the early days of the camp, has paid its creditors a hundred cents on the dollar. The property was long in the liquidator's hands, and he has recently sold some properties which enabled the company to pay off all debts. If any more claims are sold the stockholders of the company might even benefit though that possibility is remote.

The Nipissing's Progress.—The production of the Nipissing for the month of June was $225,162 net, while the shipments of ore and bullion amounted to $220,048.

Vein 73 still continues the biggest producer. Work is confined to the second and third levels. To the east of the shaft a drift has been started on a small seam running at right angles to the main vein. This drift at the beginning of the month was in twelve feet, and the vein assays 1,500 ounces with a width of one inch. It is possible that this branch may prove to be vein 74. On the surface this vein is small, but has considerable length. It was open-cut in 1906, but the ore was low grade at the surface. Two stopes are ready to produce at the third level. The vein in both averages three inches in width and assays 2,500 ounces. There is much silver in the wall rock, and it is likely that both stopes will have a width of at least ten feet. A drift has been started on a branch of the main vein at the third level, and is now in 18 feet. The ore assays 1,200 ounces over a width of one inch. A cross cut has located the main vein east of the fault, showing a throw of 58 feet. The ore assays 1,200 ounces, but the vein is small. The vein will probably widen out as it is drifted on away from the fault. An incline following the ore between the second and third levels shows 67 feet of ore assaying 2,000 ounces over a width of six inches. The ore is still in the face.

In exploration work at shaft 64 the shaft is down to the 400-foot level and the fourth level will be put in at 440 feet. Raising from the third level several hundred feet east of the shaft ore was encountered from two to twelve inches wide of 1,800 ounce value.

No. 100 vein is developing longer shoots than was anticipated when the work was commenced. Between the Meyer vein and No. 100 several small veins are being developed. One of the raises shows 75 feet of ore assaying 2,000 ounces over a width of an inch and a half.

The high grade mill treated 181 tons of ore during the month, the bullion shipments from the mill amounting to 326,278 ounces valued at $198,824.

The hydraulicking operations on Nipissing Hill have discovered the extension to vein 92. It carries between one and two inches of high grade ore. Two other veins have been discovered one two inches wide of 1,063 ounces, and the other one inch wide of 1,744 ounces.

The larger vein has been exposed for a length of forty feet.

PORCUPINE AND SWASTIKA

THE DOME IN OPERATION.—The Dome mill is the only plant operating in the camp that could furnish figures that would establish the camp on a thorough sound basis, but the management has not as yet seen fit to do so; the other mills, with the exception of the McIntyre, which is, of course, only of ten stamps, have not been running long enough yet. It is an incontrovertible fact, however, that actual practice at all the four mills has more than proven all the contentions that were made for them. During the month of July the Dome will treat 325 tons of ore per day with the prospect in the near future of raising it to 400 tons. It is making an extraction of 96 per cent. altogether. An average grade of ore reports vary all the way from $8 to $20 per ton. For several days in succession the clean-up ran $6,000, but it is generally conceded that this is above the average.

THE VIPOND.—The Vipond plant has so far proven entirely satisfactory. With the rolls crushing to one inch only, between 75 to 80 tons per day were milled, so that it will be possible easily to make a daily aver-

age of one hundred tons and better. During the month of July it will probably average about 75 tons. The only saving will be on the tables, the tailings running into a swamp where they will be dammed up until they can be retreated. An extraction of 85 per cent. can easily be obtained.

ALSO THE HOLLINGER.—Mr. P. A. Robbins is pleased with the practice at the Hollinger. All thirty stamps are now dropping and a duty of nine tons per stamp can easily be maintained. Ore for the mill is being obtained from the dump and the first level. One day this month the mill was running on $17 ore and there will be no difficulty in obtaining an average of between $25 and $30. The pan amalgamators will not be used, save when some very high grade ore is being run through the mill.

AND THE McINTYRE.—At the McIntyre a six days' run produced a brick worth $5,400. The mill is being run at full capacity. With these four mills running the camp should earn enough before the end of the year to, in some measure, retrieve its position in the public eye, forfeited by its long period of sterility.

