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VOL. XXXVII

TORONTO

No. 1

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IN THIS ISSUE

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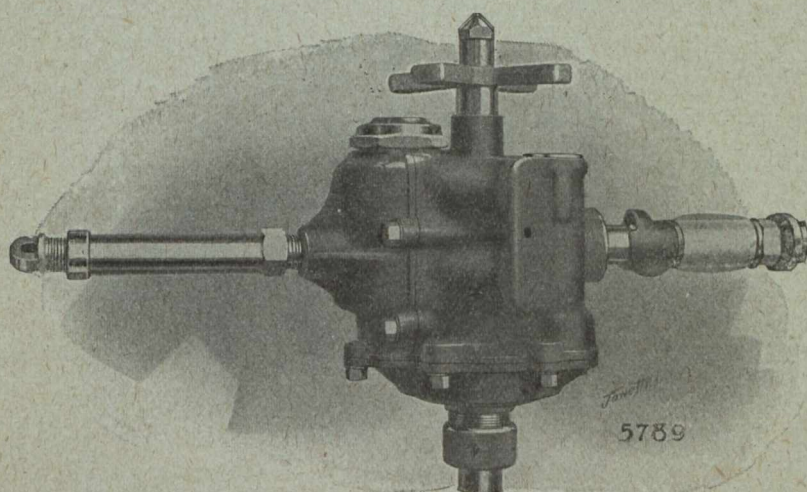
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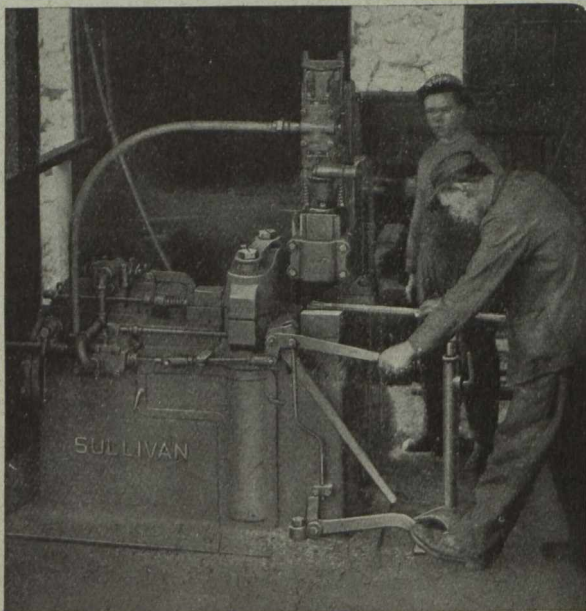
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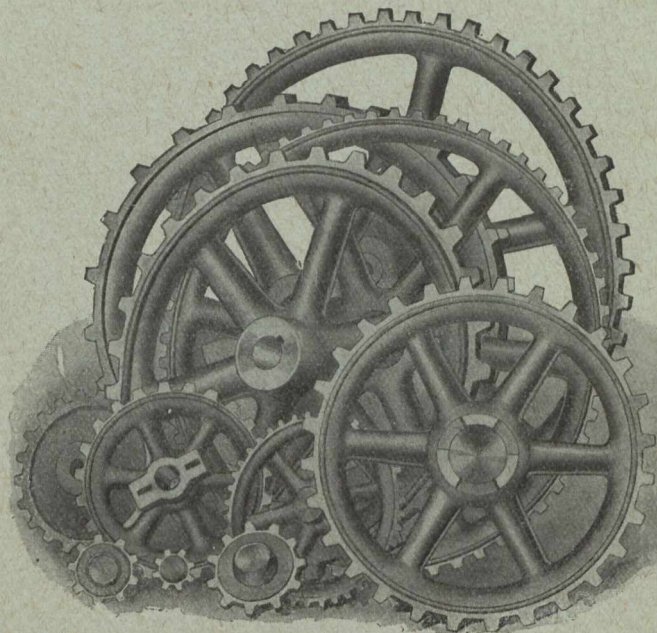
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Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of \$5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of \$10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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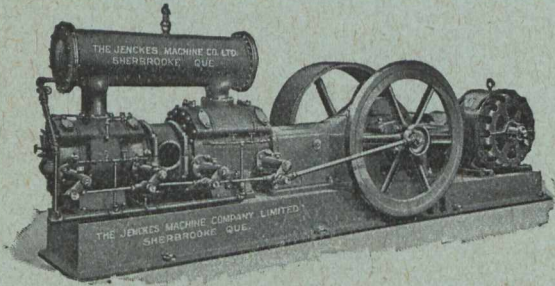
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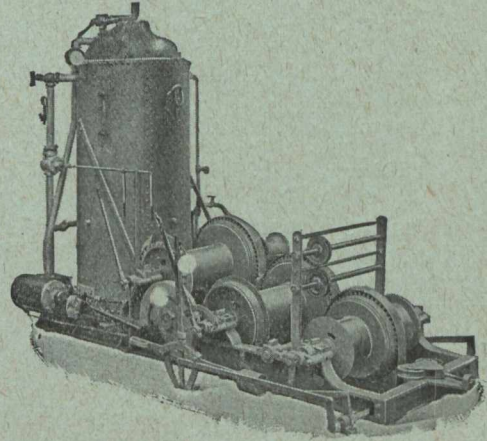
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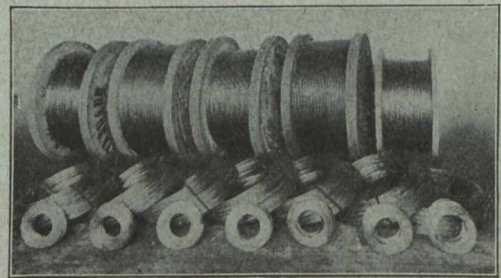
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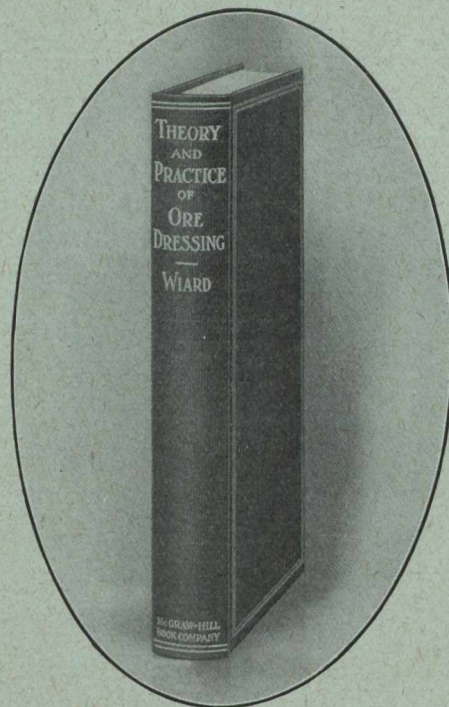
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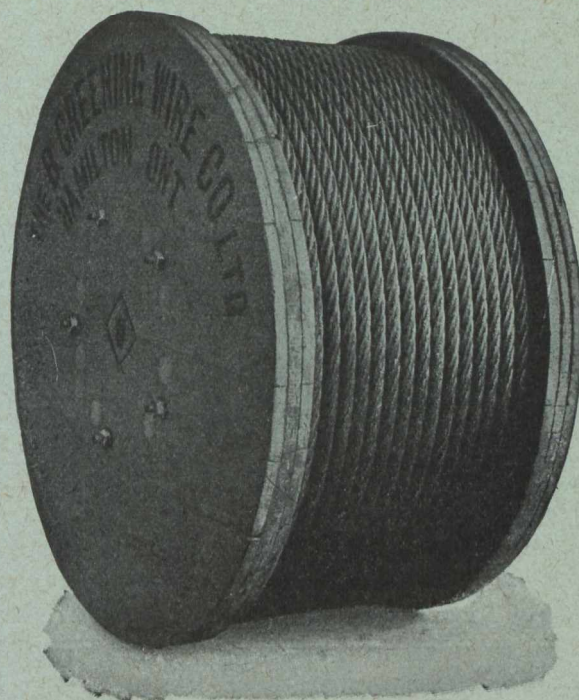
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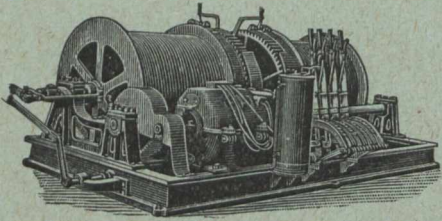
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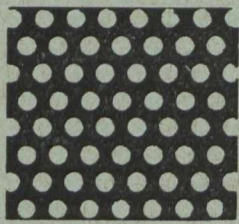
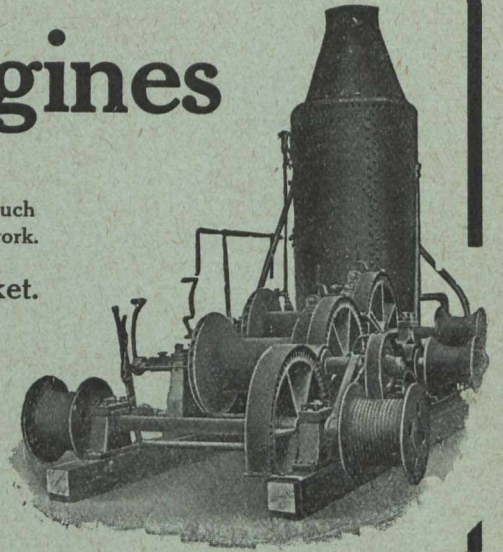
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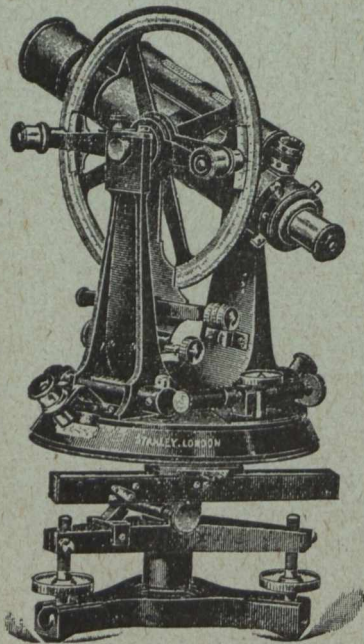
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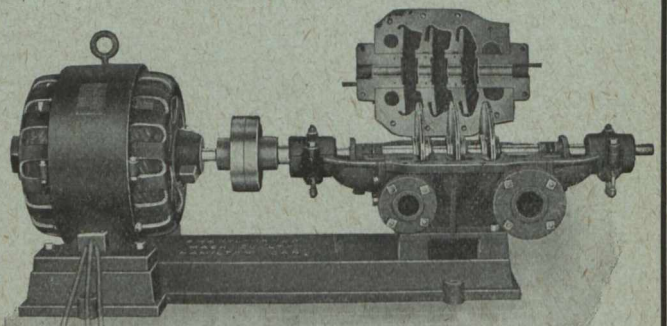
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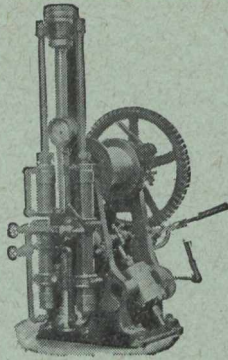
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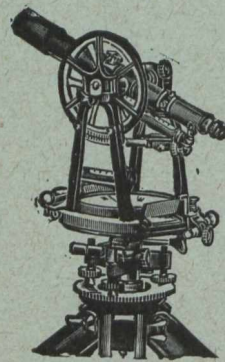
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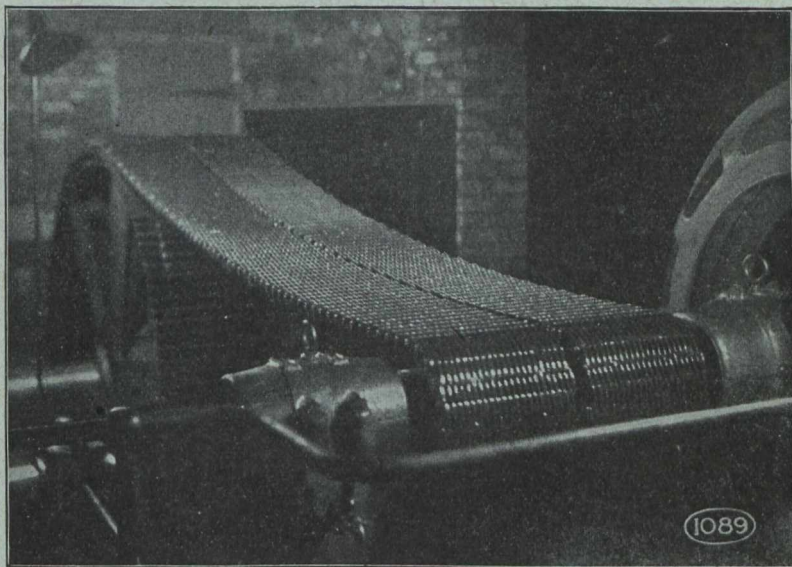
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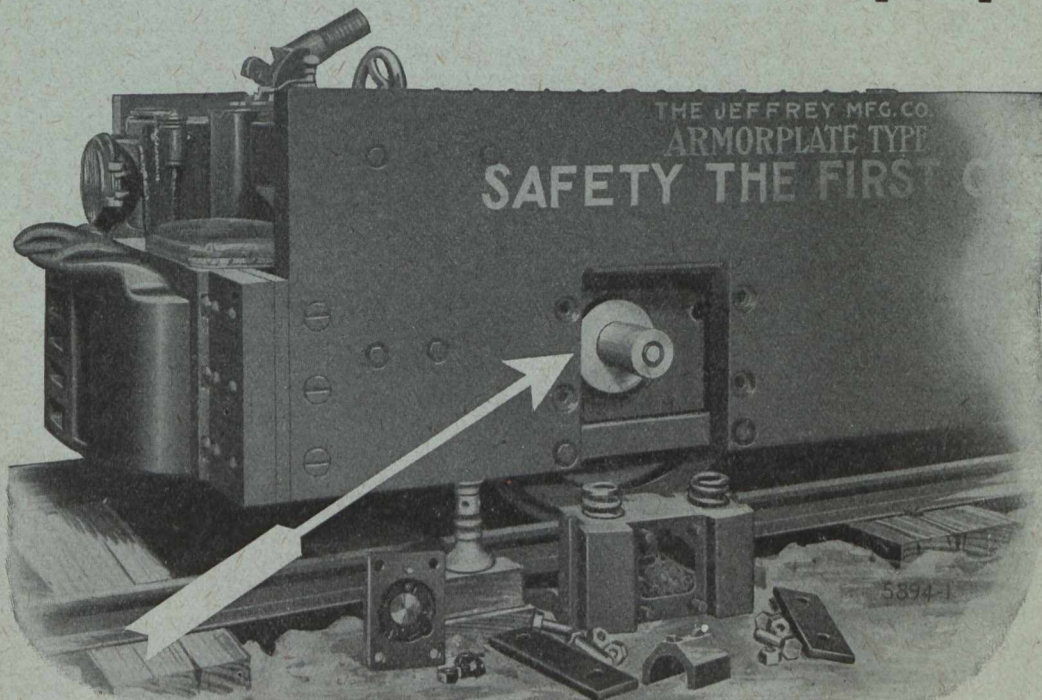
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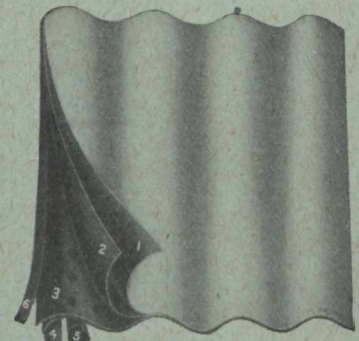


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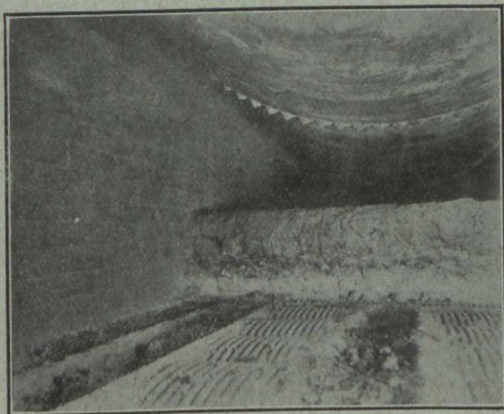
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THE CANADIAN MINING JOURNAL

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CONTENTS

Editorial—	Page.
Greater Production is Needed	1
The German Invasion of Belgium. By A. Ledoux	3
The Coal Trade of Nova Scotia in 1915. By F. W. Gray..	6
Mining in Quebec During 1915. By Theo. C. Denis	9
Consolidated Mining and Smelting Co. of Canada, Annual Report.	10
Relation of Governments to Mining. By H. V. Winchell	14
The Development of Electrolytic Copper Refining. By Lawrence Addicks	16
Mining in Alaska in 1915	19
Evaluating Coal Properties in Western Canada. By R. W. Coulthard	21
Personal and General	26
Special Correspondence	28

GREATER PRODUCTION IS NEEDED

In talking of the cost of the war, Sir George Paish in a recent interview said that Britain's financial loss is mainly in the wealth we fail to create. The actual loss in accumulated wealth has been small.

"We are selling American securities, but we are buying Russian, French and Italian bonds, and on the balance there has been little reduction in our investment since the beginning of the war.

"If each one of us were to live economically during the war we may not need to meet our great war expenses by realizing on our capital. Of course, we shall fail to save during the war the usual \$2,000,000,000 yearly of our income that we use for reproductive purposes."

Canadians will have to pay and are willing and able to pay their share of the cost of the war. It has been estimated by Sir George Foster that the war will cost Canada more than \$20,000,000 a month; but as an editorial writer in the "Mail and Empire" said recently: "Our foreign trade conditions, the Customs returns and the special war taxes have developed most encouragingly. In his budget speech the Finance Minister will be able to show a surprisingly effective raising of funds for current purposes, and at the same time a sharp upturn in general prosperity. The war loan just placed in Canada by the Dominion Government reached the large total of \$100,000,000. The bucket may go several times more to the well, and in every case return filled. If there is a continuation of war order business and full agricultural production in 1916 there is not much reason for doubting that the people of Canada will be able to provide the necessary funds to finish the war. Now that the depression has been shaken off the resourcefulness and vitality of Canada should suffice for the war's financial demands."

The people of the British Empire have made up their minds to go through with the war until victory is won, no matter what the cost, and sacrifices of capital were to be expected. During 1915 the fighting force of Great Britain has been increased from a powerful fleet and a little army to a more powerful fleet and a great army, the latter for a time poorly supplied; but now well supplied with ammunition. The cost of maintaining the army and fleet has increased enormously. It is gratifying therefore to have such a financial authority as Sir George Paish state that the huge expenditure of \$2,000,000,000 annually can be paid out of income and that Great Britain's accumulated wealth remains intact. Apparently the financial

authorities in Great Britain and Canada are convinced that the war can be continued for many years at the present rate of expenditure without necessitating loss of capital.

It is reassuring to have occasionally pointed out to us the magnitude of the financial resources of Great Britain. It is only during this war that most of us have realized how great they are. The recent subscription of over \$100,000,000 by Canadians to the \$50,000,000 war loan is also enabling us to better appreciate what can be done in this country.

Why is it that Canada is in such a satisfactory condition? What are our present sources of wealth? Can they be increased during the war, so that we can stand greater strain if need be?

Our basic sources of wealth are our agricultural soil, mineral deposits, forests and fisheries. Can we advantageously increase production from these sources? Undoubtedly we can and should increase our mineral production.

In the early months of the war there was a falling off in demand for some mineral products that made increased production unwise. In the case of some non-metallic minerals the market is still not strong enough to warrant increased production. But nearly all metals are in demand at good prices, and the market could readily absorb much larger quantities.

During the latter part of 1915 Canada's mineral production has been considerably increased; but it is not yet as large as it should be. A larger production can profitably be made at this time, and operators will be rendering a service to the country generally, as well as taking advantage of a good market, by increasing output. The farmers have helped by increasing productive acreage. Mining men should strive to make new records in 1916.

The apparently long premeditated invasion of Belgium and the horrible manner in which the German plans were carried out will forever stamp the leaders of the Huns as enemies of civilization. Before the war it was hard for Canadians to place much credence in the rumored danger of German aggression. We knew very little of European affairs. That the Belgians were, however, beginning to realize that Germany had sinister motives in their professedly friendly interest in Belgian industries is evident in Professor Ledoux's article in this issue.

Professor Ledoux writes with an intimate knowledge of Belgian affairs and the German invasion. Called suddenly from his work at the University of Brussels he joined the army and became a member of the corps of engineers who assisted in the heroic defence of the Liege forts, and later in the retreat. He took part in the fighting at Antwerp and in the retreat of the remnant of the Belgian army down the

coast. Then seriously ill he was confined to hospital and later declared physically unfit for further military service. He went to England, and then to Canada, where he is now on the staff of the Department of Mineralogy at the University of Toronto. His health is improving and with admirable patriotism he is planning to return again to help defend what is left of Belgium. Later, we trust, he will be able to take part in driving the foe out of his native land.

The effect of heat on the dissolution of gold in cyanide solutions is the subject of a paper by Mr. E. A. Wraight, published in Bulletin No. 133 of the Institution of Mining and Metallurgy. Mr. Wraight carried out a number of experiments, from which he concludes that the effect of heating cyanide solutions is of very doubtful benefit.

It is well known that gold dissolves faster in hot cyanide solutions than in cold. This is an accepted fact with which Mr. Wraight's results are in accord.

Apparently, however, the increased rate of reaction at higher temperature is not of as great advantage as might be expected. According to Mr. Wraight the extraction is increased for a short period, but this is counterbalanced by increased cyanide consumption and subsequent decrease in the rate of dissolution of gold.

Mr. Wraight found, however, that, while oxidizing agents, hydrogen peroxide excepted, are apparently of no value; the addition of oxygen in a more active form, as peroxide or by means of heated air, increases the solvent activity of cyanide solutions in a very pronounced manner.