OTHER MINES.—Mr. F. W. Summerhayes, who has succeeded Mr. John Macdonald as manager of the McEaneny mine, has at once commenced to excavate for the foundations of the five-stamp mill to be installed. The work will be pushed forward with all expedition.

Within the past six weeks development has commenced on two properties which heretofore have received little or no attention. The South Dome claims are being prospected by the Montreal syndicate, already operating the Dome Lake. Work so far has been confined to the surface. In the Pearl Lake section a shaft is being sunk on the Christ claim adjoining the McEaneny.

It has at last been decided to suspend work on the East Dome claims, the only properties remaining to the Preston East Dome Company when they refused to make any further payments on the Preston claims. That the struggle to find pay ore would be unsuccessful has been more or less of an open secret for some time and the decision to close down causes no surprise.

While the Crown Chartered, on the Davidson, has not yet run into the ore shoot at the 200-foot level, the vein has been picked up and looks very encouraging. It is at least fifteen feet wide and only one wall has been discovered as yet in the raise.

Thirty to forty miles south of the Transcontinental Railway, at the Harricanaw River Crossing, a considerable amount of development is in progress. Gold discoveries on the banks of the Harricanaw River caused a small stampede of prospectors last winter, with the results that several hundred claims were staked. Coarse gold can be seen in narrow quartz veins. On the Sullivan properties a gang of men is at work and the success or non-success of it will probably decide the fate of the camp as a gold mining field. On Keewagama Lake and River Mr. M. J. O'Brien is developing the Independence mine, where there is reported to be silver and zinc, and at the Peninsular mine a level is being run at fifty feet to open up a deposit of molybdenite and bismuth.

PROSPECTING.—Most of the mining syndicates on the "qui vive" for good prospects in the North Country, have sent their scouts in to the Tough claims, some six miles north of Swastika. The vicinity of Kirkland Lake was the scene of a little excitement last winter and the Tough claims are about a mile distant. One vein has been stripped for 250 feet. It is on the surface as well defined and regular as a Cobalt silver vein and is not more than four inches wide. It is very rich in many places. The porphyry is heavy with sulphides and an official report states that it carries some values. In a dyke of porphyry, the walls of which have not been defined, occur veinlets of quartz and a considerable amount of coarse gold is to be discovered in these.

BRITISH COLUMBIA

The first half of the year has closed with mining operations generally being carried on vigorously in the more important mining districts of the province, so that thus far the favourable forecast made in May and published in "The Canadian Mining Journal" of June 15 seems to have been warranted, at any year is concerned. With the average New York rate so far as the expired portion of the cents an ounce higher than that for the year 1911, and for electrolytic copper nearly three cents a pound higher, the total value of production for the half year has been increased correspondingly. Whether prices will be maintained throughout the remainder of the year, it is, of course, not possible to positively conclude, though the probability is they will be. However, there is much satisfaction in contemplating the results of the half year's operations, which are known to have been generally favourable. The good effect of the improved conditions is indicated in the survey of the position to follow presently. Meanwhile a few other mining notes may be of interest to readers of the "Journal."

French's Process for Separation of Zinc and Lead.

Mr. Wm. Fleet Robertson, Provincial Mineralogist for British Columbia, in the "Annual Report of the Minister of Mines, 1911," recently issued, says:

"For the past year or so, A. Gordon French has been conducting a series of experiments in Nelson, B.C., with the object of separating and saving the zinc occurring in the Slocan ores in conjunction with silver-lead and iron. He has equipped the old city electric light station on Cottonwood Creek as an experimental plant, where a series of experiments have been carried on which culminated in the development of a process which, Mr. French claims, has solved the problem commercially and produced an electrolytic zinc product of great purity.

"Much publicity has been given to this process and to the claims of its success, and, since a commercially feasible process would be of great importance to the district, the matter was investigated by the writer, who, in September, 1911, visited Nelson, when he was shown over the plant by Mr. French and the process explained."

Note.—The description of the process was printed in "The Canadian Mining Journal" of January 1, 1912, page 6. The following are additional notes, also prepared by Mr. Robertson:—

French's Zinc Process.

"Mr. French has patented at least a portion of the process, his Canadian patent, No. 136,341, covering the process down to the getting of the zinc into solution in water slightly acidulated with sulphuric acid, and Mr. French stated to the writer that he has applied for another patent covering the fractional electrolytic deposition of the zinc, but whether this has been issued is not known.

"This Bureau has made no attempt to test the commercial value of the process, but has made some investigation as to the principles involved.

"The electrolytic zinc produced in the experimental plant was assayed, and found to contain 99.5 per cent. zinc, 0.5 per cent. copper, with 0.2 oz. silver to the ton, a highly satisfactory product.

"In an investigation as to the effect of sulphuric acid on the oxides of lead and zinc present in the roasted ore, it was found that the acid had a selective action, and first converted the lead-oxide into lead-sulphate before reacting on the zinc-oxide to any extent. This selective action was noted both in the roasted ore and also with definite quantities of the pure oxides, as will be seen from the following experiments.

"An experiment was made to further demonstrate this point as follows: Pure oxide of lead (litharge) and oxide of zinc were mixed; to this was added dilute sulphuric acid, but not in sufficient quantity to sulphate all the lead-oxide present. With repeated stirrings, this was allowed to stand for 24 hours at a temperature of 40 degrees C., when it was found—first, that there was no free acid remaining and, second, that lead-sulphate had been formed, but practically no zinc-sulphate, the zinc remaining as an oxide.

"A further experiment was made as follows: Commercial zinc-sulphate was dissolved in water; to this solution lead-oxide (litharge) in excess of the acid was added and allowed to remain for 24 hours under similar conditions, when it was found that the zinc-sulphate had been converted into zinc-oxide and some of the lead-oxide into lead-sulphate.

"It would seem from this that the amount of 'nitro-cake' necessary to add must be sufficient to contain enough sulphuric acid—first, to sulphate all the oxide of lead present in the roasted ore, and, in addition to this, sufficient to afterward sulphate the zinc-oxides present. Consequently, if a large percentage of lead were present in the ore, perhaps a prohibitively large amount of 'nitro-cake' would be required."

ATLIN AND CARIBOO.—As it is not until after the close of the season that dependable news of placer-gold mining is obtainable, little more can be written now than to state that the larger hydraulic mines in Atlin camp, and in both Cariboo and Quesnel mining divisions of Cariboo district, are nearly all being worked to the full capacity that available water will allow. In some other parts of the province summer rains have fallen, and there has been fewer hot days than in ordinary seasons. If similar weather conditions have been experienced in the above-mentioned placer-mining districts, then the operating season may be expected to be proportionately longer.

EAST KOOTENAY.—The only metalliferous mine in this district producing much ore this year is the Sullivan, which, during six months to July 1, shipped about 16,000 tons of lead-silver ore to the smeltery at Trail. Newspaper reports published lately have been to the effect that some work is being done in the old St. Eugenie mine, Moyie Lake, and that the Aurora, situated across the lake from the St. Eugene, is also being worked. Several other lode properties have men doing development work on them, while placer mining is being carried on in various parts of the district, but not on a large scale. Coal mining in the Crow's Nest district is without unusual features just now.

WEST KOOTENAY.—In this extensive district, there is much mining activity, and it is gratifying to note that this comment applies to nearly all the mining divisions in which productive mining is usually carried on.

In Ainsworth division, at the Blue Bell mine on the east side of Kootenay Lake, in Ainsworth camp on the west side, at the Utica and Whitewater group mines up from Kaslo toward the divide between this division and Slocan, and in smaller degree at other places, is work in progress. As these parts will probably shortly be visited by the writer of these notes, mention of individual properties will be deferred.