As was predicted by well-posted authorities a few weeks ago the copper market is stronger than at any time since the war started. It is reported that Anaconda has made a very large sale to the British Government and that Calumet and Hecla is sold out to April 1. These reports lack confirmation, but if true they mean that two of the largest copper producers in the world are finding for their products a ready market at good prices.

ANTIMONY ORE IN ALASKA.

The high price of antimony in 1915 led to the mining of over 800 tons of stibnite ores in Alaska. Nearly 700 tons of this output came from the Fairbanks district, and the rest from Seward peninsula. It is difficult to obtain any exact valuation of the stibnite ores shipped from Alaska. The evidence in hand indicates that the producer received from \$1.25 to \$1.75 per unit of stibnite. It is probably reasonable to estimate that the Alaska shipments sold for \$85 a ton in San Francisco. This indicates a value of about \$70,000 for the total shipments made in 1915.

THE GERMAN INVASION OF BELGIUM, WITH PARTICULAR REFERENCE TO THE MINING INDUSTRY

By A. Ledoux,

Mining Engineer, Professor at the University of Brussels.

It has been often stated and repeated that the principal reason of the present war is of an economic nature. Since 1870, the population of Germany has increased more than that of any other big European country. She is actually of 70 millions. The mean decennial increase per 100 inhabitants, for the period 1870-1900 is 9.23 for Germany, 7.22 for the United Kingdom and only 2.50 for France.

With the large increase of her population, Germany was naturally forced to develop her industrial activities and her external trade. The exports increased from \$1,451,000,000 in 1902 to \$2,671,000,000 in 1911; and in the same time her exports increased from \$1,203,000,000 to \$2,223,000,000.

It might have been supposed that this increase of the external trade would have brought wealth and happiness to Germany; but in fact, only a very small proportion of the people profited by it. The bulk of the population was in a state of perpetual discontent, as is shown by the increasing strength of the "social democrat" party in that country. A large number of the German population was emigrating every year, to find elsewhere better resources and more liberty. But this emigration provoked by internal discontent was really favoring the German expansion outside.

If we analyze the occupations of the German people, we see that 37 per cent. are supported by industries and mining, 33 per cent. by agriculture and 11.5 per cent. by trade and traffic. Germany is also principally an industrial and mining country. She is producing a large quantity of ores and minerals, but she is nevertheless obliged to import a large quantity of raw material and metallurgical products. This is shown for the principal mineral products by the following figures for the year 1912, in millions:

	German production.	German imports.
Fuel—		
Bituminous coal	174,875,297	10,380,482
Lignitic coal	80,934,797	7,266,116
Petroleum	134,986	1,040,000
Ores—		
Copper ores	969,330	
Copper matte	2,574	23,192
Copper ingots	49,447	200,000
Iron ore	27,199,944	12,120,090
Lead ore	142,839	122,847
Manganese ore		420,709
Pyrite	242,121	1,073,285
Crude tin		15,550
Zinc ore	643,598	293,090
Non-metallic Minerals—		
Potassium salts (kainite, etc.)	11,389,000	
Phosphate rock		902,844
Salt rock	1,352,524	
Chili saltpetre		812,898
Sulphur		42,284
(Sulphuric acid)	1,649,681	130,257

One of the principal aims of modern German policy is to make Germany a country independent of other nations for her supplies in raw material. Minerals cannot be planted and cultivated as wheat; the German country does not contain a sufficient quantity of petroleum fields and deposits of copper, iron, lead, manganese, zinc, pyrite and phosphate. Her coal deposits are worked too actively and new reserves are lacking. The only way for Germany to get such mineral deposits is to steal them from somebody else. That's the German theory in all its crudity. We saw its application after

the 1879 war: the part of Lorraine annexed at that time was just that containing the iron deposits which were then known. Happily for France, those deposits extended at depth into the unannexed territory and discoveries of very important beds were made later on in France.

Very curious postcards and maps representing Europe in 1950 have been published in Germany. On these maps Austria-Hungary, Belgium, Denmark, Netherlands, Northern France, Serbia and a part of Roumania have been incorporated in the German Empire. Such an extension of Germany would have given her the mineral deposits she wanted. In fact, the theory of pangermanism was to create in Europe a new Holy German Empire extending from Calais on the North Sea to the Bosphorus and to take overseas some French colonies and the peace of the British Empire. Although Germany has remained at peace with Holland there is no doubt that if Belgium was to be annexed now, the turn of Holland was to come very soon. The annexation of those two small kingdoms would have given to Germany the big coalfields of Belgium and all the mineral wealth of Dutch East Indies and of the Belgian Congo. It will be to the honor of Great Britain to have prevented the realization of such a diabolical scheme.

Although the German emigration to America was becoming every year more important, people of the new Continent do not seem to be well acquainted with the methods employed by the German in order to capture a country. It should not be thought that the invasion of Belgium started the 4th August, 1914, with the beginning of the war. The German invasion of Belgium is much older, but was not started in the military way. Numbers of Germans of all ages and of all classes had arrived in Belgium long before the war and were residing there. In the big Belgian towns such as Antwerp, Brussels and Liege they were so numerous that they succeeded in establishing there German schools. This is a fact to be held in consideration, the Germans residing in other countries remain Germans and although sometimes naturalized they are not losing their national character with its qualities and its faults. Their children must be educated by German system and German pedagogy. And so they hope to constitute a small state, in the country receiving them. The actual experience of the United States is conclusive in this regard.

Most of the young Germans arriving in Belgium were entering tradehouses or factories, generally as simple volunteers. But when they were acquainted with their employer's organization, they asked for big salaries or went away, very often it was in order to open in the same town an opposition business. If there was an opportunity to invest money in their employer's business, the German clerk was generally ready to do so and the big banks of his country were supporting him. In other cases a more simple way to Germanize a Belgium firm was to marry the employer's daughter, and this has also often occurred.

Before Germany declared war the number of German industrial and commercial establishments in Belgium was increasing tremendously in number and importance. Big branches of German banks had been opened in Antwerp and Brussels. The German navigation lines were using Antwerp as a German harbor. To compete with the Belgian zinc industry the firm Beer, Sondheimer & Co., of Frankfurt had established in Belgium very large smelting plants. The German banks were monopolizing the shares of big mines and factories, buying at the stock exchange all they could get. At some annual meetings of shareholders of Belgian companies, the Belgians were astonished to see that the majority of the shares were in German hands. Quite recently the Germans were also trying to Germanize the Belgian Congo and principally the province of Katauga which is the richest in mineral deposits.

The Germans introduced into Belgium, brought with them a strong faith and attachment to their "vaterland." When it was possible for them to recommend products of Germany, they did never fail. We have known big Belgian factories, managed by Belgians, but having in their staff two or three Germans, where all kinds of goods, from the stationery and the laboratory apparatus to the big electrical machinery were ordered in Germany. For the Teutons nothing is of good quality except that which comes from their country. Really most of the German products are rubbish, attractive for their low prices, but not resisting the test of time.

The international exhibition at Brussels in 1910, showed to what an extent these German activities had undermined the whole Belgian trade and industry. The German department was a very large one, very well presented and interesting. The Germans and the Kaiser himself came to their "dear friends of Belgium" to express to them the extent of their sympathy and their desire to continue peaceful relations with Belgium. But the Belgians were warned by that exhibit of German expansion, and in themselves they felt that it was time to pay attention to these armed neighbors who talked too easily of peace.

Time has passed: on the 2nd of August, 1914, the German ambassador in Brussels was yet answering the Belgians that they had nothing to fear from Germany: "perhaps the house of your neighbor will burn, but yours will not suffer," were his own words. In the meantime the German Army Corps were crowding along the Belgian border. Two days later the invasion began, systematical and coolblooded.

The Belgians had to learn strange things about the work that the Germans had done in their country before the war. All the works of defence of Belgium had been carefully studied by German spies. Certain of these were naturalized Belgians and had been in the Belgian army. The work of offensive of the Germans in Belgium had long since been prepared. In the vicinity of the Belgian fortified towns, the Germans had built up factories, and in those factories,—whose position with regard to the forts had been accurately determined,—big concrete foundations had been prepared to receive the big German siege-guns. Preparations of the same kind had been established on the Belgian coast. There at numerous summer resorts, large numbers of German families were coming every year. Who could suppose that some of them had other intentions than to find their health and comfort? Nevertheless, German engineers had built in summer

cottages concrete works to receive the artillery of the Teutons.

I remember to have seen in Belgium before the war, blue advertisements for ultramarine to which we paid no peculiar attention; but after the war had started it has been noticed that they had been fixed by Germans and only along the roads leading to Antwerp. They were destined to indicate the way to the invading troops! Really the German sympathy in peacetime for their "dear friends of Belgium" was of a very special kind.

After the capture of the forts of the Meuse and the fall of Liege and Namur, centers of two large industrial and mining districts, the German military authorities organized their conquest. All the big mines and factories were occupied militarily. A similar occupation was made later on in the other Belgian coal fields.

The Germans proposed that the employees of Belgian mines and factories should work for them. From the managers to the most humble workmen, all refused. Difficulties arose with the mining people; the Germans sent in those districts lots of soldiers; trenches were dug in the streets of the "corons,"—the name given in Belgium and France to the agglomerations of work people houses in mining districts,—and in those trenches, machine guns were placed. The workmen were made prisoners and in some localities placed two days in cattle trucks, without having anything to eat. Afterwards some of them were obliged to work on roads and railways, under the steady threat of a German soldier's rifle.

The inactivity of the mining population could not last always; when they were quite starved out, they were obliged to return to their pits and to work. The newspapers have frequently stated how terrible was the situation of the Belgian people under the rule of the German invaders. Let us now see how their arrival affected the industry in the country.

It is easy to understand that the Belgian factories must be very much affected by the war. Before the war the total trade of Belgium amounted to \$1,620,000,000 or \$216 per head as compared with \$120.75 for Canada, \$114 for the United Kingdom, \$70.75 for France, \$67.25 for Germany and \$40 for the United States. This high standard of the total trade of Belgium per head, gives an idea of the industrial activity of that country. Necessarily it was principally based on her exports. Actually all her harbors are blockaded and trade with foreign nations has become an impossibility. As a consequence a lot of factories are closed and the working population without resources.

In his latest speech to the Reichstag, the German Chancellor held that the production of coal in Belgium during the three last months had reached 3,000,000 tons. In normal times the production should be 6,500,000 tons, so the reduction is more than 50 per cent.

Although no exact data are available, the reduction must yet be larger in the numerous quarries of Belgium. In ordinary time they number 1,700 and employ 40,000 workpeople. Building stones have for the present no market in Belgium and the sand for glass factories has no use as most of the furnaces are idle.

Woollen, linen, and rubber industries are completely stopped for lack of raw material and several zinc smelters have been obliged to cease operations.

In normal times Belgium produces 205,940 metric tons of zinc (1912), or more than one-fifth of the world's total production. She is only surpassed by

the United States and Germany. Now that big industry is arrested because exports are impossible.

And so we could go on, examining every industrial branch particularly. The war has paralyzed Belgian industry and it will take time for Belgium to recover.

Miners know that the arrest of continuous work in certain mines may occasion losses from which it is difficult to recover, and such is the case for the Belgian mines. Pumping being stopped some levels are flooded, and in the case of mines whose financial situation was not all too bright it may mean stopping for ever. Then also the lack of renewal of timbering will cause falling and caving in many mines.

New large coalfields had been discovered in the north east of Belgium and in most of the concessions the pits were actually being sunk. The work was not easy; before reaching the coal measures, the miners had to pass through 1,500 feet of clay and sand, the latter being always very wet. The processes of freezing and cementing had been applied with success. In most of the workings, the sinking was only half done, and since the beginning of the war all the work has been stopped. At the taking up of those sinkings, new soundings will be necessary and a lot of work that had been achieved will be wasted. It would be difficult to give now in figures the amount of the losses of all kinds that the war has imposed on Belgian mining and industrial companies.

Along with the losses produced by the decrease or stopping of work, destroying of large industrial plants has also to be noticed. During the bombardment of Liege, Namur and Antwerp, the German artillery destroyed the installations of mines and of great factories, without any strategical necessity.

Later on, when the Kaiser's armies had taken about the whole industrial part of Belgium, another system was inaugurated. In the big steelworks of John Cockerill at Seraing near Liege, a great part of the machinery has been dismantled and sent to Germany. All the copper available in Belgium's electrical works and other plants has been taken and directed to Germany.

The manner in which the Teuton officers performed this part of their programme is interesting. In one of those factories a Prussian captain entered the office of the manager, revolver in the hand. The Belgian manager, who spoke very good German, told him in this language that it was not a very civilized way to enter anybody's room. The officer replied that he was not a poet but a soldier, that he had nothing to do with that childish sentimentality, but that he wanted all the copper which was in the factory.

After all that has been related about cruelty of the German soldiers with regard to children, women and old people, this lack of respect for the civilian or industrial property will not seem astonishing. The atrocities committed in Belgium have sometimes been considered as isolated facts or the fault of soldiers intoxicated by the rage of the battlefield. If this was true that spirit of destruction, murder, robbing and exhaustion would have vanished when the Germans were masters of the greatest part of Belgium. The preceding facts show that the invasion of Belgium has been performed systematically along the lines of a long prepared scheme. The Teutonic staff thought it necessary for their glory and safety to terrorize the people remaining in the country they had conquered, to destroy the strength of Belgium's industry, to reduce her people to poverty and starvation. All those aims have been realized and nevertheless, Belgium although

bleeding and martyred is not dead; she remains hopeful and looks at the coming new year as a year of revenge and liberation. She is proud to have been the first in that list containing northern France, Poland, Serbia and Armenia to suffer for the destruction of militarism.

From these facts we can draw an interesting moral for people, such as Canadians, who want to make their way by honest labor. Industry and militarism are two opposite concepts: the first involves a perpetual work of creation, building up and invention; the second is a perpetual work of destruction. To nobody this will appear more true than to those people interested in mining and who strive all their lives to increase the potential wealth of humanity. When war breaks out, militarism destroys in a short time all that industry has raised by years of patient and continuous labor. Therefore we are more interested than anyone else in the destruction of that spirit of conquest, characterizing the German race. It is not only the interest of Belgium, of Serbia and the other people who were crushed by the Germans; it is the interest of the whole world.

ALUMINUM.

The consumption of aluminum in the United States in 1914 was the largest on record and amounted to 79,129,000 pounds, valued at \$14,523,000. Sixty years ago aluminum was a chemical curiosity, valued at \$90 per pound. The total amount produced in 1883 was 83 pounds. About 1889 it was selling in the United States at \$4.50 per pound, and the output was 75 pounds per day. With cheapened electric power and improvements in manufacturing processes, due to the genius of men like Charles M. Hall, the metal has ceased to be a "chemical" and its uses and applications are growing. At the end of 1914 it was selling at 19 cents a pound, but now, owing to the great demand, it is worth 60 cents a pound.

The consumption of metallic aluminum in the United States is much greater than the output and, though some metal is exported, a much larger quantity is imported. Much secondary aluminum is recovered from one source or another, largely from scraps, borings, and turnings. This recovered aluminum amounted, in 1914, to 6,253 short tons, or 12,506,000 pounds. The consumption of the metal is growing rapidly and the facilities for turning out enough for home consumption are inadequate. The one concern manufacturing the metal in the United States has steadily expanded its plant capacity in recent years, and has recently acquired an immense plant capable of generating 100,000 horsepower at Whitney, N.C., financed by French capital, but on which work had been suspended.

The great increase in the consumption of metallic aluminum has been determined by the peculiar properties of the metal, especially its lightness. Commercial aluminum has a specific gravity of about 2.7, whereas the specific gravity of brass is about 3 times as great, that of steel about 2.8 times as great, and that of copper approximately 3.3 times as great. Hence the metal has been in demand in the manufacture of automobiles, aeroplanes and dirigible balloons.

Aluminum vessels are coming into use in the brewing industry, varnish manufacture, the preparation of food-stuffs, the soap and candle industry, the refining of sugar and fatty and vegetable acids, and in the manufacture of high explosives, because of its ability to withstand the action, either separately or combined, of sulphuric and nitric acid.

THE COAL TRADE OF NOVA SCOTIA IN 1915

A RESUME

By F. W. Gray

The production of the coal mines of Nova Scotia during 1915 was practically the same as the yield of 1914. The writer estimated the production of 1914 as having been at least one million tons less than the full output capacity of the mines, had full operation been possible.

Since the autumn of 1913 there has been an almost complete suspension of new development work and capital extension at the collieries. In the interim several old collieries have become exhausted and have been permanently closed, and mining in unprofitable sections of collieries still operating has been discontinued. Several serious underground fires in the Pietou and Cumberland fields occurring during the last three years have caused the temporary, and in some cases the permanent loss of the mine districts affected.

Because of these various causes, the output capacity of the collieries is now lessened and the actual yield of 1915 is probably not more than 600,000 tons below the full output capacity of the mines, under the most favorable circumstances. In reviewing the outputs of 1914 the writer stated that "Not one of the operating coal companies in Nova Scotia is in a position to very materially increase its production over the figures of 1913," and since the date of this statement the number of collieries in active operation has been still further diminished.

It is therefore apparent that a serious shrinkage of the output capacity of the coal mines of Nova Scotia has taken place and the causes which have given rise to this recession of productivity will continue to operate for several years to come, independent altogether of considerations of market demand and labor supply.

When, however, there is combined with this lessening of capacity an increased demand for coal and a most serious reduction in the labor supply, it may be expected that a decided coal shortage will follow, and indications are now pointing to a temporary excess of demand over supply in the coal market.

The condition is an artificial one and has been brought about altogether by causes incident to the war. Moreover the duration of present conditions is quite uncertain and the prolongation of the present brisk demand for coal is too problematical to warrant any large expenditure on capital extensions by the coal companies, even were the labor available or in sight.

The most noteworthy feature of the year has been the response of the miners to the call for recruits. The writer, in the Canadian Mining Journal of 15th August last, gave some statistics concerning recruiting among the miners, and in another section of this article these statistics are corrected to the end of November. There has been some disposition to question the accuracy of these figures but it may be stated that the tabulation given is as correct as it is possible to make it and errs on the side of incompleteness rather than of exaggeration.

The record of the Nova Scotian miners in answering the call of King and Country is a noble one, one that in years to come will be a continuing source of

proud memories to themselves and also to those who have the honor to be associated with them.

But the drain upon the industry has been a severe one. The drop in production has assumed very serious proportions, and, as the writer ventured to forecast a few months ago, the question of recruiting among miners is resolving itself into a choice between men and munitions.

Enlistments to the end of November total 3,075 men, equal to 21 per cent. of the total force of 14,500 workmen* employed at the beginning of the war in and about the collieries. The Dominion Coal Company and the Nova Scotia Steel and Coal Company have between them lost 2,500 men by enlistments. Each of these companies is largely concerned in supplying coal for steel making, and both in the case of the Dominion Iron and Steel Company and the Scotia Company the output of steel is to-day almost altogether in the shape of munitions material.

The great railways of Canada now occupied in transporting troops, grain and munitions; the large fleets of transports that constantly ply between Canada and Great Britain; the mail steamers, the converted cruisers that patrol the Atlantic seaboard of North America; the factories in Montreal and Eastern Canada, occupied in manufacturing such materials as rifle sights, shells of various kinds, clothing, underwear, leather goods, boots, etc., all these are dependent on coal mined in Nova Scotia. The men who have gone cannot be replaced until the conclusion of war, and the reduction in the output of coal is, and will continue to be, in direct proportion to enlistments among the workmen at the collieries. This question of recruiting among miners is one that has already received the anxious attention of British and French statesmen, and in both countries special action has been found necessary to preserve the output capacity of the coal mines. The attention that has been paid by the Great General Staff of the German Army to the questions of coal and steel production is well known to all mining engineers who have followed the development of hostilities. It must be admitted that coal is as necessary to our final victory as any other munition. One might go further and say it is more necessary, because coal is the foundation of all manufacturing activity.

In England the hours of schools have been shortened in order to save gas, and reduce thereby the consumption of coal.

The availability of coal for the manufacture of munitions in Canada seems often to be taken for granted. In the Canadian Mining Institute Bulletin for December there is a brief but illuminating article by Hon. Col. D. Carnegie, dealing with the activities of the Shell Commission. A list of the materials used in the manufacture of shells is given, namely, steel, brass, copper, lead, tin, resin, powder, cordite, and trinitrotoluene, but coal is not mentioned by name. Its use is of course implicit in every single item of material mentioned. In the period covered by Col. Carnegie's remarks 360,000,000 pounds of steel has been used in

*See Mines Report Province of Nova Scotia 1914.

shell manufacture in Canada. The fabrication of this quantity of steel necessitates the consumption of at least 640,000 tons of coal. Trinitrotoluene, the consumption of which is given as 11,000,000 pounds, is a direct coal derivative, at least so far as the un-nitrated toluene is concerned.

There is no need to further elaborate this point. It has already been done in an inimitable manner by David Lloyd-George. Without coal the manufacture and the transportation of munitions is impossible.

The following table gives the annual production of the various coal companies of Nova Scotia over a period of five years. Inspection of the figures will show that, notwithstanding all the drawbacks to production previously pointed out, the coal raised in 1915 is slightly in excess of the outputs of 1914, a better showing than was to be hoped for, seeing that at the end of June the provincial output was 426,000 tons behind the first half of 1914.

The percentage of output to the credit of Cape Breton increases steadily from year to year, and may be expected to continue to do so.

The tonnage of the Dominion Coal Company in 1915 reached 75 per cent. of the entire provincial output,

per cent. from amongst this Company's employees. The Maritime Coal & Railway Co. had the largest output for a good many years. During the last three months this Company's production has averaged over 17,000 tons per month. The Colonial Coal Company also show a slight increase over last year, although this Company now is operating one colliery, having closed down the "MacKay" mine.

The coal output of Inverness County is steadily dwindling. The falling off in the output of the Inverness Coal & Railway Company occurred during the first six months of the year. In the closing months a production of 25,000 tons per month was being obtained.

The reduction in the production of the Nova Scotia Steel Company also occurred during the first five months of 1915. During the last half of the year this Company's mines have been on full production, and are averaging about 62,000 tons monthly.