Across the divide, in Slocan division, the position is decidedly promising. The construction of the branch railway line from Three Forks to Bear Lake is being rapidly advanced towards completion, so that it is expected shipment over it of ore from the Lucky Jim zinc mine and the Rambler-Cariboo silver-lead mine will be commenced in the early autumn, both mines having much ore available for shipment. In the vicinity of Sandon, development work at the Slocan Star and Payne mines is being pushed forward, the work of driving the long cross-cut tunnels on these properties, respectively, being continued uninterruptedly. That on the Slocan Star may be expected to reach the ore zone in September, while at the Payne a longer period will probably elapse before a similar result will be achieved. The Richmond-Eureka continues to make occasional shipments of ore to Trail, but in much smaller quantity than last year. The Ruth-Hope group is another of the producing mines in the same locality. In the vicinity of Cody the Noble Five and Reco are making preparations for production, but neither has sent out much ore as yet this year. At the Surprise the long raise has at last been put through to the old workings, so development of this mine will hereafter be practicable with better prospects of production than during the long period during which attention had to be concentrated upon the work of making connection between the low-level adit and the 300-ft. level above. Several other properties in the vicinity of Cody are being worked, and this part of the Slocan district appears to give much promise of soon becoming important as regards production of ore. There are several mines in various directions from Three Forks upon which work is being done, and these will add to the output of ore from this division. In Silverton camp, near Slocan Lake, the Standard, Van-Roi and Silverton Mines companies, respectively, are employing many men. The good results being obtained from operations at the Standard especially are attracting much attention to this part of the Slocan, about which more information will be given later, probably for the next number of the "Journal." In parring it may be mentioned that it has lately been reported that another important shoot of ore has been found in the Van-Roi Company's mine, and that the Silverton Mines, Ltd., has had the misfortune to be deprived of the use of the Wakefield concentrating mill, held on lease but lately destroyed by fire. There is little to note concerning operations in Slocan City division, in which the Eastmont, Enterprise, Meteor, Lily B., and other properties are being worked.

NELSON MINING DIVISION may be expected to increase its output of ore during the latter half of the year, for one or two mines in Ymir camp will probably ship, while in Sheep Creek camp the Mother Lode 10-stamp mill will be regularly operated, as well as that at the Queen. Production reports published recently

do not show much lead ore to be coming from this division now. Near the City of Nelson, the Granite-Poorman group is understood to be doing better, from a financial point of view, than last year. It is reported that the British Columbia Copper Company is negotiating for a working bond on the Eureka copper mine.

Only brief mention may now be made of Rossland mines, leaving these for more notice next month, after they shall have been visited. Rossland camp is stated to be generally in a sound condition, the Centre Star group and Le Roi No. 2 Company's mines both well-maintaining their customary output of ore of profit-yielding grade. The Le Roi, now that it is being worked by the Consolidated Mining and Smelting Company, is sending out more ore, its production this year to July 1 having reached a total of nearly 25,000 tons. In the South Belt progress is also being made.

BOUNDARY.—The Granby Consolidated M. S. and P. Co. shipped from its own mines to its smeltery at Grand Forks during the seven months of its last fiscal year (ended June 30, 1912); it was operating approximately 732,000 tons of ore, and produced about 13,500,000 lbs. of blister copper. Foreign ore receipts totalled about 19,000 tons. The British Columbia Copper Company, beside keeping its Mother Lode and Rawhide mines producing at about full capacity, has resumed work on its Napoleon and Lone Star mines (both in the neighbouring State of Washington). It has closed its Wellington camp mines, but lately resumed development of the L. H. mine, near Slocan, and has a number of men and five diamond drills at work on the Voigt property and some neighbouring claims in Similkameen district.

Outlook for Metalliferous Mining.