The production of the Dominion Coal Company exceeded that of 1914 by some 300,000 tons, the output of the Springhill Mines showing a slight decrease. In comparing the outputs of this Company with those of 1914 it must not be forgotten, that in 1914 the mines could easily have produced a million tons more than

Yearly Production of the Coal Companies of Nova Scotia.

	1911.	1912.	1913	1914.	1915.
Dominion Coal Co.—					
Glace Bay Mines . . .	3,895,000	4,513,269	4,739,149	4,287,717	4,610,000
Springhill Mines . . .	266,000	419,096	381,414	417,416	400,000
N. S. Steel & Coal Co. .	780,000	841,528	813,877	752,153	618,000
Acadia Coal Co.	370,000	435,654	536,000	394,000	336,000
Inverness Coal & Ry. .	281,000	279,318	293,847	264,843	244,000
Intercolonial Coal Co..	263,000	235,859	189,550	213,000	178,000
Maritime Coal & Ry.. .	160,000	140,000	158,847	142,000	173,000
Minudie Coal Co.	105,000	60,000	65,500	70,000	86,000
Colonial Coal Co. . . .	30,000	36,897	65,844	53,134	56,000
Cape Breton Coal, Iron & Railway Co.			8,424	49,000	6,000
Total	6,250,000	6,961,619	7,252,452	6,643,263	6,707,000
Cape Breton Island . . .					
Per cent.	80%	81%	81%	81%	82½%
Nova Scotia					
Per cent.	20%	19%	19%	19%	17½%

and this preponderance may also be expected to still further increase.

The Springhill mines during the year were able to overcome the effect of the underground fire that occurred in 1913. The Allan Shafts of the Acadia Coal Company were successfully recovered but did not produce much coal until the last half of the year. The Drummond Colliery was doing very well indeed, but unfortunately a fire broke out in November which has necessitated the sealing of the mine and the flooding of the affected area. The time that will be occupied by the recovery operations is uncertain, but it will probably be one or two months.

With the exception of the mines in the Joggins Field all the Pictou and Cumberland collieries show decreases in output. The strength of the smaller companies is worthy of remark. The Minudie Company again show an increase, notwithstanding an enlistment of 26

was actually mined, whereas during the last half of 1915 the collieries have been working to the fullest capacity.

The highest monthly production yet obtained by this Company was 462,240 tons in June. No. 2 colliery put out 80,933 tons in July, the highest mark reached by this large colliery. During the year No. 3 colliery became exhausted and was closed down. No. 17 colliery has not been operated during the year. No extensions or new development work took place during the year. A new turbo-compressor plant is on order for the Springhill Mines, it being the intention to use compressed air for pumping and auxiliary haulages underground.

The number of enlistments from among the employees of the various coal companies of Nova Scotia, to the end of November, is, accurately as it is possible to determine, as follows:

	Enlisted among Forces of the Allies	Enlisted with British Forces
Cape Breton Island—		
Dom. Coal Co.	540	1,017
N. S. Steel & Coal Co.	25	531
Inverness Coal & Ry. Co.	17	60
Colonial Coal Co., etc.	—	20
	582	1,628
Nova Scotia Mainland—		
Springhill Mines (Dominion Coal Co.)		
	140	256
Intercolonial Coal Co.	1	118
Acadia Coal Co.	20	115
Minudie Coal Co.	18	66
Maritime Coal & Ry. Co.	1	130
	180	685
Total for the Province. . . .	762	2,313

The men shown as having joined the forces of the Allies were of French, Belgian and Italian nationality. Practically no Frenchmen or Belgians of military fitness remained in Nova Scotia. The enlistments since the date of the last figures given in the Journal have been exclusively from among men of British nationality, that is to say, since the end of June last, 1,325 men have left the collieries of Nova Scotia for the front. The proud Gaelic motto of the Nova Scotia 85th Highlanders, which is translated as "The breed of manly men" might fittingly be bestowed upon the miners of Nova Scotia. Nor should a lesser tribute be paid to the wives and mothers of the mining population, who, more than is probably recognized, have helped their menfolk in their great resolve and supreme sacrifice.

Shipping Matters.—St. Lawrence shipments were lower than in 1914, the decrease being attributed to the shortage of shipping. The Admiralty requisitions have greatly limited the available freighting tonnage. At the beginning of the St. Lawrence season the Dominion Coal Company had lost no less than fifty-five per cent. of its season-chartered tonnage by Admiralty requisition, and in addition this company lost at sea the chartered vessels "Kron Prins Olaf," "Easington," and "St. Kilda," and its own two vessels the "Cacouna" and "Cabot."

Some years ago the Canadian Government passed regulations which barred vessels of Norwegian and other alien nationalities from trading in Canadian waters unless they transferred to Canadian or British register. This regulation was doubtless conceived with the idea of fostering a Canadian-owned mercantile marine, but no steps were taken apparently to encourage or subsidize the building of ships in Canada. It has been found necessary to modify the exclusion of Norwegian tonnage to some extent because of the difficulty of getting suitable British or Canadian-owned vessels, but the regulation has had the effect of lessening the number of neutral vessels employed in the Canadian coasting trade and increasing the number of British-owned vessels. Neutral vessels could not have been requisitioned by the Admiralty, and but for the regulation referred to it is probable that more neutral vessels would have been employed in the coal-carrying trade, and freights would not to-day have been so badly affected. It is curious that a regulation intended to foster a home-built and Canadian-owned

marine should have really worked against Canadian interests under present circumstances. The regulation has merely had the effect of substituting English or Scotch owners for Norwegian owners, and has not assisted in the slightest degree in bringing into being a Canadian mercantile marine. In any case, whether these chartered vessels are Norwegian-owned or British-owned, they are all built in Great Britain, so that the regulation has not helped the British ship-building industry either.

One outcome of the war will be the advertisement given to Nova Scotian coal. Because of the difficulty of obtaining coal in Great Britain, steamers on the transatlantic route have been taking double bunkers on this side. The large auxiliary cruisers, including such leviathans as the "Mauretania" have been bunkered with Nova Scotian coal. Ships from all the ends of the earth—vessels that in palmier days would have scoffed at any grade of bunker below that of "best Welsh"—have used Nova Scotian coal, with excellent results.

The writer cannot forbear referring to the standing miracle of the unmolested and uninterrupted coastwise trade of Nova Scotia during the progress of seventeen months of war with the second greatest naval power in the world. Our everyday immunity from hostile attack from the sea is now a commonplace and accepted circumstance, but it is none the less a thing to marvel at.

USES OF PLATINUM.

Probably one of the most important uses of platinum at the present time is in the manufacture of "fuming" sulphuric acid and sulphur trioxide, materials that are practically indispensable to the makers of high explosives and aniline colors. It is not possible to estimate the quantity of platinum tied up in the manufacture of sulphur trioxide, but the loss of platinum in the industry is very small. Should the price of platinum prohibit its use, sulphuric acid manufacturers could still make the fuming acid by substituting iron oxide for platinum.

In former years platinum was considered essential in electrical work where it is now replaced by "nichrome" and other alloys or metallic molybdenum and tungsten. In dental work, platinum plating gives as satisfactory results as the pure platinum formerly much used.

USES OF QUICKSILVER OR MERCURY.

The principal uses of quicksilver are in the manufacture of fulminate, in making electric appliances and in the milling of gold and silver ores. The quantity of quicksilver used for the latter purpose is much less than formerly because of the growing use of the cyanide process. Consequently more quicksilver is available for use in the manufacture of explosive caps and electrical appliances. More than 30 per cent. of the gold mined in the United States is recovered by cyanidation, and only about 21 per cent. by amalgamation, the total amount of quicksilver used for the purpose amounting to only 700 or 800 flasks a year.

The average gold recovery from 11,000,000 tons of siliceous ores treated in the United States in 1914 was \$5.53 per ton. The average gold per ton from the Alaskan deep mines was \$2.78; from California, \$5.46, and from South Dakota, \$3.63. Even with these low recoveries of gold per ton of ore, the dividend yield has been large.

MINING IN QUEBEC DURING THE YEAR 1915

By Theo. C. Denis.

As far as an estimate can be made, the figures of the mineral production of the Province of Quebec during 1915 will show an appreciable decrease as compared with the previous year. This falling off, however, will not be as large as it would have been had the second half of the year resembled the first six months.

The vast majority of the products of the mines and quarries of the Province of Quebec is non-metallic in character,—being principally made up of asbestos and structural materials. The metallic products of our mines only enter for less than 9 per cent in the figures of our mineral production. It is therefore natural that such products that are in demand mainly in times of industrial prosperity, should show a falling off in these times of abnormal economic conditions. Such are: Asbestos for structural purposes and manufacture of heat insulating coverings; mica for electrical apparatus; building materials, limestone, cement, marble, brick.

On the other hand, the metallic mines enjoyed an activity unprecedented in their history. As the European situation has created a demand for most metals at most attractive prices, this has had the effect of stimulating the re-opening of our chromite and molybdenite deposits, and of greatly increasing the production of our copper and sulphur ores.

From January until May, the outlook for the asbestos industry was rather dark. Many of the mines suspended operations during the whole winter, limiting the work to pumping the water out of the pits. But activity began to develop in the early part of the summer, and, as a matter of fact, the shipments of asbestos will only show a decrease of perhaps 10 per cent. At present, the asbestos market is practically normal and the demand is good. The acuteness of the situation during the first months of the year may be gathered from the fact that the wages for unskilled labor in the asbestos districts were \$1.25 and even \$1.00 in January and February, whereas now, in December, they are \$1.75, which is the normal standard.

The greater part of the chrome which can be mined in New Caledonia and in Rhodesia is required in France and England; moreover ocean freight is very difficult to obtain, and the rates are abnormally high. Under these conditions, it is quite natural that the demand for Quebec chrome in the United States should be very brisk and result in the re-opening of our chrome mines, which had laid dormant for several years.

It is estimated that during the last six months of 1915 some 10,000 tons of chrome ore, of an average content of probably 30 per cent. chromic sesquioxide, have been exported from Black Lake and Coleraine. It is not at all impossible that, from this galvanization of an industry which was flourishing a few years ago, permanent results may follow.

All previous records of shipments of copper and sulphur ores will be broken, and this despite the fact that the shipments of ore from the Eustis mine have been handicapped by the burning down of the concentrator, which occurred in August. Immediate steps were taken for building a modern and up-to-date concentrator. Some of the monthly shipments of the Weedon mine have neared 10,000 tons.

Substantial shipments of zinc and lead ore are recorded from the deposits of Notre Dame des Anges, in Portneuf county. These deposits are proving to be im-

portant and interesting. Dr. J. A. Bancroft made a study of these occurrences during the field season, for the Quebec Mines Branch, and the results of his field-work will be published in the annual report of the Branch.

The mica and the graphite production, from the Lievre and Gatineau Rivers district, will show a considerable decrease, but this will be compensated, to some extent, by an increase in the production of magnesite.

In 1914, the total mineral production of the Province of Quebec reached \$11,732,782, made up, roughly speaking, as follows: Asbestos, 25 per cent.; structural materials, 62 per cent.; metallic ores, 9 per cent.; miscellaneous, such as mica, feldspar, magnesite, 4 per cent. A large decrease in building materials is to be expected, but it is gratifying to note that our asbestos industry has picked up so well during the latter part of the year and there is little doubt that on resumption of normal industrial and economic conditions, the mineral production of the Province of Quebec will resume the regular growth and increase which, until last year, each year had shown over the preceding one.

ANTIMONY.

The demand for antimony caused by the European war has resulted in the opening of many deposits in various parts of the world. The element is almost indispensable in type and bearing metals, and there has been a great demand for antimony to be used in making shrapnel bullets. Antimony used in America has been mostly obtained from China and Mexico.

MANGANESE.

Prior to 1870 iron found its principal use as wrought iron and crucible steel in which manganese is not used. The development of the Bessemer process about 1870 created a demand for manganese alloys, and manganese now constitutes about one-half of 1 per cent. of all Bessemer and open-hearth steel. Manganese also forms a large part of some special alloys used in the manufacture of grinding and crushing machinery that are highly important in modern industries.

CHROMIUM.

Although the salts of chromium have many minor uses, the metal finds its greatest use as an alloy with iron in the manufacture of high-grade steel for the most part uniquely adapted to special uses. Tool steel containing small amounts of chromium and tungsten permits a rate of cutting not possible with any other alloys and is therefore important in modern machine-shop practice.

Three thousand four hundred and thirty ounces of refined platinum were recovered in the United States in 1914 from the electrolytic refining of gold bullion, platinum sands and copper matte. The platinum recovered by gold and copper refiners occurs in the original ores in such minute quantities that it is rarely determined in assaying. Only the immense tonnages of gold, copper and silver ores treated annually render the platinum content of importance.

CONSOLIDATED MINING & SMELTING COMPANY OF CANADA—ANNUAL REPORT

President W. D. Matthews' report for the year ending September 30th, 1915, is in part as follows:

The net profit after writing off \$192,478.85 for depreciation amounts to \$795,411.15, out of which four dividends (a total of 8 per cent.), amounting to \$464,398.00, have been paid, leaving a balance of \$331,013.15, which, added to the balance at the credit of the Profit and Loss Account as shown last year, makes a total of \$2,058,299.88 at the credit of that account.

During the year the Property Account has been increased by the sum of \$42,372.37, which includes the cost of claims adjoining the Sullivan mine and work done on the Lucky Thought, Ottawa, Molly Gibson, Highland and Silver King mines.

As outlined in a notice to the shareholders on November 15th last, the directors decided to issue 11,610 shares of the stock of the company. This new issue of stock was for the purpose of providing funds for the extension of the company's operations at Trail and elsewhere.

The directors being of opinion that further issues of capital may be required for the purposes of the company have passed a by-law, increasing the amount of the authorized capital to \$15,000,000.00.

Since the last report important additions have been authorized at the smelter, to take care of an increased tonnage of ore and also to allow of the production of zinc on a commercial scale and to provide a copper refinery. These additions and extensions are well under way at the present time and some of the equipment is already in operation.

Contracts have recently been entered into with the Shell Committee for the supply of a considerable tonnage of zinc and refined copper. The manufacture of zinc is a new departure for the Company, but with the large tonnage of zinc ores available in the company's properties it will develop into an important feature of its operations. Up to the present the copper matte coming from the smelter has been refined in the United States, but the refinery when in operation at Trail will enable the company to refine copper in Canada.

The development work at the Sullivan mine, and also at the Rossland group, has opened up some promising bodies of ore. Very little work has been done at the other properties of the company.

Balance Sheet as at September 30th, 1915.

Capital—		Liabilities.	
Authorized:			
75,000 Shares of \$100 each	\$7,500,000.00		
Issued and fully paid—			
58,052 shares of \$100 each	\$5,805,200.00		
Sundry Banks—			
Bank of Montreal—			
Loan and overdraft	\$664,461.57		
Accrued interest	2,881.30		
Pay roll accounts overdrawn	1,742.85		
			669,085.72
Contingent liability at September 30, 1915, on drafts against shipments.		\$184,485.20	
Accounts payable and unpaid dividends			528,007.90

Reserve, including provision for claims awaiting adjustment	24,552.57
Profit and Loss Account—	
Balance at September 30, 1914	\$1,727,286.73
Profit twelve months ended September 30, 1915	795,411.15
	<u>2,522,697.88</u>
Less dividends declared Dec. 15, 1914, March 10, June 10 and Sept 10, 1915	464,398.00
	<u>2,058,299.88</u>
	<u>\$9,085,146.07</u>

Assets.

Mines, Mineral Claims and Shares in Other Companies—	
Balance September 30, 1914	\$5,290,396.91
Expenditure, twelve months to September 30, 1915	42,372.37
	<u>\$5,332,769.28</u>
Mining, Smelting, Concentrating and Refining Plants—	
Balance September 30, 1914	\$1,882,615.24
Construction, twelve months to September 30, 1915	334,909.14
	<u>\$2,217,524.38</u>
Less depreciation	192,478.85
	<u>2,025,045.53</u>
Smelter Product on Hand and in Transit to Refineries—	
Pig lead, bullion, matte, bluestone and antimony	\$179,448.47
Ores and Metals on Hand and in Transit to Smelter at September 30, 1915—	
Value of metal contents corrected to market quotations:	
Ores on hand	\$525,899.60
Refinery metals on hand	410,942.17
Ore in transit to smelter	30,023.15
	<u>966,864.92</u>
	<u>1,146,313.39</u>
Mine and smelter stores and materials	414,283.87
Accounts receivable	146,169.11
Insurance and taxes paid in advance	15,926.33
Cash in Banks and on hand—	
Head Office, Toronto	\$1,831.91
Sundry pay roll bank accounts	2,806.65
	<u>4,638.56</u>
	<u>\$9,085,146.07</u>

Profit and Loss Account.

For the Twelve Months Ended September 30th, 1915.	
To smelter product on hand and in transit from smelter to refineries at Sept. 30, 1914	\$133,492.80
To ores and metals on hand and in transit to the smelter at Sept. 30, 1914	1,319,758.45
To Customs ore, lead and bullion purchased	1,400,000.43
To freight on ore from company's mines	151,442.94

To Mining, Smelting and General Expenses—	
Molly Gibson Mine	\$2,614.36
Richmond-Eureka Mine	245.35
Maestro Mine	106.64
Highland Mine	2,556.72
No. 1 Mine	22,632.70
St. Eugene Mine	8,166.05
Sullivan Mine	113,183.67
Le Roi Mine	352,831.80
Centre Star Mine	602,766.46
No. 7 Mine	1,342.72
Ben Hur Mine	17,194.12
Trail smelter and refinery	1,940,075.65
	3,063,716.24
To Development Expenses—	
Ottawa Mine	\$1,826.06
No. 1 Mine	11,721.47
Sullivan Mine	59,261.66
Le Roi Mine	74,001.14
Centre Star Mine	288,311.49
Silver Dollar Group Mines	108.95
	435,231.06
To Depreciation, General Plant and Equipment..	192,478.85
To Directors' fees	8,800.00
To sundry items written off, including bad debts	5,766.53
To Balance—profit	795,411.15
	\$7,506,098.45
By sales of smelter product, ore, etc.	\$6,349,651.11
By smelter product on hand and in transit from smelter to refineries at Sept. 30, 1915.....	179,448.47
By ore and metals on hand and in transit to the smelter at Sept. 30, 1915—	
Value of Metal Contents correct- ed to market quotations—	
Ores on hand	\$525,899.60
Refinery metals on hand	410,942.17
Ore in transit to smelter....	30,023.15
	966,864.92
By rents and sundry revenue	10,133.95
	\$7,506,098.45

General Manager R. H. Stewart, reports in part as follows:

Operations for the year show a net profit of \$795,411.15 after writing off \$192,478.85 for depreciation on plant and equipment, and charging to Profit and Loss Account \$435,231.06 expended during the period in development on our properties.

Increase in plant account for the year, deducting depreciation and sales of plant, amounted to \$142,430.29. Increase in property account, \$42,372.37.

Production of the company's mines and smelter are shown in the following statements. The tonnage smelted at Trail shows an increase over that of the previous fiscal year of 6,025 tons monthly, or 72,293 tons for the year.

Mine Production.

	Year 1914-15,	1894 to date
	Wt., tons.	Wt., tons.
Centre Star—Ore	180,410	2,386,753
Centre Star—Concentrates .....	.....	9
Le Roi—Ore	134,758	1,816,995
Le Roi—Concentrates .....	.....	612
Sullivan—Ore	44,841	264,408
St. Eugene—Ore	169	1,018,492
Number Seven—Ore .....	.....	7,388
*Molly Gibson—Ore .....	.....	5,084

*Number One—Ore	5,598	14,851
*Highland—Ore .....	.....	1,346
*Highland—Concentrates .....	.....	2,666
*Maestro—Ore .....	.....	419
Richmond Eureka—Ore .....	.....	14,661
Lucky Thought—Ore .....	.....	36
Ottawa—Ore	35	377
Phoenix Amalgamated—Ore .....	.....	2,493
*Silver King—Ore .....	.....	(17,238)
*Ben Hur—Ore	6,767	6,767

Note—Production given above includes that of previous owners.

*Since company acquired property only. Previous records not available.

Smelter Production.

	1894 to date.	1914 to 1915.
Tons ore smelted	4,372,886	447,064
Ounces gold produced	1,610,903	148,891
Ounces silver produced	22,247,832	2,230,500
Pounds lead produced	374,091,124	40,177,910
Pounds copper produced	63,196,978	5,306,184
Gross value	73,402,078	

The company's mines in Rossland are in about the same position as regards ore reserves as at this time last year. The Le Roi mine has increased its reserves to some extent, while the War Eagle and Centre Star mines show a slight decrease in ore reserves.

In the War Eagle the principal development has been the opening up of a new level at a depth of twenty-four hundred feet from the surface, by means of a crosscut from the 16th, or lowest level of the Centre Star shaft, this being connected to a winze from the lowest War Eagle workings three hundred feet above. A small stope has been opened up near the intersection of the winze and crosscut in new ground, but no development has as yet been done in the ground under the stopes on the level above. There have been some new bodies of ore developed in some of the upper levels.

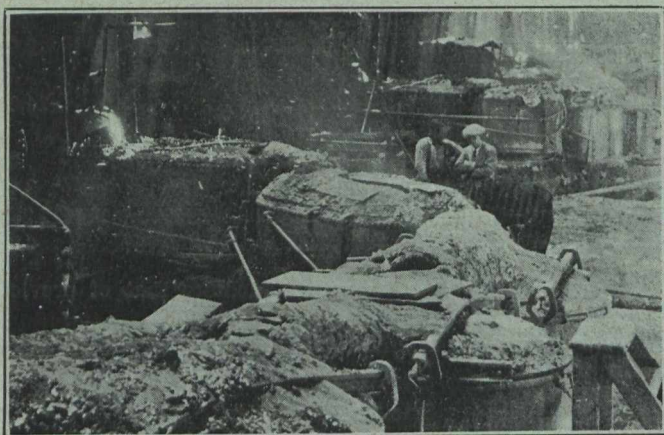
In the Centre Star, on the 6th level, a crosscut has opened up some promising ore in new country, but it has not yet been opened up to any extent. Ore has also been found on the 13th level in ground which has hitherto been unproductive.

In the Le Roi a drift has been run west from the Centre Star shaft and connected with a winze from the lowest level of the Le Roi, and from this drift it is intended to further prospect the ground below the lowest levels of the Le Roi. Considerable productive ground has been opened up in the west end of the mine from the 1,650 level upwards.

At Kimberley, in the Sullivan mine, development has been confined principally to the old tunnel level and the level one hundred feet below it, and some promising bodies of ore have been opened up in the drifts and by diamond drilling. A tunnel has been started at a depth of seven hundred feet below these upper workings, which it is intended will be the main working tunnel of the mine. This tunnel will be between eight thousand and nine thousand feet long before it reaches the present workings of the mine.

Very little work has been done at the St. Eugene mine.

At Ainsworth the mines were closed down during the greater part of the year, a few men being employed at the Highland in driving No. 5 tunnel, which tunnel is



Copper Settlers, Trail Smelter

intended to open up the veins one hundred and ten feet below the lowest previous workings of the mine. Ore has been encountered in this tunnel, but no development has as yet been done on it. The prospects are encouraging.



Roasting Pots, Trail Smelter

In the Number One mine a shaft has been sunk one hundred feet, and a crosscut is now being driven to intersect the vein.

At Slocan City, in the Ottawa mine, only a small amount of work has been done, and some small bodies of high-grade ore have been encountered.

At Silverton a small amount of work was done in the Lucky Thought, but with negative results.

At the Molly Gibson a few men have worked on the tunnel from the surface with fairly satisfactory results, but no ore has been shipped and the mill has not been operated.

No work was done in Sandon at the Richmond-Eureka.

The charge to property account of \$42,372.37 included small amounts for the purchase of claims or rights in Rossland, at the Sullivan and in Slocan City; also development done on properties from which shipments were not made during the year.

Expenditure on plant account for the year is \$334,909.14. Of this amount, \$329,539.64 has been expended at Trail. The principal items of this expenditure have been:—

Purchase of the rights to use the Cottrell patents and the building and extension of Cottrell plants for the lead roasters and furnaces. The saving from the use of these plants is very great already, and will be

greater after some alterations in the electrical equipment.

An additional lead furnace, together with the necessary flues and extension to the furnace building.

An additional crane in the Huntington and Heberlein plant.

Wash houses for men working around the lead plant.

New lead sampling mill, which is not quite finished.

Copper converters and the necessary accompanying plant, also unfinished.

Experimental work on the treatment of zinc.

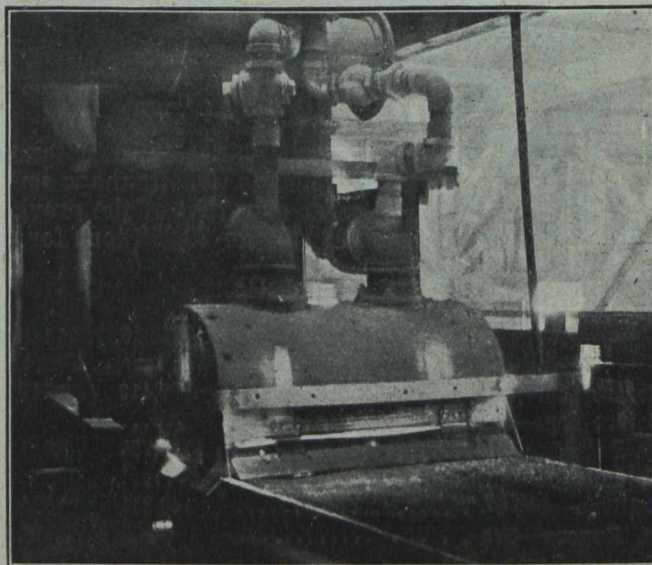
Rebuilding tanks, and alterations to the lead refinery, also unfinished.

Beds for bedding of copper ores previous to their treatment in the copper furnaces, and some additional electric locomotives and scales used in connection with the bedding plant.

At the Sullivan mine a shovelling machine has been installed for handling the rock from the long tunnel.

During the year considerable experimental work was carried on in the production of electrolytic zinc, and spelter of a good grade has been produced at the rate

of about one-half ton per day from zinc contained in the Sullivan ore. The results have been promising enough to warrant the building of a larger plant, and, on account of exceptional circumstances, a plant of twenty-five to thirty-five tons capacity of spelter per



Sintering Machine, Trail Smelter

day has been designed and is now being erected. It is hoped that this will be in operation early in the year.

The operation of this plant should make available a very large amount of complex ore at the Sullivan mine, and the extraction of this ore will probably lead to the development of further bodies of lead ore in the same mine.

Notwithstanding difficulties incident to the war, and to the disturbed state of the markets during the early part of the fiscal year, operations have been on the whole satisfactory, and, although the mines in the greater part of the country, which are shippers to the Trail smelter, were closed down for a time, after the commencement of the war, there has been recently a very considerable increase in their activity, and the amount of customs ores received by the smelter has recently increased largely. The total tonnage of customs ore receipts for the year, including lead, copper and dry ores, was 57,251 tons, as against 72,098 tons for the previous year, the decrease being almost entirely due to the decrease in the amount of lead ores received.

There have been a number of changes in the staff of the company during the year, owing, principally, to a number of our engineers having enlisted in the various contingents, which have either gone to the Front or are in training. Those who have gone to the Front are: A. W. Davis, now Lieutenant in the Royal Engineers, who enlisted with the first contingent of Canadian Engineers; K. B. Carruthers, now Captain in the Canadian Artillery, at present at Shorncliffe; A. J. L. Evans, Lieutenant in the Canadian Infantry, now serving in France; A. B. Ritchie, Corporal in the Canadian Artillery, serving in France; Robert Walker, of the Accounting Department, with the Royal Engineers, Divisional Signal Corps, now at the Dardanelles; G. Cruickshank, Lieutenant in the 54th Battalion; H. S. Marlatt, Lance-Corporal, Third Field Company Divisional Engineers; F. A. Fortier, Lieutenant, now in training with Canadian Engineers at Ottawa; R. G. Macfarlane, Assayer, now Lieutenant in the Royal Engineers.

Mr. J. M. Turnbull also resigned from the staff of the company to take the Chair of Mining Engineering in the new British Columbia University.

Besides those named, about one hundred and twenty-five of the employees of the company at the mines and smelter have enlisted in the different contingents, and have either gone to the Front or are in training. In addition to these, some fifty Italians have returned for service in the Italian Army.

The officers of the company now in charge of the various departments of the work are as follows:—

Mr. S. G. Blaylock, Assistant General Manager; T. W. Bingay, Comptroller; James Buchanan, Superintendent of Smelter; H. M. Sullivan, Assistant Superintendent of Smelter; J. F. Miller, Superintendent of Refinery; F. W. Guernsey, in charge of zinc experimental work; C. H. McDougall, Engineer in charge of construction at a Smelter; M. E. Purcell, Superintendent Centre Star Group of Mines; E. G. Montgomery, Assistant Superintendent; F. S. Peters, Superintendent Le Roi Mine; J. K. Cram, St. Eugene and Sullivan Mines; W. M. Archibald, Mining Engineer in charge of Ainsworth and Slocan properties.

OUR RETURNED SOLDIERS

The establishment of the Soldiers' Aid Commission for Ontario, of which the secretary is Mr. C. N. Cochrane, Parliament Buildings, Toronto, is the first result of the report recently issued by the Hospitals Commission, and the forerunner of others.

The care of the soldier who has returned to Canada, mutilated or weakened as a result of active service, is the prime duty of Canadians. For some months the Canadian Patriotic Fund has been endeavoring to ensure that the men already back from Europe should suffer no want. This work has been voluntarily undertaken by local committees of the fund, although in most instances their time is fully occupied with the task of making provision for the families of soldiers.

Each soldier is interviewed at Quebec by a representative of the fund and a confidential report sent by the latter to the patriotic committee of the town to which the soldier is going. This serves the two-fold purpose of protecting the fund against the greedy or unscrupulous and of giving the local committee information that is helpful in finding employment for the deserving. Not every man who returns to Canada wearing His Majesty's uniform is included in the latter category, but the great majority have done their duty in the fullest degree. To the latter it has been the privilege of the fund to present a small badge bearing the words "For service at the Front." The men who are wearing these badges are the worthiest citizens that we can acknowledge. Like charity, that badge should be allowed to cover a multitude of sins.

The work that the Canadian Patriotic Fund can do for returned soldiers, however, is limited by Act of Parliament, and it has been specifically enacted that no assistance can be given by the fund to "any person who is in receipt of any gratuity, pension or allowance paid by His Majesty or by any foreign government in consequence of incapacity or death occurring as aforesaid." Partly on this account and largely because the pensions and gratuities paid to incapacitated men are oft-times admittedly inadequate, it has been necessary to establish a Hospitals Commission and Disablement Fund. The officials of the latter, in their report to the Federal Government, recommended among other measures, that provincial commissions be formed for the purpose of supplementing these pensions either by monetary grants or by free training in various trades. The Soldiers' Aid Commission of Ontario, as we have said above, is the first step in this direction. Already it has announced its intention of mobilizing the manufacturers of Ontario and we do not doubt that the process will be facilitated by the manufacturers themselves. Others also will be asked to lend their aid in discharging a great national duty and there is every prospect that in Canada at least the traditional tragedy of the returned soldier will have no place.

Mining in Boundary district is largely restricted this winter to operations at the copper mines of the Granby Consolidated Co. at Phoenix and of the British Columbia Copper Co. near Greenwood. Leasers are working at the Jewel gold mine, and at the Skylark silver mine, both in Greenwood mining division. Further prospecting is being done in Franklin camp, up the north fork of Kettle river, and several small mines in the neighborhood of Beaverdell, west fork of Kettle river, have been sending out carload lots of high-grade ore.

RELATION OF GOVERNMENTS TO MINING*

By Horace V. Winchell.

Full consideration of this subject would involve its elaboration to an extent far beyond the limits permitted to this paper, and be largely repetitive of much that has often been ably presented by economists and philosophers of this and other lands. Indeed, its fundamental importance may perhaps have been more clearly apparent in the days before our industrial systems and operations reached their present state of complexity, and may to-day sometimes be lost sight of in the maze of legislative enactments and the multiplicity of modern industries, which, although impossible without the aid of mining and its products, yet have attained proportions of such dimensions as to endow them with attributes of apparent primary rank.

Nearly half a century ago there was presented to Congress and the people of the United States a discussion of this very subject by Dr. R. W. Raymond, who has been long recognized as the dean of American mining engineers. The arguments there advanced are of universal application; and no later author is likely to improve on the manner of their arrangement and presentation. To this article the present writer wishes first to pay his respects; and from it to appropriate language, ideas and references.

It has been said that "mining and agriculture are the two great forms of productive industry. Strictly speaking, agriculture is the most important, since without it men could not exist; yet mining is almost as essential, since without it men could only exist as savages." If this be true, then the man who makes two blades of grass grow where one grew before is no more desirable and valuable a citizen than he who adds tuppence to the world's supply of available and useful minerals. The prospector and the miner are as useful and as necessary to general prosperity as is the farmer; and the fostering arm of government should be extended with equal care over both. Indeed there are considerations which justify closer attention of lawmakers and greater liberality of appropriations for the encouragement and protection of mining than for farming. On this point Dr. Raymond speaks as follows:

"1. The products of mining are in general far less perishable than those of agriculture, and, in proportion to their first cost, of greater, because more prolonged, use to mankind. Who can estimate the blessings diffused by a ton of iron, mined, smelted, wrought into forms of beauty and usefulness, serving for generations the needs of men, and repeatedly reformed, and reappearing, as by a material metempsychosis, to enter upon new periods of beneficence? More difficult still is it to measure the importance of gold and silver, the production of which, aside from their application in the arts, is so subtly connected with the profoundest problems of political economy. The sophistry that gold and silver money is a conventional matter altogether is trivial. So is all society conventional; and the things upon which mankind have agreed are the things which God has ordained. Gold and silver are world's money, or means of exchange; and this accepted medium must bear a certain relation to the volume of the world's business. Experience, speaking

louder than the philosophers, has shown that, in spite of all contrivances of barter, credit, and paper money, the supply of the precious metals is of vital importance to all commercial nations.

"2. Gold and silver are especially valuable as articles of export. If a country produces more grain than it can consume, it must seek a market elsewhere for its surplus, and this market may not be readily found. Besides, there is danger of loss or deterioration by transport and storage. The precious metals, on the other hand, command the markets of the world. They can be shipped or hoarded without deterioration, and they form the best basis of international exchange.

"3. But these advantages of mining are counter-balanced by the fact that its sources are not perpetual. Men till the same soil for generations, and, if it is properly cared for, it is as able at the end as it was at the beginning to sustain the desired crops. But every mineral deposit is certain, sooner or later, to be exhausted. Sometimes this exhaustion is absolute. The valuable mineral is all extracted, and the end of the deposit is reached. This was the case a few years ago with the silver mines of Andreasberg, in the Hartz Mountains. Sometimes the exhaustion is merely an economical one. The deposits continue, but it no longer pays to work them. This is the disaster looked forward to within the next century by English economists with regard to the coal mines of England. In either case the source of wealth is closed, and great national changes are often the result. We may say, then, that mining yields a permanent form of wealth from a transient source, while agriculture presents a perennial source of perishable wealth.

"4. The mistakes of mining are always to a greater or less extent ir retrievable. Wasteful and ignorant farmers may exhaust the soil; but nature, time, and skill will restore it. Even the wanton destruction of timber entails upon a nation only a temporary evil, since the trees will grow again. But the economic exhaustion of a mine, or a whole mineral region, can be brought about by reckless mining beyond the possibility of restoration. * * *

"5. Finally, the resources of mining are not so equally distributed among nations as those of agriculture, and, as a consequence, the relative power of nations depends largely upon their mines. The iron and coal mines of England are well known to be the secret of her commercial strength; and in the United States the State of California owes her wonderful progress and increasing power to the mines. Even the enormous agricultural capacity of that State (however much her farmers may sneer at the idea) would never have been known nor developed but for the gold mines.

"In view of these peculiar relations of mining, it is evident that governments are in a certain sense trustees of the wealth stored in the mineral deposits of their realms—trustees for succeeding generations of their own citizens and for the world at large. It is not a matter of indifference to the citizens of this country whether our mining fields be ravaged and ex-

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., Sept. 20-25, 1915.

hausted in one or even five centuries, when they might last a score."

Since the power and relative standing of nations wax and wane with their control of necessary minerals, it has been commonly observed by historians that many of the wars of history have been occasioned by a desire on the part of one country or people to possess mines situated in the territory of another. Thus it has been pointed out by Hoover that Jason and the Argonauts in their search for the golden fleece were nothing but placer miners, the gold that they sought being in the sands of eastern rivers; the mines of Laurium often furnished the sinews of war for the Greeks; the contest for supremacy between the Romans and the Carthaginians was founded in large measure upon the desire of the Romans to acquire the mining interests of the people of Carthage. After the Romans gained possession of the mines of Rio Tinto they made war in Gaul to capture slaves for working the mines. In more recent times, we recall the conquest by the Spaniards of Peru and Mexico in the search for golden treasures, the struggle between the Swedes and other people of northern Europe over the sovereignty of the great Fahlun copper mine, which was called by Gustavus Adolphus the "Treasure House of Sweden"; the conquest by the Germans of the iron ore and coal fields of Lorraine; the struggle in the Boer war over the control of the Transvaal gold mines, the conquest by the French of Tunis and Algeria, with their rich deposits of iron ore and phosphates; and the still more recent invasion and capture of the principal zinc producing districts of Belgium.

Indeed, from the very earliest days, dominion over minerals has been a prime desideratum of man. Our stone age ancestor quarried the rock from which to shape his weapons; tribal communities located their habitations near the deposits suitable for such purpose; and many an unrecorded contest was fought to a sanguinary conclusion between those in possession and those who came from afar to renew their stock of arrow points, red pipestone for pipes, and native copper for domestic utensils or spear tips. Miners operated before Tubal Cain had use for a forge or Solomon and Croesus could accumulate their treasures. The geographical distribution of the human race has from the very earliest times depended on that of easily won mineral deposits, and relative stability and tribal or national supremacy has been conditioned by the ability to retain and use them most extensively. "The discovery and appropriation of minerals, thus, long preceded the settled rights or even the early pretensions of the crown or overlord. Held by the mere fact of possession in the days when might was right, the fundamental ownership and title to minerals gradually became merged in the landlord and the discoverer with varying extent of proprietorship as laws became established."

And to-day we find a more or less complicated system of jurisprudence governing the appropriation and use of minerals in different countries. Recognizing the prime importance to every nation that its mines be worked, and, at the same time, taking cognizance of the fact that mining is an occupation financially hazardous, as it affects the proprietor, and individually perilous, for the miner, in these days when slaves are no longer used and the laborer is admittedly worthy of his hire, all countries provide by statute those regulations which are considered best suited to local conditions and most likely to encourage the industry.

Two fundamental principles are common to the mining law of all countries: (1) The right of the mineholder to a perfectly secure and indefeasible title to his property so long as he fulfills certain specified conditions entirely within his own control; and (2) the right of the state or other landlord to certain rents, royalties or taxes on the property or its output, and to the reasonably constant operation of the mine.

In the power of the government to fix the rate of royalty or taxes lies also the ability to promote or to discourage prospecting and mining. If the chief aim of the government is the development of national resources and the increase of general prosperity and business, its policy for the disposition and holding of its mineral lands will be most liberal. If there is a desire to enrich the public treasury directly by means of revenues from taxes upon mines, the result may be a rapid decline of the mining business and a shifting of the population to more favored communities.

In these days, when our production and consumption of minerals has mounted to towering figures, it has been strongly urged by some that we are prodigal in their expenditure and that the principles of conservation dictate restrictive measures, to the end that there may be something left for future generations. Much alarm has been occasioned in the minds of a certain element of our population by the widely disseminated predictions that our mineral resources are becoming exhausted. The National Conservation Commissions and similar organizations, of this and other countries, have endeavored to form estimates of the supplies of useful minerals known or reasonably supposed to exist within their respective territories; and attempts have even been made to measure the total tonnage of iron ore and coal remaining in the ground in all the lands of the globe.

The results of those mineral censuses have tended to allay the alarm. It has been discovered that although our supplies of coal will not last very long at the constantly increasing rate of consumption which has been maintained for the past half century of tremendous industrial development, yet there is enough in the United States to last us for more than 6,000 years at the present rate, and coal fields of unknown size exist in many other little explored lands.

The blast furnaces of the world seem to possess an appetite that is insatiable, and their size keeps pace with their growing consumption of iron ore. Yet, vastly more ore of commercial grade is being discovered than consumed, and the price, although unstable, tends downward rather than upward. Improvements in the art of recovering metals from various ores are constantly increasing the supply of usable raw materials, and he must be indeed a pessimist who can predict the exhaustion and disappearance of any mineral indispensable to the welfare of the human race.

But even though we may take for granted the sufficiency of the world's stores of minerals, the fact of their unequal distribution often gives to one country an advantage over another; and the less favored countries must do their utmost by protective and encouraging legislation to equalize matters, making their abundance in some resources compensate for poverty in others. Herein, and in true appreciation of the importance of mining and industrial economy, lies the opportunity for constructive legislation.

(To be continued.)

THE DEVELOPMENT OF ELECTROLYTIC COPPER REFINING*

By Lawrence Addicks.

The rapid progress of electrolytic copper refining in the past twenty-five years has been due to several causes. While the possibilities of the electrolytic separation of metals had been understood in a general way, there was no suitable source of current until the dynamo was practically developed in the seventies. This, at the same time, made possible the development of the whole family of modern electrical industries and thereby created the demand for high conductivity copper, which can only be obtained from very restricted pure ores or by electrolysis.

If we say that electrolytic refining costs $\frac{1}{2}$ cent a pound over fire refining and that copper sells for 15 cents a pound, it will take but a 3-1-3 per cent. gain in conductivity to pay for the refining, when electrical uses are involved. Further, it is quite impossible to make a clean separation of silver and gold from copper by fire methods, while the "values" in cathode copper run but a few cents a ton. Copper is nearly always associated with silver and gold and our $\frac{1}{2}$ cent a pound increase in cost calls for but \$10 a ton of either or both of these metals to justify electrolysis from this standpoint.

The first commercial experiments in the United States, in the electrolysis of copper were carried out at Phoenixville, Pa., in 1879, but the tonnage handled was negligible for several years, and we may take, say, 1884 as the starting point for the industry.

The first great difficulty was in keeping the purity of the electrolyte within reasonable bounds; the early electrolytic copper was very irregular in quality, resulting in a market premium for "Lake" copper produced from the pure native ores of Michigan. About this time bessemerizing of copper was accomplished, resulting in a high elimination of impurities from matte, owing to the strong oxidizing of the converter, and the universal adoption of this process removed the last obstacle to the expansion of electrolytic refining.

How rapid this expansion has been is shown in the accompanying table. As a matter of interest, the tonnage refined by the series and by the multiple processes are shown separately, as in the early days there was strong rivalry between the processes.

Both processes have survived and given relatively pure bullion. There is little to choose between them. The multiple process, however, is much less sensitive to impurities and requires less skill in operation, and has been adopted by those later entering the refining business.

Pounds per Year Electrolytically Refined.

Year.	Series.	Multiple.	Total.
1884	0	0	0
1890			
1896	102,000,000	150,000,000	252,000,000
1902	146,000,000	412,000,000	558,000,000
1908	430,000,000	734,000,000	1,164,000,000
1914	642,000,000	936,000,000	1,578,000,000

Three distinct stages in the development of copper refining may be noted; that of early development; that of tonnage extension; and that of efficiency work. The first period ends with the development of mechanical lading, general use of cranes for handling electrodes and the undertaking of the building of the Raritan Copper Works in 1898. The second period covers the next half-dozen years, which saw the creation of the first really large plants; and the third, ten years just closed, with plenty of work in sight to put refining on a finished basis.

Refining proper may be considered to begin with the treatment of copper bullion of the grade of converter blister and may be divided into anode furnaces, electrolysis—including production of power, electrolyzing, purification of electrolyte, and refining of anode slimes—and refining furnaces for the cathode product.