The improved outlook for metalliferous mining in British Columbia is emphasized by the fact that several mining companies are now dividend-paying, while there is reasonable prospect of two or three others becoming so ere long. Not for years has this province made a similarly good showing as the following for about six weeks, June 9 to July 15, both dates inclusive:

1912.	Amount of Dividend.
June 9, dividend of 2½ cents a share on 2,000,000 shares paid by the Standard Silver-Lead Mining Company.	$ 50,000 00
June 29, dividend of 50 cents a share of 120,000 issued shares paid by the Hedley Gold Mining Co'y.	60,000 00
July 1, dividend of 1 shilling a share on 120,000 shares paid by the Le Roi No. 2, Ltd., £6,000, or say.	29,400 00
July 9, dividend of 2½ cents a share on 2,000,000 shares paid by the Standard Silver-Lead Mining Company.	50,000 00
July 15, dividend of 15 cents a share on 591,709 shares paid by the British Columbia Copper Co., Ltd.	88,756 35
Total.	$278,156 35

The foregoing statement by no means shows the total of earned profits—only the production that quite recently has been divided among the shareholders in the several companies shown on the list. It is well tively large profits, with copper at the average price of the last few months, while it is understood that the present policy of the directors is to use these gains for the development and equipment of the company's Hidden Creek mines, though there is a possibility of there being dividend payments later in the year. The directors of the British Columbia Copper Company are authoritatively stated to have said, when announcing their intention to pay Dividend No. 4 in July: "The company has in hand a full year's dividend at the rate declared to-day, and is earning at the rate of more than 25 per cent. annually on the par known that the Granby Company is making comparavalue ($5) of its shares." This means that net profits are at the rate of about $750,000 a year. As to the Standard Silver-Lead Company—the directors make no secret of their expectation to maintain payment of a monthly dividend totalling $50,000, so long as silver and lead prices shall keep up to their present level, for there are large reserves of ore of good grade in the Standard mine. Then, there is the steadily improving financial position of the Consolidated Mining & Smelting Co. of Canada, Ltd., the seventh annual report of which—for the fiscal year ended June 30, 1912—will no doubt be made public about two months hence. While this may be expected to show that the total tonnage from the various mines owned or leased by the company was considerably less than in the immediately preceding fiscal year, prices of metals other than gold averaged higher during the last fiscal year—silver about 2½c. an oz., lead about £2 10s a ton, and copper about 2½ cents a pound higher for the whole year. The Britannia Mining and Smelting Company, is also stated to be making substantial profits, with an abundant supply of ore of good average grade and copper at a higher price. The heavy outlay period for the Rambler-Cariboo Mines, Ltd., appears to be drawing to a close, and it is confidently expected that the last quarter of the current year will see this company making much profit. Other silver-lead and zinc mines in Slocan and Ainsworth divisions will probably earn money above working expenses, while in Nelson division the Granite-Poorman group is stated to be now making a profit, the Quee gold mine is doubtless doing well, and it is expected the Mother Lode Sheep Creek Mining Company will be dividend-paying in the late autumn. There is no known reason to suppose that the Hedley Gold Mining Company's total net earnings for 1912 will be less than for 1911, in which latter year the net profit on its gold mining and milling operations was $308,802, and its total of dividends distributed $300,000, or 25 per cent. on its issued capital of $1,200,000.

In the foregoing rapid survey of the profit-earning condition of the chief producing metalliferous lode mines of the province, it is probable some have been overlooked, besides which no mention has been made of placer-gold mines, several of which should make an excellent showing this year, especially if sufficient rain shall fall in the autumn to lengthen their gravel-washing season.

It will be observed that this review of the position takes into account only metalliferous mines. What the year's results will be as regards coal mining is not plainly apparent, so a forecast may not now be made. But, leaving out of account the profits that it seems reasonable to conclude some of the coal-mining com-

COMPANY NOTES

MINTO COAL CO., LTD.

This company was formed in July, with a capital of $400,000, to take over coal interests acquired during the past few months by Sir Thomas Tait, in Queen's and Sunbury districts, Grand Lake district, New Brunswick.

Nipissing's Position.

The position of the Nipissing Mines Company on July 6th was the strongest in its history up to date. It had a surplus of $1,525,898, of which $1,173,000 was in cash. Half of the low-grade mill, to cost $275,000, has already been paid for by the earnings.

La Rose Finances.

On July 1st, the financial position of La Rose Consolidated Mining was as follows:—

Cash in bank, ore in transit and at smelters	$1,611,830.03
Ore sacked at mine ready for shipment...	105,880.01
	$1,717,710.04

Temiskaming Board.