The anode and cathode furnaces have so many points in common that they may be considered together, taking the latter as the example. The size of charge taken out in the 24-hour cycle has steadily increased with the capacity of the plant, until it has become evident that the only practical limit is the tonnage a plant can supply. Before mechanical lading was introduced, the size was limited to the amount that could be taken out by hand. Even when a bull ladle was used, 40,000 lb. was considered a large charge. As soon as the Walker Wheel and other machines for mechanical lading were successfully introduced, the size of charge was increased to 100,000 lbs., with marked lowering in all items of cost; and since then there has been a regular speeding up in each of the time-consuming elements making up the 24 hours, until with the modern charge of 600,000 lbs., or more, the refining is done for less than half the cost in the best of the old hand-ladled furnaces.

Furnace refining may be divided into charging, melting, rabbling, skimming, coking, poling, lading and fettling. Charging is now done mechanically, by special cranes, at the rate of 300,000 lbs. an hour. Melting has been accelerated by means of forced and induced draft, the modern method being a combination of both in connection with waste-heat boilers. Mechanical stoking has been tried several times, as well as the use of fuel oil and pulverized coal. Up to this writing, however, hand-firing, combined with what is practically a gas-producer fire-box, has held its own. The coal consumption has fallen, with the increasing size of charge, from about 20 per cent. at 40,000 lbs. to 10 per cent. at 600,000 lbs. The fuel item is much smaller than in the case of either reverberatory matte smelting or open-hearth steel practice. Rabbling by hand has given place to blowing with compressed air. This, in turn, has raised structural questions in the design of the furnace on account of the consequent damage to the roof from the splashing of more or less oxidized copper. In anode practice this is now being met by the use of basic or neutral brick in the roof, and when melting cathodes, the blowing has been greatly curtailed. Skimming is still done by rabbles, but the proportion of slag made has been gradually reduced from 4

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., September 20-25, 1915.

per cent. to less than 1 per cent. by keeping silica from the furnace lining, or from coal ashes, away from the cuprous oxide formed while melting and blowing. Coking used to consist in blanketing the bath with charcoal, but crushed low-sulphur coke or anthracite has been largely substituted. Poling is still done with green hard-wood poles forced under the surface of the bath. Fuel oil has been tried, but it is difficult to avoid overpoling, on account of the rapidity of the action, and the sulphur content spoils the set of wirebar copper.

Some hydrocarbon gas may be substituted in time. Lading is now done mechanically at as high a rate as 90,000 lbs. an hour with one ladle and 120,000 lbs. an hour with twin ladles. This speed could easily be increased by tapping the furnace at two places. Fettling is practically eliminated with basic furnaces.

It is now realized that the only obstacle to changing the furnace refining of cathode copper into a simple melting is sulphur brought over as sulphates from the tank-house or absorbed from the products of combustion, etc., in the furnace. With a perfect cathode and a sulphur-free atmosphere, the process could be made a continuous melting, and steady progress is now being made toward this goal. The great capacity of modern furnaces is due partly to increased hearth area, but quite as much to deeper baths and the constant feeding in of fresh cathodes (or anode scrap) during poling and pouring. In some plants blowing has been practically eliminated, and the production of slag almost suppressed in the cathode furnaces.

Structurally, the main improvements in recent years have been along the line of substitution of magnesite and chrome brick for siliceous material. Magnesite hearths are now thoroughly proved out for treating foul pig. Magnesite flash-walls, for all classes of work, are now yielding place to solid chrome walls, and chrome brick is contesting with silica brick in roof construction.

Power.—Turning now to the electrolytic part of the plant, we may dismiss the power problem very briefly as not being truly metallurgical in its nature. The characteristics of the power requirements are high amperage, low voltage direct current, with a 100 per cent. load factor. As individual circuits are limited to about 1,500 kw., the reciprocating steam engine is at its best under these conditions, and up-to-date a high-economy, slow-speed, compound or triple-expansion engine, generating a kilowatt-hour for about 15 lbs. of steam at 150 lbs. pressure sq. in., 100 degree F. superheat, and 27-inch vacuum, has been favored. The plants around New York harbor are able to procure steam sizes of anthracite at a much lower price than coal suitable for gas-producer work. Considerable steam is also produced by the waste-heat boilers on the reverberatories. Gas engines have therefore been handicapped and have not as yet found a single application. The total capacity of the power plant has been a little too small, in extensions to existing plants, to justify the consideration of a central turbo-alternator of the great capacity necessary to develop a sufficiently low economy to offset the conversion losses in motor generators, and large high-speed direct-current turbo-generators are still in their infancy. We may therefore say that reciprocating engines still hold the field but that the indications are that the time is coming when they will have to surrender to a prime mover which can operate through a wider temperature range.

In the tank-house, capacity has been pushed from all sides. The Walker system of connections, whereby many tanks are placed edge to edge with but a small equalizing bar for carrying the current from the cathodes of one tank to the anodes of its neighbor, has been universally adopted, resulting in an increased efficiency in the use of floor space as well as cutting down the bus-bar investment. The size of the anode has been steadily increased, until several plants use electrodes three feet square, and in at least one leaching plant, four feet square. The number of anodes per tank has also been increased. Thirty-two have been successfully placed in space originally planned for twenty-six, and longer tanks can easily be used, the limit really being the amperage on the circuit. Current densities have gradually risen with the lower costs of power, until Eastern practice is close to 20 amperes per square foot. A current efficiency of about 90 per cent. seems to express the economical balance between labor and power. Lead-lined wooden tanks are still universally used in multiple-system practice, but their maintenance is a large item and much experimenting is now under way with various types of tank construction. The ideal system would be a large acid-proof basin without watertight division into single cells, the electrodes being supported independently by an independent bridge structure. Chemically, it is generally realized that a highly refined anode is more important than a pure electrolyte, and with anode copper 99 per cent. or over, an electrolyte with 2.5 to 3.0 per cent. copper and 12 per cent. free sulphuric acid will give good results with almost any quantity of arsenic, nickel, etc. A good quality of anode has diminished the silver and gold losses in the cathodes until they are now but a small item—perhaps half of one per cent. of the anode contents at ordinary current densities. Basic anode-furnaces have made possible the production of a first-class anode from very foul raw material.

The general improvement in the grade of anode has simplified the problem of purification of electrolyte. The complete plant now used is to divert the necessary portion of electrolyte daily, remove the copper and arsenic as a cathode sludge, using insoluble anodes, concentrate the resulting liquor, first by steam in lead-lined tanks and then by direct heat in iron vessels, to a heavy liquor consisting of strong sulphuric acid and sodium sulphate, the sulphates of iron, nickel, etc., having fallen out as anhydrous salts. The sodium sulphate can be largely removed by chilling, if it is present in troublesome quantity, and the sulphuric acid returned to the electrolyte. The anhydrous salts form a starting point for nickel recovery. A small quantity of either hydro-chloric acid or salt is added to the electrolyte, with the result that the antimony largely slimes as oxychloride. Glue or similar organic addition agents are generally used in very small quantity and greatly assist in forming smooth cathodes, although a slight excess greatly increases the working voltage. In general, six to seven pounds of cathode copper are obtained per kilowatt-hour.

The refining of the anode slimes is still in a transitional stage. A great deal of experimental work is being done on wet processes, on account of the metal losses associated with fire methods. As anode slimes are worth five to ten dollars a pound and a large refinery produces a couple of tons of such slimes daily, a considerable expenditure on treatment is permissible. A simple fusion of raw slimes will yield three superimposed molten layers,—bullion, matte and slag. The

bullion is chiefly made up of the precious metals, lead and copper; the matte of copper, silver, selenium and tellurium; and the slag of the more easily oxidized elements, such as arsenic and antimony. The general plan in common use is to give the slimes a light roast to oxidize the copper, which is then dissolved as sulphate in suitable tanks. The copper-free slimes form but little matte when smelted. After fusion in a small basic reverberatory the bath is skimmed clean and the base bullion refined to a high grade, done by blowing and nitreing. The slag is sorted, part sent back to the anode furnaces, part desilverized by a quiet fusion to free it from prills and part charged back into the silver furnace. The silver and gold are generally parted electrolytically and the resulting gold slimes treated for recovery of platinum and palladium. Selenium is recovered from the silver refinery flue dusts by leaching and reduction with sulphur dioxide.

One of the great difficulties in the way of devising a comprehensive wet process lies in the great variation in composition of the slimes at different times and places and in the number of elements present. The strong solvent action of ferric sulphate upon copper and the purity of silver chloride precipitated from foul solutions give a foundation for a wet process. The progress in electrostatic fume recovery is helping out the older process, however.

UNITED STATES IRON TRADE IS BRISK.

Under date of December 23 "The Iron Trade Review" says: With prices continuing to advance on pig iron and finished materials, consumers are still clamoring to place additional orders and the announcement that there is nothing to sell is being made by more mills and furnaces.

The congestion on the railroads between Pittsburgh and tidewater is becoming a serious factor in the pig iron market and threatens to be much worse unless the railroads succeed in adopting some radical measures of relief. The pig iron market throughout the country is very strong and prices are steadily being moved upward. Along the lakes, from Chicago to Buffalo, quotations are higher and available iron is being rapidly reduced. The Norfolk & Western railroad is distributing orders of an inquiry for 10,000 tons of various grades for last half delivery, but not many sales for delivery after July 1 are reported. Furnaces, especially those along the lakes and in the valleys, are unwilling to quote for deliveries so far in advance.

Scarcity of billets and sheet bars continues and many consumers are worrying as to where and at what price they will be able to buy for early requirements. In eastern Pennsylvania forging billets are selling at \$55 and open hearth and rolling billets at \$40. Very high prices prevail in Pittsburgh.

Inquiries, amounting to several hundred thousand tons of steel bars, largely rounds for the manufacture of high explosive shells, are pending. It is estimated that the entente governments will require at least 500,000 tons of various forms of steel, principally bars, for shipment before July 1, and fully as great a tonnage for the last half of the year. It is difficult to obtain delivery on any tonnages of large size for the first half on account of the mills being overwhelmed with orders. Shipments of sheet steel to Europe at present are estimated at 10,000 to 15,000 tons weekly and much of this is for shrapnel.

The recent order of the English government in regard to the importing of machine tools into the United Kingdom does not promise to interfere with the movement of machinery to England, except that speculators who have obtained exorbitant prices will not be allowed to continue to do so. Heavy buying by Russia continues to be a leading feature of the machinery market. The freight congestion is causing considerable annoyance to manufacturers.

Extraordinary demand for blue annealed sheets has brought about a decided scarcity and leading makers are entirely out of the market, while others are quoting very high prices. Owing to the high quotations on spelter, galvanizing operations at many sheet plants have been abandoned. Prices of black sheets have been advanced. Prices of wire products, with the exception of galvanized wire nails have been advanced \$2 a ton to a basis of \$2.10 a keg for wire nails, the highest price since 1901. Wire products are now quoted at from \$12 to \$13 a ton above prices of a year ago, but sales at the new quotations are limited, as nearly all consumers are under contract. Advances have been made in cast iron pipe and higher prices on steel pipe are expected. Coke is gradually growing stronger, thus eliminating the only weak feature of the present market. Sharp advances are noted in scrap in several centers and the demand is active throughout the country. The very high price of old material has caused some manufacturers of bar iron to withdraw temporarily from the market, as they have taken all the orders for iron that they desire and are awaiting developments in the scrap market. This is true in the Cleveland district.

TIN MINING IN ALASKA.

It is estimated that about 200 tons of stream tin were produced in Alaska during 1915. Much the larger part of the tin came from the York district of Seward peninsula. Here one tin dredge was operated throughout the season on Buck Creek. A new dredge was installed on the same creek during the summer and operated for a part of the season. No returns have yet been received from the two dredges operated in 1914 on Anikovik river in the same district, but these were probably also operated. These two are working on placers carrying both tin and gold. Developments were continued on the Lost river lode-tin mine, and there was also some prospecting of other lode-tin deposits. There was, however, no production of lode tin.

The only other tin mining in Alaska during 1915 was done in the Hot Springs district of the lower Tanana basin. Here considerable tin is recovered incidental to gold placer mining.

At the quarterly meeting of the Slocan District Board of Trade, held at Silvertown, Slocan Lake, B.C., on December 9th, Mr. J. P. Keane, of Rosebery, submitted some interesting data relative to the zinc industry of Canada and having particular reference to the production of spelter in the Dominion. After discussion it was unanimously resolved, on the motion of Mr. W. H. North, local manager for the Standard Silver-Lead Mining Co., operating a silver-lead-zinc mine and concentrating mill near Silvertown, to memorialize the Dominion Parliament to place a protective duty on imports of zinc and zinc products to become effective as soon as spelter shall be produced on a commercial scale in Canada. There were present at the meeting delegates from Silvertown, New Denver, Rosebery and Sandou.

MINING IN ALASKA IN 1915

The annual report on mineral resources and production in Alaska for 1915 is now in preparation under the direction of Alfred H. Brooks, of the United States Geological Survey. Some of the important features of this report relating to mining development during the year are abstracted in the following statement.

The Alaska mining industry as a whole was more prosperous in 1915 than in any previous year. This is indicated by the value of the total mineral output, which is estimated to have been \$32,000,000, compared with \$19,064,963 for 1914. The highest value for any previous year was in 1906, when Alaska produced \$23,378,428 worth of minerals, but this was at a time when the bonanza placers of Fairbanks and Nome were yielding their greatest returns.

The high value of the mineral output in 1915 was due in large measure to the extraordinary amount of copper that was mined. Preliminary estimates indicate this to be 83,850,000 pounds, valued at \$14,400,000. In 1914 21,450,628 pounds of copper were mined, valued at \$2,852,934. The gold production also increased in 1915, when the value was about \$16,900,000, against \$15,626,813 for the output of 1914. This is the largest gold production since 1912, when the output was valued at \$17,145,951. As the production of silver is incidental to gold and copper mining, this also increased. It is estimated that \$400,000 worth of silver was mined in 1915, against \$218,327 worth in 1914.

The output of other minerals, including tin, antimony, marble, gypsum, coal and petroleum, in 1915 had a value of about \$300,000, compared with \$222,802 in 1914.

In addition to the productive mining a large amount of dead work was accomplished during 1915 on properties that made no output. Therefore the abnormally large value of the total mineral production must not be considered as simply a temporary expansion of the mining industry, due to the high price of copper. The developments made during the year give assurance of continued large operations in both copper and gold lode mining. Placer mining has been less prosperous, for this industry has not yet reacted to the stimulus of the Government railway, which will make available for profitable exploitation large bodies of low grade gravels. The same is true of the coal mining industry, which also must await railway transportation.

The first gold mining in Alaska was done in 1880, and since that time gold to the value of about \$261,050,000 has been produced. Of this about \$186,200,000 has been won from the gold placers. Copper mining began in 1901, and the total copper output of Alaska is now about 217,250,000 pounds, valued at \$34,150,000. The value of the total silver production to date is about \$2,650,000. Coal, petroleum, tin, lead, quicksilver, antimony, marble, gypsum and other minerals have been produced to the value of about \$2,150,000. Therefore, the value of the total mineral production during 36 years of mining in Alaska has been \$300,000,000.

The data in hand indicate that the value of placer gold produced in 1915 was \$10,500,000, compared with \$10,730,000 in 1914. This decrease of output, if borne out by the final figures, is chargeable to the falling off in the output of some of the Yukon camps. On the other hand, the developments in the Toloyana district, where gold was discovered in the autumn of 1914, indicate that this will become of some importance as a producer.

MINING IN HIGHLAND VALLEY, B.C.

The Highland Valley Mining and Development Co. has been organized by Messrs. Frederic Keffer and Henry Johns, both of whom were for a number of years prominently connected with the management and operation of the British Columbia Copper Co.'s mines in Boundary district, B.C. The first work to be undertaken by this company is the development and operation of two groups of mineral claims held under bond by the company, and situated in Highland valley, Ashcroft mining division of British Columbia. These groups are known, respectively, as the Chataway and the Sanson (or Tamarac) groups of claims. They are reached by a good wagon road from Ashcroft, 25 miles to Chataway ranch and thence by trail between three and four miles to the mine workings. The elevation of the workings is about 4,400 feet above the Canadian Pacific railway at Ashcroft and 5,400 feet above sea-level. The locality is in what is known as the "dry belt" of British Columbia, where both snow and rainfall are comparatively light.

Chataway Group.

There are four claims in the Chataway group. The country rock is a coarse-grained granite with the feldspars predominating. The ore follows lines of fracturing in the granite and is composed of quartz, feldspar, mica, and copper and iron pyrites, the mica being the most plentiful mineral. The copper occurs entirely as copper pyrites, and as a rule is distributed through the gangue in quite large crystalline masses, thus forming an ideal ore for concentrating, especially as the gangue is soft and easily broken. The ore is usually quite free from the walls of the vein.

Development work done consists of an adit driven with the ore for about 80 ft.; then in barren ground for 95 ft., the ore having been thrown a short distance to the north by a fault and then for another 80 ft. with the ore. Near the adit entrance a winze has been sunk 50 ft. in ore. Where explored the vein varies in width between 4 ft. 6 in. and 14 ft.; the average width is approximately 10 ft. Average assays of the ore are stated to give 5 per cent. copper, and gold and silver together 60 cents to the ton.

The first new development planned is to drive a second adit along the vein at approximately 100 ft. below the adit already driven. Subsequent development will be determined by results obtained in driving this lower adit.

Sanson Group.

The Sanson group of seven claims adjoins on the east the Chataway group of which it is regarded as an extension, the country rock and vein filling being identical with those of the Chataway and the conditions generally similar. There are three open cuts on the copper ore showing along a distance of 244 ft. The average metal contents of the surface ore are given as 2.80 per cent. copper and about \$1 a ton in gold and silver.

The ore occurrences on the two groups of claims are more than one mile apart, but as yet no connection has been traced between them, the deep cover of soil rendering prospecting somewhat difficult.

Farther east on this group there are a shaft and some cuts on what is termed the molybdenite vein, but this is not considered to be of much present interest. Promising croppings of copper ore have been found on another of the claims of this group.

BRITISH COLUMBIA'S NEW MINISTER OF MINES

The resignation on December 15th of Sir Richard McBride as Premier and Minister of Mines for British Columbia has led to the appointment of a separate minister to the important folio of the Mines Department of that province, and the choice has fallen on a man of Ontario birth, and, withal, one who, of all the members of the Provincial Legislature of British Columbia, has been most intimately associated with the mining industry. Not only has Mr. Lorne A. Campbell had long familiarity with the affairs of metalliferous mining companies, but as well he has been in the capacity of president of the McGillivray Creek Coal and Coke Co., Ltd., operating in Southwestern Alberta, closely identified with coal mining. The following information concerning Mr. Campbell was published in the Victoria Daily Colonist, the oldest and one of the most influential of the daily newspapers of British Columbia:

Hon. Lorne Argyle Campbell, the new Minister of Mines, who represents Rossland, was born on March 5th, 1871, at Perth, Ontario. He is the son of John G. Campbell, and his wife, Helen I. Campbell, both Canadians. He was educated at Perth public school and collegiate institut . He is vice-president and general manager of the West Kootenay Power and Light Co., and president of the Cascade Water Power and Light Co., etc. He first contested Rossland seat in 1907, but was not successful until the general election of 1912, when he swamped his opponent. Mr. Campbell's nomination at this election was supported by Conservatives, Liberals and Socialists alike. Naturally, he is extremely popular in his constituency, where his able and energetic personality and his persistent and aggressive advocacy of the claims of his district have given him a position of unique popularity. He is well known as one of the foremost business men of the provincial interior, who has played a very useful and important part in the upbuilding of the mining and general industrial interests of the Kootenays. His majority at the last election was a record for the constituency.

In assuming the portfolio of Minister of Mines, the Hon. Lorne Campbell will bring to the execution of his duties a mind especially well fitted for the task, for ever since he took up residence in British Columbia, he has been living in the heart of a mining country, and probably knows as much about the industry as any man in public life in the country to-day. His position as head of the West Kootenay Power & Light Co., with which he has been identified since its inception, brought him into intimate relation with the mining industry in the Kootenay and Boundary districts, from the circumstance that this project was founded chiefly with the idea of supplying power and light to the numerous mining properties and the smelting works in those districts. It is well known that Mr. Campbell holds some advanced and progressive ideas in respect to what ought to be the policy of the Government in fostering the mining industry; and his tenure of the important portfolio which has been allotted to him will, it is assured, be characterized by an intelligent aggressiveness founded upon an intimate knowledge of what is required to place the industry in the new position rendered imperative by the world-shaking events which have transpired since the outbreak of the war.

THE ALUMINUM CO. OF AMERICA.

Boston.—President Davis, of the Aluminum Co. of America, recently made a speech at Detroit to a gathering of men interested in aluminum, which was notable as indicating the efforts his company is making to increase the production of aluminum.

Mr. Davis stated that his company was now producing 18 pounds of aluminum where 10 pounds were made in 1914. This would indicate an output of 144,000 pounds per annum.

The company is now expending upwards of \$20,000,000 to increase its production. Some portions of the new plants will be in operation next May, and the balance by the close of 1916.

This expenditure does not include the extensive plant of the Southern Aluminum Co. which the American Co. has recently taken over, but which will not be in operation for another 12 months.

Referring to the current high price of aluminum, Pres. Davis said that it was in part due to the fact that the British Government had commandeered the production of his company's plant located in Canada for the current year and 1916, so that this supply, 8,000 or 10,000 tons per annum, goes to England instead of coming to the United States as usual.

As to war orders, Mr. Davis stated that his company had not sold an ounce of aluminum for any war order, directly or indirectly.

In the manufacture of the white metal, cheap power is the sine qua non. The Aluminum Co. of America started in to develop a big water power on the St. Lawrence river, expecting to create some 800,000 horse power. Several million dollars have already been invested in it, "but until this deadlock is broken between these people who are conserving the interest of the public, and those who are willing to give the corporations a little chance, I do not suppose that water power can ever be developed." All this results in confining the efforts of the company to small streams, and at increased cost.

The Aluminum Co. for several years has enjoyed a profitable return upon its capital. Its dividends have been limited, however, with the result that it has abundant resources to carry out the extensive plans it has in contemplation.

SILVER.

The production of silver in the United States in 1914, the largest ever recorded, was 72,400,000 ounces, valued at \$40,000,000. The silver production of the world is estimated as about 225,000,000 fine oz., of which the Cobalt district, Ontario, produces one-tenth and the United States produces one-third. Practically three-fourths of the world's silver production is derived from North America, about 14 per cent. from Europe, and the remainder mainly from Australia and Asia.

STELLITE.

The Haynes Stellite Co., of Kokomo, Ind., has placed a contract with the Snyder Electric Furnace Co., Chicago, for a 1½-ton per 24-hour electric melting furnace. The furnace has an eighth ton holding capacity, 50 k.w. input and will produce 12 heats per 24 hours. The Haynes Stellite Co. is the manufacturer of the cobalt alloy stellite, which has been making a number of remarkable records during the past two or three years. Mr. Elwood Haynes, president of the company, will be remembered as the manufacturer of the first American automobile, and it is planned to hold a great anniversary celebration in his honor next year at Kokomo.

EVALUATING COAL PROPERTIES IN WESTERN CANADA

By R. W. Coulthard.

The most recent estimate of the content of the Western coal beds of Canada is 1,217,386,000 tons, which is classified as follows:—

Anthracite and Semi-Anthracite, 830,000,000 tons; Bituminous, 282,313,000,000 tons; Sub-Bituminous, 847,821,000,000 tons; Lignite, 86,422,000,000 tons.

So enormous, therefore, are the fuel potentialities, that we must content ourselves with the consideration of such of these as are a present economic asset. And this it is the function of the engineer to ascertain.

Some of the essentials which will determine the value of coal properties I shall enumerate. These essentials have reference, primarily, to virgin coal lands, but the remarks and deductions will apply equally to operating coal properties which may be under examination.

1. Titles, Royalties, Etc.

The title will be held under either freehold or leasehold, each of which may be subject to the payment of a royalty to the Government controlling them. This royalty may be varied at the will of the Government. At the present, it does not exceed $7\frac{1}{2}$ cents per ton of coal mined and shipped, and some of the freeholds are exempt. Leaseholds from the Dominion carry an imposition of 5 cents per ton.

2. Geology.

The coal beds of Western Canada embrace periods from the Lower Cretaceous to the Tertiary. It is desirable to learn the geological age of the beds under examination, as this has its economic bearing.

3. Quality of Coal.

(a) **Sampling the Seam or Seams.**—The history of the sample should be minutely recorded. A legitimate sample can only be taken from a clean face of coal, across its full width, or such part of its width as it is deemed advisable to exploit. It is allowable, however, to eliminate those undesirable bands of rock, dirt, or "bone" which may be excluded from the shipping coal either during the process of mining or by later treatment. Hand specimens are misleading, and will serve only as museum exhibits, or may be as items in determining classification.

Sometimes the seam must be entered upon for some considerable distance from surface influences before a fair sample can be obtained. This applies chiefly to lignite and sub-bituminous coals, but friable or easily weathered bituminous or anthracite also come under the same category. Where, however, the latter two readily withstand erosion and weathering, samples may safely be taken from the surface.

There are, of course, conditions met with where the seams do not reach the surface, in which cases the samples must be procured by boring.

The portion or portions of the seam chosen for sampling should be free from abnormalities.

(b) **Analysis.**—For general, practical purposes a proximate chemical analysis, with a determination of British thermal units and coking properties is, by most, considered sufficient. I would, however, go fur-

ther and advise an ultimate analysis. Evolutions in the utilizations of coal are a natural outcome of competition and industrial exigency, and I predict that they will come to Western Canada in the not distant future. These will embody not only the fuller utilization of its heat units, but also of the by-products from coke and gas plants.

(c) **Physical Properties.**—As these have considerable to do with the ultimate marketing of the coal, they bear strongly on the value of the seam. The main features are: friability or firmness; weathering propensities; percentage of fines produced by comminution from handling and weathering; general aspect.

(d) **Combustion Tests.**—Practical tests under practical conditions give practical results.

4. Section of Measures.

A log, with details of the cross-section of the seam or seams and nature of enclosing rocks, is essential in determining the scheme of mining. The "dips" and "strikes" of the measures are part of this detail.

5. Extent of Deposit.

This is determined by figuring out the cubical contents of the seam or seams, so far as the stratigraphical features will admit, and no farther. The deposit should then be classified as follows:

I. Seams Capable of Present Economic Production.

(a) **Wholly.** This is possible when the seam presents no extraordinary difficulties in the way of development by reason of entry, quality, flexures, faulting, intrusions, thinning or pinching out, ventilation, gas, haulage, etc.

(b) **Partly.** Where development can be prosecuted only for a certain distance into, or in certain portions of, the seam, owing to one or more of the difficulties indicated above.

II. Seams Capable of Future Production.

(a) **Under Present Day Mining Methods.**—This may embody the "wholly" or "partly" sub-divisions above, including also those seams which present drawbacks by reason of their location, accessibility, or other physical considerations, and cannot, therefore, promise immediate profitable returns, especially if competition is keen. They may be accepted as resources for development when favorable changed conditions of market and price would warrant their exploitation.

(b) **Under Future Mining Methods.**—These seams comprise those which can be erased entirely from the roster as present workable projects owing to adverse conditions of quality, dimensions, and other geological and physical features, etc.; and this is apart from the question as to whether or not they may be economically accessible from point of attack. The time may come when such beds of coal may be drawn upon, but it is not at all probable that this will eventuate so long as the more favorable conditions obtain among competing coals.

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., September 20-25, 1915.

III. Seams to be Disregarded.

Included here are those which can show no practical value within a comparatively remote future. One cannot speculate on the distant future in the matter of heat-producing mediums which may then prevail, nor of the uses to which coal may then be put.

In estimating the amount of coal available in the seams, due allowance must be made for waste and mining losses. Under prevailing conditions in Western Canada this amounts to from 15 to 50 per cent. of the total content. This waste will undoubtedly be reduced.

Under the caption "seams capable of present or future production" must also be included those seams whose product, being amenable to economical mechanical treatment and rendered marketable thereby, would otherwise remain unsalable so long as the demand can be satisfied at lower, similar, or even higher prices by cleaner and more desirable rival coals.

6. Accessibility.

Access to the coal deposits is an absolute requirement, absence of which has militated against the successful operation of more than one otherwise excellent property. The cost of reaching the seam, transportation from the pit-mouth to the tippie, and then to its ultimate market, might preclude the possibility of successfully working the coal.

The chief factors to note are:

I. Transportation Facilities.—(a) Already available; (b) Already projected; (c) Feasibility of projected transportation from the standpoint of practicality; (d) Distance to market; (e) Freight rates; (f) Cost of construction, equipment, maintenance and operation; (g) Revenue to be derived, other than from the coal-carrying traffic (if required to be constructed and operated by the mines); (h) Effect on cost of coal per ton.

II. Mine Entry or Entries—(a) Proximity to tippie and plant site; (b) Strategical position with regard to system of mining advocated or adopted.

Where possible, outside inclines are to be avoided, especially if they be of great length. There is always trouble with inclines, due to climatic conditions, accidents, up-keep, and consequent increased cost.

7. Plant Requirements.

The plant is the vital link between the mine and the market, and its effectiveness should be the resultant of the requirements of both. Therefore, in designing the plant, or evaluating one already constructed, these features of mine and market will decide its actual fitness and commercial value.

8. Method of Mining.

Certain maxima which are to be observed in the development of a mine are: Maximum output; Maximum cost; Maximum safety to men; Maximum safety to mine. These are interdependent and inseparable.

An enumeration of the salients which govern the initial and future methods to be adopted is given hereunder:

(a) Elevation—above or below sea-level; (b) Dips and strikes, with their variations; (c) Nature and extent of folding of strata; (d) Nature and extent of intrusions in strata; (e) Nature and extent of faulting of strata; (f) Nature and extent of other geological presentments; (g) Thickness of seam, with included rock bands (if any); (h) Structure of coal; (i) Proximity of other seam or seams in same measures; (j) Overbur-

den; (k) Surface conditions; (l) Ventilation requirements, including gas and dust conditions; (m) Liability to mine fires; (n) Haulage considerations; (o) Water disposal; (p) Extent of workings; (q) Cost of supplies and equipment; (r) Market requirements as to quality; (s) Market requirements as to quantity; (t) Labor conditions; (u) Legal mining restrictions.

9. Cost of Production.

The cost of to-day can not be assumed as the cost of to-morrow; nor need the cost prevailing in any one case correspond with that obtaining in another, even in the same district, because never are the conditions identical. There are, however, certain temporarily constant factors, which, if taken in conjunction with the engineer's knowledge of the other details, will enable him to arrive at correct estimates.

I have purposely used the phrase "temporarily constant factors". The only fixed factor is rate of return of capital. Some of the others may be fixed for a certain period only, and in reality are variable. Some of these are:

(a) **Wages.**—This, for many years past, as we all know, has had an upward tendency; conversely, and this is statistically proven, as wages have increased, so has the producing capacity, per man, decreased.

(b) **Strikes.**—A recurrent condition concomitant with coal mining.

(c) **Supplies for maintenance and equipment.**

(d) **Unforeseen contingencies** arising in the strata, such as pinches, faults, folds, intrusions, gas emanations, etc., etc.

(e) **Unforeseen contingencies** arising in the mines themselves, and any other adverse conditions of those items enumerated in Division 8 preceding (Method of Mining), or due to plant failures. This variable has wide limits.

(f) **Gradually increasing cost**, due to haulage, timbering, track laying, ventilation, water disposal, producing efficiency, and the various other odd problems which accumulate as development proceeds and the more distant portions of the seam are exploited.

10. Plant Site.

The suitability of a site for the erection of a complete plant affects profoundly the value.

The proximity of water is, of course, desirable, and the facilities afforded for miners' residences and other accommodations bear their part in the economy of things.

11. Market.

Unless the market be sufficiently stable to assure the continuous operation of the mine on the scale originally provided for, which, of course includes the return of capital and dividends, the value of the lands depreciates correspondingly. It may be that the capitalization and bonded indebtedness are out of proportion with the potentialities of the market, or, again, it may be that the latter have not been taken advantage of to the full.

The chances of securing and retaining a sufficient market for any given property are affected by the competition of other coals, petroleum, natural gas, peat, wood and hydro-electric power. It is such competition that will undoubtedly induce the development of new and more scientific methods of utilization, together with a more rational selling organization. These remarks are peculiarly applicable to Western Canada.

General Remarks.

In evaluating a coal area, due regard must be given to the elimination of such portions as are in no way useful. For instance, a property may be altogether economically inaccessible. Again, it may be accessible at one point, but the limit to which haulage can be carried with profit will determine that part of the area which alone is commercially valuable. In a certain case that I have in mind, where the seam is steep-pitching, thick, regular, and enclosed by good walls, mining has been prosecuted for over 2½ miles along the strike, and there is no reason why it could not be pursued for twice this distance. Haulage and timbering expense will probably be the chief items of expense which will decide the limit of exploitation from the present pit-mouth. Ventilation at this mine, I might say, is secured by advancing the fan along with the workings.

When the overburden is of such thickness and of such a nature that great weight must be supported, and when occlusions of gas are apt to be troublesome, owing to sudden outbursts, and where the ventilation is extremely difficult, we then have another phase which may absolutely prevent the carrying on of mining. Or again, the dimensions of pillar support re-

500 x 250 x 40

equals 666.6 acres.

11 x 0.75 x 1000

At the end of the term there would therefore be 4333.4 acres of the land which remained unworked, and upon which lease rental has been paid for the full period. For further purposes of illustration, let us assume this to be 4,000 acres. The government rental is \$1.00 per acre per annum, or \$4,000 yearly, for 40 years. This sum, if otherwise invested at 5 per cent. per annum, compounded yearly, would have amounted at the end of the 40 years to \$483,100.00.

All useless expenditure may be treated in the same manner, and similarly charged up to capital account.

I have intimated that the actual value of the mine plant is not in excess of its net earning capacity. If too small, it is deficient; if too large, the superfluous equipment may fairly be appraised at scrap value.

Likewise, I might assume that the coal rights should be evaluated only upon the basis of net earnings, after all other estimates, expenditures and the capitalization have been determined.

For the better elucidation of this, I have prepared a statement, which accompanies this paper, and which is but a tabulation of six purely hypothetical cases. In

YEARLY STATEMENT

Working days per year	Output per working day (tons)	Output per year (tons)	Acreage of leasehold	Cost of Plant and equipment	Depreciation of Plant and Equipment	Cost of Mining per ton	Selling price per ton	Dividend in per cent of Cap.	Receipts Total output sold at \$2.50 per ton	Expenditure					Paid Up Capitalization on basis of 0% Dividend	Evaluation of Coal Rights		
										Cost of Mining at \$2 per ton	Lease Rental at \$1 per acre	Depreciation and repairs	Dividend	Total		Total (Capital less cost of plant, etc.)	Per acre	
1	175	1,000	175,000	1,000	\$200,000	12%	\$2.00	\$2.50	10%	\$437,500	\$350,000	\$1,000	\$13,000	\$73,500	\$437,500	\$735,000	\$535,000	\$535.00
2	115	1,000	115,000	1,000	200,000	10%	2.00	2.50	10%	287,500	230,000	1,000	10,000	46,000	287,500	460,000	260,000	260.00
3	175	500	87,500	1,000	200,000	10%	2.00	2.50	10%	218,750	175,000	1,000	10,000	32,750	218,750	327,500	127,500	127.50
4	125	500	62,500	1,000	200,000	10%	2.00	2.50	10%	156,250	125,000	1,000	10,000	20,250	156,250	202,500	2,500	2.50
5	150	250	37,500	400	50,000	12%	2.00	2.50	10%	93,750	75,000	400	2,500	15,850	93,750	158,500	108,500	271.25
6	150	150	22,500	1,000	40,000	12%	2.00	2.50	10%	56,250	45,000	1,000	2,000	8,250	56,250	82,500	42,500	42.50

quired may be so large in proportion to the coal extracted, that the slow development proves a deterrent. We have illustrations of these.

There has not, as yet, been evolved in our Western interior mining an economical process for replacing the coal pillar supports, such as sand filling, etc. Long wall mining, however, in some of the thinner seams, might well be substituted for pillar and stall.

Operating shafts sunk through rock would handicap the operations with this initial dead expenditure, in competition with other producers who are not under the necessity of such outlay.

Where shafts or slopes, on the other hand, are driven in coal throughout, the sinking is in the nature of development, and the increased cost, due to winding, over and above that of gravity planes in other mines, would not be such as to preclude successful competition.

If the coal concession be a leasehold with a limited life, the acreage which can be mined during that term is all that can be accounted valuable. This must be figured upon the basis of an assumed annual output. Let us make this clear by a hypothetical case:

The amount of leased land, 5,000 acres; thickness of workable coal, 11 ft; mining losses, 25 per cent.; coal content of seam per acre, 1,000 tons per foot of thickness; daily output, 500 tons; working days per year, 250; term of lease, 40 years.

Then at the termination of the lease there will have been worked out

this statement I have shown how to arrive at the evaluation of the coal lands per acre, after assuming as fixed the various other items, namely: number of working days, output, acreage of holding, cost of mining, selling price, dividend percentage, total receipts, total expenditures, depreciation of plant and capitalization.

Although the tabulations have been arranged to suit leased, prairie sub-bituminous or lignite coal mines or lands, the principle involved may be applied equally to any property, and this is my basis of evaluation of coal concessions.

I would wish, particularly, to draw attention to the fact that I have fixed the capitalization upon the basis of actual capital outlay. Should there be a bond issue, this would reduce the capitalization by the amount that it replaced.

The prime object of all such papers as this I have the honor to present before the International Engineering Congress, is to incite profitable discussion, and thus to stir up interest in the betterment of the industry. I have no doubt that in Western Canada, and in the Northwestern States, coal-mining suffers from identical maladies. We can not and must not blink the fact that disregard of the true principles of evaluation has been a contributory cause in crippling the industry. Whilst we are urging our respective Governments to help us, we must not forget that we have our own clear duties to perform. Not the least of these is preaching the gospel of practical common sense in appraising coal lands.

GREAT MINING ACTIVITY IN THE UNITED STATES

To-day the U. S. Geological Survey is making public its usual estimate of mineral production for 1915 in the form of a separate statement for each of the more important mineral products.

A review of these statements confirms Secretary Lane's comment of last July to the effect that the mining revival is in full swing. In the Western States alone the metal production shows an increase in value of more than \$130,000,000 over the corresponding figures for 1914; and the year's increase in output for the principal metals measured in value is more than \$250,000,000. Moreover it is not unreasonable to expect that when the full returns for all mineral products are compiled they will show that 1915 was the country's most productive year in the mining industry. The total may even reach two and one-half billion dollars.

In the response to bettered conditions the production figures for copper, iron and zinc show the largest increase.

Copper.—The copper mines passed all records for previous years, the 1915 output having a value of \$236,000,000, or \$83,000,000 more than the value of the production for 1914. The statistics and estimates received place the output of blister and Lake copper at 1,365,500,000 pounds, or more than 120,000,000 pounds in excess of the largest previous production and eighteen per cent. above last year's figures. Only twice in the history of copper mining has there been a larger increase in quantity of metal produced.

Iron.—The total shipments of iron ore from the mines in the United States in 1915 are estimated to have exceeded 55,000,000 gross tons, an increase over 1914 of more than 38 per cent. Based on the same price as received in 1914 this represents an increase in total value of about \$27,645,000. The increase in pig iron is estimated at 6,500,000 tons, with a total increase in value of pig iron production of more than \$120,000,000.

Zinc.—The U. S. output of zinc (spelter) made from domestic ores was larger than ever before being about 425,000 tons worth \$120,000,000 as compared with 343,418 tons in 1914, an increase of about 82,000 tons or nearly 25 per cent. in quantity and of \$85,000,000 in value. Production was increased during the latter half of the year, as the production during the first half was at the rate of 415,000 tons annually and at the rate of 436,000 tons during the last half.

Lead.—The U.S. output of refined pig lead from domestic ores was about 515,000 tons worth about \$48,500,000 as compared with 512,794 tons in 1914, an increase of only 2,500 tons in quantity but of \$8,500,000 or 20 per cent. in value. The production of antimonial lead was 20,550 tons as compared with 16,668 tons in 1914, an increase of 3,882 tons or 23 per cent. in quantity and an increase in value of nearly \$2,000,000.

Gold and Silver Increases.—The annual preliminary estimates on the production of gold and silver in the United States, made jointly by the United States Geological Survey and the Bureau of the Mint, are not yet complete, but early figures based on reports from the mines indicate an increase in mine production over that of 1914 of over \$7,000,000 in gold, principally from

Colorado, California, Alaska, Montana, and Idaho, and an increase in mine production of silver of fully 4,000,000 ounces, chiefly from Montana, Utah, and Arizona. This increase in gold production may bring 1915 up to the record year of 1909, when the gold output of this country was nearly \$100,000,000.

Quicksilver also had its best year in 1915. The quantity increased 25 per cent. over 1914, but the value of the output more than doubled owing to the much higher prices. The estimated production was 20,681, flasks of 75 pounds each, valued, at the average price for the year—the highest in the last 40 years—at \$1,768,225. In value, this domestic production was the highest since 1881 and in quantity the largest since 1912.

Coal.—The production of bituminous coal and anthracite in 1915 is estimated to have increased between 4 and 5 million short tons, or less than 1 per cent. The quantity of bituminous coal mined increased about 6½ million tons and that of anthracite decreased over 2 million short tons. Owing mainly to steady demands for export coal and for coke for steel making, the output in Pennsylvania, West Virginia, Kentucky, and Alabama increased over last year, but little change is recorded in other eastern States. The region west of Ohio, including the Mississippi Valley, shows a general decrease, Colorado being the only Western State to show betterment.

Coke.—Connected with the coke industry was the completion during the last summer of a number of large plants for the recovery of benzol from by-product coke-oven gas. This gives the United States its first output of this material, so important as a raw material in the manufacture of high explosives and chemical dyes, and the amount of this product will be reported later.

Petroleum.—Preliminary estimates of the total output of petroleum in the United States in 1915 indicate a slight increase over the corresponding output in 1914. It is believed that the total petroleum yield of the United States in 1915 amounted to 291,400,000 barrels, of which quantity it is also estimated that 267,400,000 barrels was marketed and 24,000,000 barrels placed in producers' field tankage during the year.

The sulphuric acid industry in 1915 presented interesting development. In spite of the abnormal demand and higher prices in the latter half of the year, much of the sulphuric acid had been contracted for or was consumed in the factories where made. The estimated production indicates an increase of 6½ per cent. in the three common grades, but more than 100 per cent. in the strongest grades.

The estimate of Portland cement output in 1915 indicates shipments from the mills of 86,524,500 barrels, an increase of one-tenth of one per cent. over 1914. There was a slight decrease in production and this, with the appreciable decrease in stock, indicates a more conservative trend in the industry, which in the preceding few years showed a tendency to overproduction. Prices generally averaged a few cents lower per barrel in 1915 than in 1914, although toward the end of the year prices were substantially increased, and the outlook for 1916 is brighter than for several seasons.

Perhaps the most notable item in the year's record is the stimulation of metal mining in the Western States.

Almost without exception the increases in production were large and in several States 1915 was the best year on record. In Arizona, which leads in copper, the output of that metal exceeded the previous record production of 1913. California continues to lead in gold and had the largest yield in 32 years, and with one exception in half a century. In Montana and Arizona record outputs of silver are reported and in Alaska the increased production of gold and especially copper made 1915 a much more prosperous year than even 1906 when Fairbanks and Nome were yielding their greatest returns of gold from bonanza placers.

QUICKSILVER IN 1915.