A special general meeting of the Temiskaming Mine Company, Limited, has been called for Monday, July 29th, for the purpose of ratifying a by-law passed by the directors increasing the number of directors from five to seven.

Timiskaming Makes Half-Yearly Statement.

Directors of the Temiskaming mine are sending out the half-yearly statement showing the condition of the company at the end of the half-year. The principal items compare with the corresponding figures at the end of 1911 thus:

Cash on hand	$299,612	$100,442
Due from smelters	114,940	158,708
Ore on hand	44,874	28,555
Accounts receivable	55,709	11,770
Insurance and taxes earned	6,197	1,300
	$521,332	
Less June pay-roll	33,327	
	$488,005	

Less balance deferred payments North Dome stock, $150,000; balance, $373,005.

COBALT DIVIDENDS.

Dividends paid by the Cobalt mines for the first six months of the year shows a net loss of but $8,376 in comparison with the first six months of the previous year, and as the gains are to all intents permanent and the losses temporary or long ago discounted, the report is better than its face value would appear. The payments in the last six months were:

	Per cent. of issued capital.	Amount paid.
Beaver	3	$ 59,892
Buffalo	16	160,000
Townsite	15	150,000
Coniagas	15	690,000
Crown Reserve	30	530,640
Hudson Bay	900	69,849
Kerr Lake	10	300,000
La Rose	4	337,500
McKinley-Darragh	20	224,693
Nipissing	15	900,000
Temiskaming	3	75,000
Trethewey	10	100,000
Wettlaufer	10	70,825
		$3,578,399

STATISTICS AND RETURNS

COBALT ORE SHIPMENTS.

Ore shipments from Cobalt camp last week were 864,168 pounds or 432 tons divided among nine mines in addition to which there were four bullion shippers. Shipments for week and year in pounds of ore are:—

	Week to July 1910.	Year to date.
Beaver	.....	361,756
Buffalo	56,371	1,367,174
Can. Gowganda	.....	15,967
Casey Cobalt	.....	929,498
Chambers-Ferland	63,400	524,900
City of Cobalt	.....	291,712
Cobalt Lake	115,100	798,299
Cobalt Townsite	86,000	1,692,363
Colonial	.....	83,200
Coniagas	.....	2,085,582
Crown Reserve	.....	661,971
Drummond	.....	682,595
Hudson Bay	.....	817,592
Kerr Lake	.....	839,080
La Rose	155,273	3,917,209
Lost and Found	.....	30,001
Mann (Gowganda)	.....	40,000
McKinley	132,731	2,981,763
Millerett	.....	196,000
Miller Lake-O'Brien	.....	146,500
Nipissing	150,087	2,442,366
O'Brien	.....	589,393
Provincial	.....	44,440
Right of Way	53,100	343,396
Temiskaming	62,106	1,215,988
Trethewey	.....	545,972
Wettlaufer	.....	216,470
Totals	864,168	23,861,187

B. C. ORE SHIPMENTS—WEEK ENDING JULY 13, 1912.

Although below the previous week's record total of over 50,000 tons, the ore production for the Kootenay and Boundary district last week was well above the average for the year and some thousands of tons above the average weekly production in 1911. Last week the output was 46,420 tons, making the total for the year to date 1,223,158 tons. The smelter receipts for the

week were 43,218 tons; for the year to date, 1,141,359 tons.

Two properties, the Lucky Boy, near Erie, and the Emerald, the well known Sheep creek silver-lead producer, at which extensive development is being carried out this summer, returned to the shipping list.

Among the Boundary mines the Lone Star made a big showing with a shipment of 664 tons, against 165 tons for the previous week.

The Monarch mine, near Field, B.C., which has been operating its mill steadily for some months, made a record shipment of 72 tons to the Trail smelter. W. J. Van Houten and associate of Vancouver are heavily interested in this property.

Ore production in detail was:

Boundary.

Granby	23,846	634,564
Mother Lode	7,038	200,716
Napoleon	171	2,061
Rawhide	5,619	110,887
Lone Star	664	829
Unnamed	594	6,223
Surprise	307	1,556
United Copper	53	424
Middleton	14	38
Total	37,706	987,682

Rossland.