The United States output of quicksilver in 1915, based on preliminary figures collected from the individual producers by H. D. McCaskey, of the United States Geological Survey, was 20,681 flasks of 75 pounds each, valued, at the average domestic price for the year at San Francisco (estimated at \$85.50 a flask), at \$1,768,225. Compared with the Survey's final statistics for 1914, which gave a production of 16,548 flasks, valued at \$811,680 (the smallest since 1860), the output of 1915 shows an increase of 4,133 flasks in quantity and of \$956,545 in value. The value therefore more than doubled, owing to the greatly increased prices demanded, but the quantity increased only about 25 per cent. The production was the largest in value since 1881 and the greatest in quantity since 1912. On comparing the production of 1881 with that of 1915 in value, it is interesting to note that it required 60,851 flasks at the average price of \$29.83 per flask for that year to exceed in value the much smaller output at the greatly enhanced average price for 1915.

The European war directly affected the quicksilver industry, first by greatly increasing the demand for the metal in the manufacture of fulminate for explosives, and, second, by reducing the imports of foreign supplies. The net result has been steadily increasing prices and encouragement to producers to operate at maximum capacity.

The average San Francisco domestic market price is estimated at \$85.50 for 1915, against \$49.05 for 1914. With the exception of the year 1874, when the average price was \$105.18 per flask of 76½ pounds, the average price of 1915 was the highest since the beginning of the industry in 1850, when the average for the year was given as \$99.45.

The monthly averages for 1915 show a rise from \$51.90 in January, to \$78 for March, a decline to \$75 for May, a recovery and rise to \$95 for July, a decline to \$91 to September, and steady increases since to an estimated price of \$119 for December. Though there have been temporary setbacks the tendency has therefore been steadily upward, and the year ends with prospects of still higher prices as the demand continues.

HIGH SPEED STEELS.

A very important group of the rare metals, known as the steel-alloying metals, includes chromium, cobalt, nickel, tungsten, vanadium, and of less importance, molybdenum and titanium. By the use of these metals wonderful alloy steels containing six or seven metals have been evolved, the "high speed" steels, by the use of which one man now does as much work with metal-cutting machinery as could formerly be done by five men.

These alloy steels have been largely though not wholly developed in the United States. The tremendous quantity of special steel ordered in that country by the war-

ring nations has shown the extreme importance of the steel-alloying metals and prices have increased by leaps and bounds.

The alloy tool steels are now sold as high as \$2 and \$3 a pound as compared with 50 to 60 cents a pound formerly, and meet no competition from the fine carbon tool steels formerly used. For carbon steels with established reputations between 10 and 20 cents a pound was considered a good price.

For the "high speed" tool steels, chromium and tungsten are essential; vanadium, cobalt, and molybdenum desirable. Tungsten and vanadium can be produced in this country easily, at least for present demands; molybdenum, chromium, and cobalt for at least a portion of our needs.

Alloy steels of simpler composition are used in many forms of machinery with great benefit. All shoes and dies in stamp mills and the tires of rolls used in crushing ores are made from steel containing chromium. Many of the best automobile axles and springs, locomotive frames and springs, and other machine parts that must stand hard usage and which must be reliable are made from steels carrying vanadium or chromium and vanadium.

GRANBY CO.'S BONANZA MINE.

Included in the Granby Consolidated Mining, Smelting and Power Co.'s annual report, which was reprinted in *The Canadian Mining Journal* of November 15th last, was a report by Mr. H. J. C. MacDonald, superintendent, Anyox, B.C., who in his brief account of the company's Bonanza mine, observed: "The value of the Bonanza mine, as an addition to the reserves of the Hidden Creek mine, tributary to the smeltery at Anyox, has not been sufficiently emphasized in the former reports."

During the field season of 1913, Mr. Donald G. Forbes, a private practising mining engineer, was engaged in making examinations of certain mineral properties in the Coast district of British Columbia, and among the many properties he then visited was the Bonanza, concerning which he reported (vide *Annual Report of Minister of Mines, British Columbia, 1913*, pp. K83-84):

"The Bonanza mine, owned by Henry Doyle, is situated on Bonanza creek, at an elevation of 200 ft. above and about one mile from salt water.

"Several small bodies of chalcopyrite, pyrite and pyrrhotite, intimately associated with small diorite dikes, have been exposed by a small creek entering Bonanza creek on the north side. The country exposed at this point consists of mica-schist containing small bedded veinlets of quartz and containing some pyrite and chalcopyrite. The schist lies fairly flat, the mineralized portion being 50 to 60 ft. in thickness.

"The development work has been done with the idea of tracing this deposit downward, and several tunnels have been driven with that end in view, without satisfactory results.

"During the past year the property has been under option to the Granby Co., and has been prospected with a diamond-drill, with the result that the deposit has been proved to be a blanket formation. The solid bodies of iron and copper pyrites above-mentioned occur on both sides of the dikes and contrary to the experience in the development of the Hidden Creek properties, two miles distant, the dikes appear to the writer to be responsible for the aggregations of ore and the mineralization of the surrounding mica-schist.

"Two samples of clean ore returned: (1) Copper and iron pyrites—gold, 0.08 oz.; silver, 1.6 oz.; copper, 6.2 per cent. (2) Copper and iron pyrites—Gold, 0.02 oz.; silver, 2.8 oz.; copper, 1.7 per cent."

PERSONAL AND GENERAL

Mr. Maurice W. Bacon, of Spokane, Washington, has resigned as general manager of the Stewart Mining Co., operating in the Coeur d'Alene district of Idaho, and has been succeeded in that capacity by Mr. Wm. Beaudry. Mr. Bacon has been active in connection with the promotion of a company to acquire and further develop a group of copper claims situated in Quatsino mining division, Vancouver Island, B.C.

Mr. David W. Brunton, who several weeks ago was on the coast of British Columbia, is back in Denver, Col.

Prof. R. W. Brock, of Vancouver, B.C., dean of the Faculty of Applied Science, University of British Columbia, has arranged to give his time and attention to military matters, and Mr. Stuart J. Schofield, of the Geological Survey of Canada, has been appointed professor of geology at that university. Mr. Schofield spent the last field season making geological investigations in the eastern part of the West Kootenay district of British Columbia.

Mr. Lorne A. Campbell, of Rossland, B.C., general manager for the West Kootenay Power and Light Co., operating in West Kootenay and Boundary districts, has been appointed Minister of Mines for British Columbia.

Mr. Henry Clark, of Victoria, B.C., representative in Canada of Head, Wrightson & Co., Ltd., of Stockton-on-Tees, England, consulting engineers and contractors, expects to leave Victoria for Japan on January 11th for a visit to the latter country.

Mr. S. Duncan Ellis, formerly of Toronto, has advised his parents in Victoria, B.C., that he has been in the trenches in France, serving as a lieutenant of the Royal Engineers.

Mr. David Elliot, of Dawson, Yukon territory, superintendent for the Treadgold Mining Co., is reported to have gone to London, England.

Mr. W. H. Falding, of Rossland, B.C., who for a comparatively long period has been in charge of the accounting department of the office of the Le Roi No. 2, Ltd., is retiring from that position.

Mr. Chas. Graham, superintendent for the Corbin Coal and Coke Co., operating a coal mine in Southeast Kootenay, British Columbia, has secured leave of absence from his mining duties and obtained a lieutenancy in the No. 2 Tunnelling Co., Engineers, that Major R. W. Coulthard, of Calgary, is raising in Western Canada. Mr. Thos. McGuckie, formerly of Nanaimo, will have temporary charge of the coal mines at Corbin.

Mr. A. D. Hughes, long associated with the management of the placer-gold properties of the North Columbia Gold Mining Co., in Atlin camp, British Columbia, is spending the winter in California.

Mr. W. H. Trewartha-James, of London, England, formerly general manager for the Tye Copper Co., with headquarters in Victoria, B.C., has lost his son Deric, who was killed in Flanders last autumn.

Capt. Harry Johns, of Spokane, Washington, for years superintending mining operations in Boundary and West Kootenay districts of British Columbia, has been in Portland, Oregon, lately, in connection with financing a mining enterprise that is being prosecuted by Keffer & Johns, mining engineers, of Spokane.

Mr. J. P. Keane, who is operating the mill at Rosebery, Slocan Lake, B.C., as a custom concentrator, has notified the Slocan Board of Trade of his intention to launch a movement having for its object the erection of a zinc-reduction plant in Canada.

Mr. D. Matheson, for some time superintendent of the Silver King mine near Nelson, B.C., when it was being worked by the Consolidated Mining and Smelting Co., is now in charge of development work that company is having done at its Ottawa mine, in Slocan City mining division.

Sir Richard McBride has resigned as Premier and Minister of Mines for British Columbia and will shortly leave for London England, where he will succeed the Hon. J. H. Turner as Agent General for British Columbia. One most beneficial feature of Sir Richard's long tenure of office as leader of the Government of British Columbia was his persistent determination to allow no legislative tinkering with the mining laws of the province.

Mr. J. W. D. Moodie, of Britannia Beach, B.C., vice-president and general manager of the Britannia Mining and Smelting Co., has been in the East for several weeks. The headquarters of those in control of the Britannia company is New York City.

Lieut. J. H. Roaf, of the 6th Regiment, D.C.O.R., Vancouver, B.C., was one of thirty who on December 6th at Victoria commenced attendance at a Royal Military course for those desiring to qualify for the rank of captain. Lieutenant Roaf has long been connected with the management of coal mines in British Columbia.

Mr. Wm. Thomlinson has returned to his home at New Denver, British Columbia, after having been for about a year at San Francisco, California, where he was engaged first in assisting in arranging the very fine exhibit of Canadian minerals in the Canadian Pavilion at the Panama-Pacific International Exposition, and afterward in giving to thousands of visitors much information relative to the great variety, extent and value of the mineral resources of the Dominion.

Mr. Wm. R. Wilson, of Fernie, B.C., general manager for the Crow's Nest Pass Coal Co., of Toronto, has been in California recuperating after having been troubled for a time with a mild attack of pneumonia.

Mr. Hugh M. Wolfen has been appointed to charge of important activities at Pittsburgh, Pennsylvania, of the United States Bureau of Mines, in connection with the mine safety work the Bureau has in hand there. For a year or more Mr. Wolfen had been engineer to the California State Industrial Accident Commission, in which office he has been succeeded by Mr. Paul Higgins, also of the staff of the Bureau of Mines and who is another enthusiastic mine safety worker. When in charge of the Bureau's mine-rescue training station on the campus of the Washington State University, Seattle, Mr. Wolfen came into close and friendly relation with a number of coal mining men from British Columbia.

Capt. H. C. Anchor is at South Porcupine.

Mr. Geo. J. Miller, who bought the McDonough claims at Boston creek, has started to build camps and will build a small mill.

Mr. H. W. Hardinge has been honored by the Franklin Institute of Philadelphia, for the City of Philadelphia itself, by being awarded the John Scott medal for the invention of the Hardinge mill. This medal is the oldest existent medal which is being awarded up to the present time. John Scott, of Edinburgh, died in 1816 and left a certain amount of award to the City of Philadelphia to be distributed in the future for improvements which would be of general mechanical benefit. The Franklin Institute of Philadelphia is the oldest scien-

tific association and on its committee and staff has some of the most celebrated men of the United States. Hence an award from them is a signal honor.

Chas. E. Van Barneveld, Chief of the Department of Mines and Metallurgy of the Panama-Pacific International Exposition, is visiting Washington and New York and will return to Berkeley, California, to take up his work as Professor of Mining at the College of Mines, University of California.

Mr. Julius M. Cohen, not Mr. S. W. Cohen as reported in our last issue, has been appointed manager of Croesus Gold Mines, Ltd.

Mr. Geo. R. Rogers, who is developing a property in the Elk Lake district, was in Toronto last week. His address is Wigwam, Ont.

Mr. A. A. Cole, of Cobalt, has been nominated for the Presidency of the Canadian Mining Institute.

Mr. T. W. Gibson, Deputy Minister of Mines of Ontario, has been nominated as Vice-President of the Canadian Mining Institute.

Mr. W. E. Segsworth, Toronto, has been nominated for councillor of the Canadian Mining Institute.

Mr. Fraser D. Reid is superintendent at the Coniagas mine, filling the place of Colonel R. P. Rogers, who is in charge of the tunneling company of the Royal Engineers.

Colonel R. P. Rogers, who is at Pembroke with his company, has had the misfortune to break his collar bone in a fall.

Mr. T. P. McNamara is mine superintendent and Mr. Ralph Scott mine engineer at Dome mine.

Mr. Geo. B. Church is at Juneau, Alaska, examining properties there.

Mr. H. L. Taylor, president of the Porcupine Imperial mine, has returned to New York after a visit to the mine.

Mr. Frank Loring is at the La Belle mine, Goodfish lake.

Mr. F. J. Bourne has returned to Cobalt after a visit to Toronto and Ottawa.

Mr. F. C. Dyer, of the Department of Mining, University of Toronto, demonstrated at a meeting of the Toronto Branch of the Canadian Mining Institute on December 11th a number of experiments illustrating flotation phenomena. The experiments provoked an interesting discussion on flotation methods.

SOME OCCURRENCES OF OIL IN BRITISH COLUMBIA.*

By J. B. Tyrrell.

The occurrence of vast pools of oil on the Pacific slope in the State of California has stirred the imagination of many of those living farther north, and during recent years some exploratory work has been done in the province of British Columbia in the hope of finding some northern continuation or representatives of the pools which have yielded so much oil to our fortunate neighbors on the south. In prosecuting exploration in British Columbia, some investigations have been conducted throughout the country near the mouth of the Fraser river, and some interesting results have been brought to light by these explorations.

In the southwestern corner of British Columbia, through which the Fraser river flows westward to the sea, there is a comparatively flat-lying area bounded on the north by granite mountains of Jurassic age, and on the east by the Sumas and Chilliwak mountains, composed of somewhat older rocks. To the south this area extends across the International Boundary line into the State of Washington, a rather high ridge of glacial debris extending east and west near the International Boundary line. This comparatively small triangular area of about 700 square miles in Canada is underlain by Tertiary sandstones and shales with a total thickness of several thousand feet. These sandstones and shales do not appear to contain any fossil remains of marine animals, but they do contain trunks and fragments of trees and land plants which have been altered to lignite or low-grade coal, this coal occurring at numerous horizons throughout the formation.

The mode of formation of these Tertiary beds would appear to have been about as follows: In pre-Tertiary times a great submerged valley extended along to the south of the Jurassic mountains. Into the head of this submerged valley or bay the early representatives of the Fraser river and other streams emptied, carrying down into it loads of detritus worn from the upper portions of the river valleys, and this detritus was spread over the floor of the bay, while around the margin of the bay grew forests whose trees fell into the edge of the water. While the streams were thus discharging their loads of sediment, the land was gradually sinking and the sediment was gradually accumulating to a greater and greater thickness. The trees growing on the shore fell in the water and were also included in this sediment, and finally formed irregular beds of lignite of greater or less extent, each bed marking the position of an old shore line of the time when its vegetation was buried. Thus the bay was gradually filled up with beds of sand and gravel, with included seams of coal or lignite, having a total thickness of several thousand feet.

After these Tertiary beds were deposited there was a rise of the land of 1,000 ft. or more, and the Fraser river cut out a canyon along the foot of the northern mountains to a depth of about 1,000 ft., and at the same time the surface of the adjoining land to the south was cut into hills and valleys, but there was no perceptible warping of the land in this district, and the beds retained the horizontal attitude in which they originally had been deposited. Subsequent to the formation of the canyon of the lower Fraser river, the land was again depressed to its present altitude, and the old canyon of the Fraser river was filled by glacial debris brought down from the mountains to the north of it.

At some time subsequent to the deposition of the Tertiary sands and clays, which are known as the Puget group, dikes of quartz-andesite were intruded through them near their northern border. These dikes also cut the beds of lignite, and subjected them to a process of distillation, giving rise to a dark oil which is still occasionally found exuding from the sandstone in the vicinity of the city of Vancouver and in the country to the east of it. It is not likely that this oil has any commercial significance or value, but its mode of occurrence as a distillate of lignite through the influence of hot dikes, is of interest.

*From a discussion of a paper by C. E. Weaver, published in December bulletin of A. I. M. E.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE AND MUNRO TOWNSHIP

Gold production.—According to the closest figures that can be obtained the gold production from Porcupine, Kirkland Lake and Munro Township will be over eight million dollars. It is quite probable that it will exceed eight million and a quarter dollars but at the time of writing the production for December has to be estimated and the growing production from scattered mines makes the difficulty of close figuring more real than it was when Porcupine was the sole producer. There were no less than nine producers from the Porcupine area and two from outside, namely, the Tough-Oakes and the Croesus gold mines. Of the eight million and a quarter produced, Porcupine contributed between seven and a half and seven and three quarter millions in gold.

Hollinger.—The experience with the metal balls in the tube mills at the Hollinger is not yet conclusive enough to justify them being installed throughout the mill. It is true the duty per stamp can be raised but the difficulties in the wear of the tube mill liners, the extra power required and various other factors makes the problem yet one not entirely solved. The metal balls certainly have great crushing possibilities and the temptation to use them is very great. Experiments are still proceeding and will continue for some time.

Dome.—The new central shaft at the Dome Mines is making very rapid progress. Since the first of November when the ground was first broken sinking has been conducted at the rate of five feet a day. The shaft is now down to between 225 and 250 feet and it is expected that all the levels will be connected up by March first. Taking the average of all the levels to the 7th about 150 of cross cutting is required to connect up the old shaft to the new. From the 5th, 6th and 7th levels of the old shaft cross cuts have been run to the new central shaft and raises now being put up from these levels. At the 5th level the 36 x 54 new Buchanan crusher is almost ready to commence primary crushing. It has a capacity of 250 tons an hour to twelve inches and about 150 tons an hour to six inches. The new central shaft consists of two hoisting compartments, one man-way and a pipe and ladder way. The work in connection with the new shaft is being rushed as fast as possible and in consequence less development is taking place in other portions of the mine. No less than 70 to 75 per cent. of the ore going to the mill is still coming from the old Dome glory hole.

McIntyre.—Profits at the McIntyre for November were slightly lower than for October according to the official statement just issued. This was due to slightly higher operating costs per ton. They went up from \$4.01 to \$4.07 per ton.

	November.	October.
Tons milled	8,657	8,741
Value per ton	\$ 7.29	\$ 7.48
Gross value	63,310.00	65,382.00
Recovery	60,284.00	62,265.00
Per cent.	95.52	95.23
Operating costs	\$35,234.00	\$35,051.00
	4.07	4.01
Operating profit ...	25,050.00	27,214.00

West Dome.—It is announced on good authority that Mr. Jacob Field a well-known operator on the New York market has obtained large holdings of large blocks of stock in northern mines. It is understood that he has taken up a large block of shares in the West Dome and he has also purchased from the same holder, quite a little of the issued stock of the Peterson Lake Mining Company. If this is so there is little doubt that the West Dome will be among the prospects in the Porcupine camp that will start up early next year.

The Porphyry Hill, once belonging to the Preston East Dome, latterly owned by the original syndicate to which it reverted, is now under option to Mr. Clifford Smith and his associates. From the Porphyry Hill there have been shipped during the past two years four cars of ore which would average more than \$100 to the ton. This ore has not come from old workings, but from new veins opened up by Mr. William Ophir and his associates in the Porphyry Hill.

The Croesus Gold Mines had cut its vein at the 200 foot level of the mine. The vein here is two feet wide and sampling shows that it still gives a very high-grade of milling ore. Good milling ore and also patches of the extraordinarily rich ore that has made this claim so well known, has been developed at both directions on the 150 sub level. It is to be noted that after the very high-grade ore had been hand picked out of the vein the heads of the mill run made at the Pyramid mill went over \$40 to the ton. With the cutting of the vein at the 200 foot level there is now every confidence that the Croesus will continue to hold good values to a considerable depth. On the other hand the development of the veins laterally is not likely to be of any great extent. Since the roads froze up it has been possible to get in supplies without much difficulty and traffic into this camp has been resumed with a good deal of vigor.

Munro Consolidated.—Upon the Munro Consolidated claims, also in Munro Township good ore has also been found and is being developed.

Prospecting.—Owing to the regulation not insisting on winter work for assessment there are very few prospectors in the bush this winter in spite of the much greater potential value of the claims. There are prospectors in Boston creek still staking and looking for claims and there are some in Munro Township too, but apart from that there are hardly any men at all in the bush this winter. This by no means goes to show that there is lack of interest in prospecting; but owners of claims recognize not fifty per cent. of the value of work can be done while the snow is on the ground. It is true that much of the assessment work will be due to be done in the spring before the snow goes but every one is putting it off until the last minute. There will be a wild rush back into the bush to do assessment work next spring, as very few claims of any value will be allowed to lapse. This inactivity is more apparent in the newer fields than in the old. Kowkash for instance, is almost deserted and beyond the claims that have got beyond surface exploration, very little development is being done.

Kirkland Lake.—Apart from the Tough-Oakes in Kirkland Lake there are now four other properties

working still. These are the La Belle at Goodfish, the Teck-Hughes at Kirkland lake and the Kirkland Lake Gold Mines and the old Swastika. It was considered most probable that some arrangement might be made whereby further power would be available from a hydro electric plant and the delay has retarded development to some extent on the Teck-Hughes. In the meantime the construction of the mill there is being pushed on vigorously but the mine as yet has not been reopened. Placing of mill machinery will commence early in the new year.

Under the direction of Mr. Floyd Weed, who was for several years manager of the Bailey Cobalt mines, the Kirkland Lake Gold Mines shaft has been dewatered and will shortly commence drilling. The Kirkland Lake had a small but complete plant on the property and no further installation will be necessary for some time to come.

La Belle.—For the La Belle Gold Mines at Goodfish lake two large tubular boilers arrived at Swastika at end of last week and have now been taken over the snow roads. A compressor will follow soon. As initial development work was carried out with a very primitive plant it was thought best that after enough development had been done to justify the purchase of the property, to merely do surface work until such time as the whole plant can be taken in. The prospects at this property are most encouraging. At the bottom of the shaft at 150 feet good ore will run 11 dollars across 15 feet.

Swastika.—At Swastika mine work was resumed at the 200 foot level about six weeks ago and cross cutting and drifting to find new ore bodies has been in progress for the last month or more. Now the water will be taken out down to the 300 ft. level so that further exploration can be proceeded with.