Centre Star	3,498	84,554
Le Roi	585	26,070
Le Roi No. 2	232	14,801
Le Roi No. 2, milled	300	8,200
Other mines	...	79
Total	4,706	133,704

Nelson.

Granite-Poorman, milled	250	7,250
Emerald	32	865
Granite-Poorman	29	189
Molly Gibson	16	1,328
Lucky Boy	8	27
Silver King	5	25
Widdowson	1	1
Queen, milled	300	6,300
Mother Lode, milled	350	2,050
Molly Gibson, milled	300	2,100
Other mines	...	4,533
Total	1,291	24,668

East Kootenay.

Sullivan	620	17,155
Monarch	72	494
Monarch, milled	200	5,200
Other mines	...	1,423
Total	892	24,272

Slocan and Ainsworth.

Standard	199	4,801
Rambler-Cariboo	35	711
Richmond-Eureka	21	763
Van-Roi	31	1,583
No. 1.	29	481
Standard, milled	400	8,600
Van-Roi, milled	1,100	32,800
Other mines	...	3,084
Total	1,825	52,832

Consolidated Co.'s Receipts.
Trail, B.C.

Centre Star	3,498	84,554
Sullivan	620	17,155
Le Roi	585	26,070
Le Roi No. 2	323	14,801
Surprise	307	1,556
Standard	199	4,801
Monarch	72	494
United Copper	53	424
Rambler-Cariboo	35	711
Van Roi	31	1,583
Emerald	32	865
Granite-Poorman	29	189
Richmond-Eureka	31	763
No. 1	29	481
Middleton	14	38
Molly Gibson	16	1,328
Lucky Boy	6	27
Widdowson	1	1
Silver King	5	25
Other mines	..	5,206
Total	5,886	161,072

Granby Smelter Receipts.
Grand Forks, B.C.

Granby	23,846	654,564

B. C. Copper Co.'s Receipts.
Grand Forks, B.C.

Mother Lode	7,038	200,716
Napoleon	171	2,061
Rawhide	5,019	110,887
Lone Star	664	829
Unnamed	594	6,223
Other mines	.....	5,007
Total	13,486	325,723

COAL MINING AT DEPTH.

Replying to the toast of "The Institution of Mining Engineers," at the annual dinner of that society last month, the President, Mr. W. E. Garforth, said that the two great difficulties the coal miner had now to face were those of superincumbent weight and increased temperature. In the past, fears had been expressed that it would be impossible to work at greater depth than 1,500 feet; but coal was now being won in several instances at depths exceeding 3,000 feet. The principal remedy in combatting superincumbent weight had been the adoption of the system of long-wall working with rapid development of the faces, so that the coal was exposed to the weight for a very short time and places could be closed rapidly. Weight was Nature's lever, and might be utilized in ways not anticipated some few years ago. Reverting to the question of temperature at depth, he said men were working to-day in temperatures of over 90 degrees; but if advantage was taken of scientific knowledge, this temperature might be reduced. Thus, by the employment of apparatus somewhat on the principle of the Green's economizer and circulating fluid, air might be considerably cooled to admit of the mining of coal at much greater depths than those regarded by the Royal Commission as constituting the limit.

MARKET REPORTS

TORONTO MARKETS.

July 13—(Quotations from Canada Metal Co., Toronto):
Spelter, 6.30 cents per lb.
Lead, 5¼ cents per lb.
Antimony, 8 to 9 cents per lb.
Tin, 46½ cents per lb.
Copper, casting, 18 cents per lb.
Electrolytic, 17¾ cents per lb.
Ingot brass, 7 to 12 cents per lb.

July 23—Pig Iron (Quotations from Drummond, McCall & Co., Toronto):
Summerlee No. 2, $23.50 (f.o.b. Toronto).
Midland No. 1, $19.75 to $20.50 (f.o.b. Toronto).
Midland No. 2, $19.75 to $20.50 (f.o.b. Toronto).

General.

Coal, anthracite, $5.50 to $6.75.
Coal, bituminous, $3.50 to $4.50 for 1¼-inch lump.

Coke.

July 19—Connellsville Coke (f.o.b. ovens)—
Furnace Coke, prompt, $2.25 to $2.50 per ton.
Foundry Coke, prompt, $2.50 per ton.

July 19—Tin, Straits, 43.55 cents.
Copper, Prime Lake, 17.37½ cents.
Electrolytic, Copper, 17.37½ to 17.50 cents.
Lead, 4.75 cents.
Spelter, 7.25 cents.
Sheet zinc (f.o.b. smelter, 8.75 cents.
Antimony, Cookson's, 8.25 cents.
Aluminium, 23.00 to 23.25 cents.
Nickel, 40.00 to 41.00 cents.
Platinum, ordinary, $45.50 per ounce.
Platinum, hard, $47.00 per ounce.
Bismuth, $1.80 to $2.00 per lb.
Quicksilver, $42.50 per 75-lb. flask.

SILVER MARKETS.

July 6	61	28 1/16
July 8	60¾	27 15/16
July 9	60⅞	28
July 10	61	28 1/16
July 11	60¾	27 15/16
July 12	60¼	27¾
July 13	60¼	27¾
July 15	60¼	27¾
July 16	60/	27⅞
July 17	60⅝	27⅞
July 18	60⅝	27⅞
July 19	60⅜	27 13/16

SHARE MARKETS.

(Courtesy of J. P. Bickell & Co.)

New York Curb.

	Bid.	Ask.
Braden	7.12½	7.50
B. C. Copper	5.37½	5.62½
Giroux	4.87½	500
Greene Cananea	9.87½	10.00
Inspiration	19.00	19.25
Yukon Gold	3.62½	3.87½
Goldfield Con.	3.87½	4.00
Nevada Con.	20.25	20.50
Miami Copper	29.62½	29.75
Ray Con.	20.75	20.87½
Chino Con.	31.50	32.25
United Copper	.50	1.00

Cobalt Stocks.

Bailey	1⅞	2¼
Beaver	43	44
Buffalo	140	150
Chambers-Ferland	17	18
City Cobalt	19	20½
Coniagas	720	780
Crown Reserve	325	345
Gerat Northern	7	9
Gould Con.	..	1½
Gifford	3¾	4½
Green-Meehan	1	1⅛
Hargraves	4½	6
Kerr Lake	270	300
La Rose	303	310
McKinley	175	177
Nipissing	750	790
Ophir	8	10
Otisse	1¼	1¾
Peterson Lake	6¾	7½
Right of Way	4½	6
Silver Leaf	3¾	4½
Silver Queen	3	4
Temiskaming	37	39
Trethewey	47	51
Wettlaufer	57	60

Porcupine Stocks.

Apex	..	3
Dobie	10	25
Crown Charter	9½	10½
Dome Extension	14	14½
Eldorado	1	4
Foley O'Brien	12½	18
Hollinger	1225	1250
Jupiter	28	31
Moneta	7	10
North Dome	25	100
Pearl Lake	17¾	19
Porcupine Imperial	1½	2
Porcupine Tisdale	1⅞	2
Preston East Dome	1½	2
Rea Mines	28	35
Standard	½	1½
Swastika	10	10½
Vipond	32	34
United	1	2
West Dome	5	15

Sundry.

Island Smelters	3½	4½
Canadian Marconi	475	625
American Marconi	825	837½

The returns of the United States' Bureau of Mines show that 2,517 persons, or 0.391 per cent. of the number employed, were killed in coal mine accidents in the United States during the year 1911. Of these fatalities, 48 per cent. were caused by falls of roof and falls of coal other than roof coal, and 14.14 per cent. only from gas and dust explosions. So far the Canadian returns, as a whole, are not yet available. The returns from Nova Scotia, however, indicate that the death rate from mine accidents last year was below that of the United States to the extent of one per thousand. Of the fatalities there 33.3 per cent. were caused by fall of coal or rock, and 22.2 per cent. to explosion of gas.