Activity apart from prospecting has never been more pronounced in Kirkland Lake than to-day. A large quantity of freight is going over the roads every day and the force of men now employed at the mines is considerable. A new townsite has been established at the confluence of the Goodfish road and the road to the Tough-Oakes mine from Swastika. Next spring the post office will be established and also a school. A small settlement has sprung up around the Tough-Oakes mine itself and promises to develop into a good sized village.

The Tough-Oakes Gold mine has now paid two dividends and has three well defined vein systems. It is remarkable, that during the month of November and most probably during December, the mill which is treating 110 tons a day will be run entirely on development ore. It is due to the fact that practically all the drills running on development are in ore. Raises are being put through from the 400 to the 300 foot level in order to block out ground for stoping. These raises are in remarkable ore. On the 400 foot level for a distance of 150 feet, the ore will run \$51 dollars over a width of 54 inches. The vein matter is divided into three branches and the whole width between is good milling ore. The veins themselves are narrow but phenomenally rich and there is gold in the porphyry. It is a significant fact that despite the remarkable ore on the upper levels in the sedimentary rock the ore across a stoping width is richer in the porphyry than in the conglomerate. Practically all the ore now being mined is in the porphyry. The stoping is confined entirely to

the number two vein which was the only vein opened up until recently. From the 200 foot level a long cross cut has been run towards the mill at a distance of 600 ft. which cut the No. 3 vein and this ore body has now been proved up for a distance of between 200 and 250 feet. The drifts both east and west are in great ore. The winze has been sunk near the end of the west drift and the ore here is most satisfactory. From the drift a raise is being put up through to connect with the drift near B shaft. A winze is also being put down on ore from the workings at B shaft. The use of B shaft will probably be discontinued for the winter and all ore mined in these workings will be dumped down the raise to the 200 foot level and then trammed to the shaft. At the time of writing it is expected that No. 7 vein will be cross cut at any moment. Owing to experience in other veins in similar contents the management is more sanguine that No. 7 vein will be at least as productive as No. 3 or No. 6. If this proves so the ore reserves of the mine will be trebled. Also if No. 7 vein proves as good as anticipations it is most likely that within a short time a new central shaft will be put down near the mill. It is now a distance of 6 to 800 feet to tram ore from No. 3 and No. 6 veins. The ore is then raised to the surface up an incline shaft and hauled back to the mill. As a large percentage of the ore comes from No. 3 and No. 6 and will increasingly do so, it is apparent that such a development would lead to economy. The mill is now treating 110 tons a day. By means of a simple device at the discharge end of the Hardinge tube mill Mr. Randall has raised the capacity of the ball mill from 80 to 110 tons a day. As a consequence the place in the mill where tonnage is apt to be arrested is at the tube mills. Heads are kept down to about \$20 and tails are running a little over a dollar a ton. About 4,000 tons a month is being hoisted by the main shaft of which three thousand is ore and a thousand waste.

COBALT, GOWGANDA AND SOUTH LORRAIN

Crown Reserve.—The Ontario Government has decided to grant the request of the Crown Reserve Mining Company and the royalty will be abolished. Since the company commenced operations the Crown Reserve Mining Company has paid 10 per cent. on the ore at the pit's mouth. It was pointed out to the Government some five or six months ago that under the altered conditions at the mine the Government was taking practically all the profits that were being made. The Crown Reserve Mining Company therefore received word that it has been decided to abolish this royalty but the Government reserves the right to reimpose it if conditions at the mine warrant it.

Chambers-Ferland.—Much better ore is being found at the Chambers-Ferland mine. A winze has been sunk from the 350 to the 400 foot level near the Nipissing line. It was sunk upon a strong vein of niccolite and smaltite with low silver content. As the winze was being put down another narrower but much richer vein came into the winze. The farther the winze was sunk the better has become the vein so that it is now about two inches wide and of 3,500 ounce ore.

The Reeves-Dobie at Gowganda is again being worked. Messrs. Sam Dobie and Reeves have sold out their

interest to a syndicate of which Mr. Christopherson of Gowganda is the Canadian representative. The syndicate purchasing the claim is substantial and it is probable that the old prospect will get a chance. Some tentative offers have also been made for the Bartlett mine.

Ophir.—Before the new year the Ophir Cobalt mine should be pumped out and ready for mining operations. It has been decided to resume work on this south eastern prospect. Before doing so, however, the old workings will be thoroughly re-sampled in order to discover the most likely place to strike further ore. Before the mine closed down several short high-grade shoots of ore were encountered but were not long enough to make mining profitable. There is also a good deal of milling rock in the mine to-day.

The Nipissing has decided to use their No. 81 shaft as a basis for operations on the ore to be cut near the Cobalt Lake fault. The old shaft will immediately be sunk to the 350 and 430 foot level before any cross cutting is attempted. A new head frame has already been erected.

BRITISH COLUMBIA

The resignation by Sir Richard McBride of the offices of Premier and Minister of Mines for British Columbia was announced on December 15. While it had been reported for a month or two that Sir Richard intended to follow this course, there was uncertainty about it, since the public announcement had been made by political opponents who had on several occasions predicted his retirement, and whose guesses previously had not proved to be based on fact.

As the year draws to a close, interest is being shown in some quarters in the matter of what the value of the mineral production of the province for the year 1915 will prove to have been. At the time of writing no estimate is available, but before the end of December it will be practicable to get a fairly good idea of the year's results. The year will have the advantage of higher average prices for some of the metals—copper, lead, and zinc, but the advance in silver did not come soon enough to give that metal a similar lift, so that it will most likely show to disadvantage this year as compared with 1913 and some earlier years. A comparison of coal and coke figures is expected to show a decrease in the year's output of coal, though coke will probably be higher than last year.

ATLIN MINING DIVISION.

Information received from Atlin is to the effect that conditions affecting the water supply for placer mining purposes were unusually unfavorable on the creeks on which operations were carried on. A very light snow-fall last winter and a warm early summer combined to make the length of time during which there was sufficient water for gravel washing shorter than in most seasons. Then the rainfall in summer and autumn was meagre, so there was little assistance to the hy-

draulicers from this source. However, it is estimated that the value of the gold recovered will be somewhere about \$300,000, as compared with a yield of \$322,000 in the 1914 season. Prospecting work was done on more than a dozen creeks that have not yet been found to be gold bearing to any considerable extent, and in some cases indications were found good enough to induce the making of locations and application for leases. While no particulars have been obtained relative to results of continued work on the Engineer gold-quartz property, it is understood that more rich ore has been found and the considerable value of the property further proved. It is reported that 20 to 25 men were employed and that the ore-shoots opened make it appear that there is more high-grade ore there than was earlier thought probable. The hydro-magnesite deposits near Atlin have again had attention, and a Vancouver city firm has shipped several hundred tons for experimental purposes.

LODE-MINING ABOUT HAZELTON.

Eight or nine properties shipped more or less ore during 1915, one of them on a comparatively large scale for a newly-opened mining district. Figures for the last quarter of the year have not been obtained, but it is known that the output from the Rocher Deboule Copper Co.'s mine on Rocher Deboule mountain up to the end of September was between 8,000 and 9,000 tons of copper ore, which was sent to the Granby Consolidated Co.'s smelting works at Anyox, Observatory inlet. The mine was operated under lease by the Montana Continental Development Co., of Butte, Montana. The terms of the lease, which was arranged for in August, 1913, provided that the lessee should equip the mine with certain machinery, construct aerial and surface tramways requisite for transporting the ore from the mine to the Grand Trunk Pacific railway, and develop the upper vein by a crosscut adit. In consideration for this development work and equipment the lessee company was to be permitted to extract all the ore it could during the term of its lease. As the stated term of the lease was only two years, and the lessees are still operating the mine, it would appear that either an extension of the lease was obtained or some other arrangement made.

The Silver Standard shipped between 100 and 200 tons of galena ore before winter set in. It may be there was further production after the snow fell, but if so no particulars have been received. This mine is situated on Glen mountain, about four miles from Hazelton. The Black Prince, on the same mountain made a small shipment, also of galena ore. The Silver Bell, Silver Cup, and Sunrise, all of Nine-mile mountain, each sent out galena ore, the Silver Cup more than 50 tons and the others smaller lots. The Coronado, on Hudson Bay mountain, and the Hunter group, in the Hunter basin, both in the neighborhood of Smithers, which is on the railway east of New Hazelton, were also small shippers, the latter of ore containing copper, gold, and silver. The Red Rose group, in the Rocher Deboule mountains had some 30 tons of ore taken out to the wagon road in readiness for shipment to a smelter.

WEST KOOTENAY.

Ainsworth.—During five weeks ended December 2, ore receipts at Trail from mines in Ainsworth mining division were as follows: No. 1 619 tons, Bluebell 514 tons, Ultica 75 tons, Cork-Province 63 tons, Retallack

& Co. 30 tons, Panama 15 tons, Bon Ton 6 tons: total 1,322 tons.

Slocan.—Silver-lead ore received at Trail from Slocan mines during five weeks ended December 2 totalled 1,278 tons, as follows: Standard 957 tons, Ruth 91 tons, Rambler-Cariboo 89 tons, Slocan Star 44 tons, Lucky Thought 33 tons, Hewitt 31 tons, Black Prince 22 tons, and Black Grouse 11 tons.

Shipments of zinc ore and concentrate during November have been given by the Nelson Daily News as having reached a total of 1,702 tons. The quantities from the several mines and mills were: From the Standard 1,109 tons, Lucky Jim 364 tons, Surprise 120 tons, Ruth 44 tons, Whitewater 35 tons, and Galena Farm 30 tons. The Galena Farm is a new shipper, the mine having been inoperative for years; the Ruth has resumed shipment of zinc concentrate after a somewhat long period of inactivity at its concentrating mill while the further development of the mine was in progress.

Nelson.—The Gold King group of five mineral claims, situated on Hall creek, two and a half miles from Hall siding on the Nelson-Spokane railway and 15 miles from Nelson, is being developed by Mr. W. S. Hawley and associates, of Spokane, Washington. The property is in the neighborhood of the old Fern gold mine which in past years was one of the producing mines of Nelson mining division. The first work undertaken by this Spokane syndicate included the construction of 2,000 ft. of road to connect with the Government wagon road to Nelson. A vein containing from 16 to 30 in. of ore of good average grade has been opened in places along a distance of about 1,000 ft., beside which open cut work an adit has been driven and a prospect shaft sunk. A steam-operated plant, comprising compressor, hoist, sinking pump, etc., has been put in and machine drills are used in the work of driving and sinking. Mr. W. A. Brockway, from Denver, Colorado, a man with 30 years experience in mining, milling, assaying, etc., is in charge of operations on the ground. The property is reported to be a promising one, and it is expected it will be on the producing list during the ensuing year. Eight men were employed on it last month, and more will be put on as soon as developments shall warrant an increase in numbers.

Trail and Rossland.—The total quantity of ore received at the Consolidated Mining and Smelting Co.'s smelter at Trail during 48 weeks of 1915 ended December 2 was 411,784 tons, an average of 8,579 tons a week throughout the period mentioned. These figures compare with a total of 364,809 tons, an average of 7,600 tons a week, for the corresponding period of 1914. The total for the whole of 1914 was 395,935 tons, so if the general average of this year be maintained for the remaining four weeks to its close, the increase in receipts in 1915 over 1914 will be approximately 50,000 tons. It is noteworthy that of this year's total of 411,784 tons for the expired period above-mentioned, the proportion from Rossland mine was 314,101 tons, or 76 per cent. of the whole.

The Daily Colonist, of Victoria, on December 15, quoted Mr. Lorne A. Campbell, representative in the Legislative Assembly of British Columbia for the Rossland constituency, as having said in the course of an interview: "It is no mere figure of speech to declare that a new era is opening—in fact, has opened—to the

mining industry of British Columbia. Evidence of this may be found at Trail to-day, for there the Consolidated Mining and Smelting Co. is making important additions to its reduction works. Provision is being made for the treatment of zinc-lead ores, and this is involving an expenditure of more than \$1,000,000. Large buildings have been erected and much modern machinery installed, and it is expected the new plant will be in running order by January 15, next. When it is remembered that these extensions were not undertaken until last September, an idea will be obtained of the expedition that has been shown by the management of the company to provide ore-reduction facilities to meet the changed conditions; a situation that, I am convinced, is more promising for the mining industry of the province than ever before in its history."

Concerning mining activities, Mr. Campbell said: "The mines in Kootenay and Boundary districts are working to their capacity. Rossland mines are making a production of about 1,000 tons of ore a day, while those of the Granby Co., in Boundary district are sending to that company's smelting works at Grand Forks more than three times that quantity daily. The town of Rossland is experiencing a return of prosperity like that of the old days; but it is prosperity that is founded on a solid basis. The entire community is benefitting from the profitable operation of the mines."

GENERAL NOTES.

A promising feature in connection with the opening of mining properties in Portland Canal mining division is that several of the mineral claim-owners have sent to the smelting works carload shipments of ore. The fact that these men have sufficient confidence in their respective properties to induce them to spend time and money in making occasional shipments of ore in bulk impresses favorably prospective buyers of mineral claims and so improves the chances of selling the property.

Efforts are being made to interest United States men in the Indian Chief group of claims, on Sydney inlet, west coast of Vancouver island. Some years ago this property was worked for a time by the Tye Copper Co. under option of purchase, but under then existing conditions developments did not warrant the company's taking up its option. It is reported that ore from the property is being tested by a flotation process; if results shall be as favorable as expected the position will be a changed one, and the outlook for profitable utilization of the ore be much improved.

SILVER PRICES.

December—	New York. London.	
	cents.	pence.
9.	56	26 7/8
10.	55 3/4	26 3/4
11.	56	26 7/8
13.	56	26 7/8
14.	55 5/8	26 1/8
15.	55	26 3/8
16.	54 1/2	25 1/8
17.	54 1/2	25 1/8
18.	54 1/4	26
20.	54 3/8	26 1/8
21.	54 3/8	26 1/8
22.	54 1/2	25 1/8

MARKETS

STOCK QUOTATIONS.

(Courtesy J. P. Bickell & Co., Standard Bank Bldg., Toronto.)

As of close of Dec. 22, 1915.

New York Curb.

	Bid.	Asked.
Atlanta . . . . .	.21	.22
Canada Copper	2.00	2.06 $\frac{1}{4}$
Belmont	4.31 $\frac{1}{4}$	4.48 $\frac{3}{4}$
Braden	16.12 $\frac{1}{2}$	16.25
Goldfields Cons.	1.00	1.06 $\frac{1}{4}$
Jim Butler	1.00	1.03 $\frac{1}{8}$
Jumbo Extension	1.18 $\frac{3}{4}$	1.25
Standard Silver-Lead (B.C.)	1.87 $\frac{1}{2}$	1.93 $\frac{3}{4}$
Stewart Mining . . . . .	.56 $\frac{1}{4}$	.68 $\frac{3}{4}$
Tonopah Extension	3.87 $\frac{1}{2}$	4.00
Tonopah Merger . . . . .	.54	.58
Tonopah Mining	6.87 $\frac{1}{2}$	7.12 $\frac{1}{2}$
Victoria Oil	2.62 $\frac{1}{2}$	2.87 $\frac{1}{2}$
West End Cons. . . . .	.74	.77
Anglo American Oil	17.50	18.25
Submarine Corp.	54.75	55.00
Kennecott Copper	53.25	53.50
Maxim Munitions	13.50	13.82 $\frac{1}{2}$
Int. Marine	17.75	18.00
do. pref.	74.75	75.25
Standard Oil of N. Y.	230.00	232.00
Standard Oil of N. J.	554.00	556.00
Standard Oil (old)	1730.00	....
Standard Oil (subs)	1175.00	....

Porcupine Stocks.

	Bid.	Asked.
Apex . . . . .	.07 $\frac{1}{4}$	.07 $\frac{1}{2}$
Dome Consolidated . . . . .	.18 $\frac{1}{2}$	....
Dome Extension . . . . .	.36 $\frac{1}{2}$	.37
Dome Lake . . . . .	.26	.27
Dome Mines	28.25	28.50
Eldorado . . . . .	....	.25
Foley O'Brien . . . . .	.56	....
Gold Reef . . . . .	.01 $\frac{1}{2}$	.02
Hollinger	27.75	28.00
Homestakes . . . . .	.25	....
Jupiter . . . . .	.18 $\frac{1}{4}$	.18 $\frac{1}{2}$
McIntyre	1.01	1.02
McIntyre Extension . . . . .	.28 $\frac{3}{4}$	.30
Moneta . . . . .	.11 $\frac{1}{2}$	.12
Porcupine Crown . . . . .	.88	.91
Porcupine Imperial . . . . .	.04 $\frac{1}{2}$	.04 $\frac{3}{4}$
Porcupine Reserve . . . . .	.01 $\frac{7}{8}$	.02
Porcupine Vipond . . . . .	.64	.66
Preston East Dome . . . . .	.06 $\frac{1}{2}$	.06 $\frac{3}{4}$
Teck Hughes . . . . .	.14	....
West Dome . . . . .	.15	.15 $\frac{3}{4}$

Cobalt Stocks.

	Bid.	Asked.
Adanac . . . . .	.25	.30
Bailey . . . . .	.05	.05 $\frac{1}{4}$
Beaver . . . . .	.40	.42
Buffalo . . . . .	....	1.05
Chambers Ferland . . . . .	.31 $\frac{1}{2}$	.32 $\frac{1}{2}$
Crown Reserve . . . . .	.57	.60
Foster . . . . .	.07	.08
Gifford . . . . .	.02 $\frac{1}{2}$	.03 $\frac{1}{2}$
Gould . . . . .	....	.00 $\frac{1}{2}$
Great Northern . . . . .	.04	.05
Hargraves . . . . .	.03 $\frac{3}{4}$	.04 $\frac{1}{2}$
Hudson Bay	23.00	....
Kerr Lake	4.35	4.75
La Rose . . . . .	.65	.75
McKinley . . . . .	.51	.56

Nipissing	7.65	8.00
Ophir . . . . .	....	.08 $\frac{1}{2}$
Peterson Lake . . . . .	.36	.36 $\frac{1}{2}$
Right of Way . . . . .	.05	.05 $\frac{1}{2}$
Seneca Superior . . . . .	.60	.68
Shamrock Cons. . . . .	.18	.18 $\frac{1}{4}$
Silver Leaf . . . . .	.02 $\frac{3}{4}$	.03 $\frac{1}{2}$
Temiskaming . . . . .	.59	.60
Trethewey . . . . .	....	.19
York Ontario . . . . .	.01 $\frac{3}{4}$	.02
Wettlaufer . . . . .	.08	.10

NEW YORK MARKETS.

Dec. 22, 1915—Connellsville Coke—

Furnace, prompt, \$3.25 to \$3.50 per ton.

First half, \$2.35 to \$2.50; Year 1916, \$2.25 to \$2.35 per ton.

Foundry, prompt, \$3.50 to \$4.00 per ton.

Contract, \$3.00 to \$3.25 per ton.

Dec. 22, 1915—Straits Tin (f.o.b.), nominal, 39.00 cents.

Copper—

Prime Lake, 20.37 $\frac{1}{2}$ to 20.62 $\frac{1}{2}$ cents.Electrolytic, 20.37 $\frac{1}{2}$ to 20.62 $\frac{1}{2}$ cents.Casting, 19.62 $\frac{1}{2}$ to 19.87 $\frac{1}{2}$ cents.

Lead, Trust price, 5.40 cents.

Lead, outside, 5.40 cents.

Spelter, prompt western shipments, 17.42 $\frac{1}{2}$ to 17.67 $\frac{1}{2}$ cts.

Antimony—

English brands, nominal.

Chinese and Japanese, 39.00 to 39.50 cents.

American, 39.00 to 39.50 cents.

Aluminum—

No. 1 Virgin, 98-99 per cent., 54.00 to 56.00 cents.

Pure, 98-99 per cent. remelt, 51.00 to 53.00 cents.

No. 12 alloy, remelt, 43.00 to 45.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, \$130.00.

Platinum—Nominal, \$88.00 to \$100.00.

Cobalt (metallic), \$1.25.

Silver (official), 54 $\frac{1}{8}$ cents.

METAL PRODUCTS.

Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market, and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 26.00 cents.

Copper wire, base, 21.50 to 22.00 cents.

High Sheet brass, base, 29.00 to 31.00 cents.

Seamless brass tubing, 29.00 to 31.00 cents.

Seamless copper tubing, 29.00 to 31.00 cents.

Brazen tubing, 32.00 to 34.00 cents.

Brass wire, 27.00 to 30.00 cents.

Brass rods, 28.00 to 30.00 cents.

Sheet zinc, f.o.b. smelter, 22.00 cents.

TORONTO MARKETS.

Dec. 24, 1915—(Quotations from Canada Metal Co., Toronto)

Spelter, 21 cents per lb.

Lead, 6 $\frac{3}{4}$ cents per lb.

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MAPS:

CANADA

Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA.

Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

Map 39A. Geological Map of Nova Scotia.

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Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.

Map 100A. Bell River, Quebec. Geology.

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Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of MacLennan and Scadding Townships), Sudbury District, Ont. Geology.

Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.

NORTH-WEST PROVINCES

Map 55A. Geological map of Alberta, Saskatchewan and Manitoba.

Map 117A. Wood Mountain Coal Area, Saskatchewan.

BRITISH COLUMBIA

Map 70A. Victoria sheet, Vancouver Island. Geology.

Map 72A. Saanich sheet, Vancouver Island. Geology.

Map 143A. Shuswap Lake, Kamloops District, B.C. Geology.

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Maps 140A and 141A. Southern and Northern Sheets of the Yukon-Alaska International Boundary between Yukon and Porcupine Rivers. Geology.

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Northern Electric Co., Ltd.
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Roessler & Hasslacher.

ALPHABETICAL INDEX TO ADVERTISERS

A		Dominion Coal Co., Ltd. 8	L	
Allan, Whyte & Co. 2	Dominion Diamond Drilling Co., Ltd. 18	Legg Bros. Inside Front Cover	Levine, Abr. 14	
American Diamond Rock Drill Co. 14	Dominion Bridge Co. 14	Ledoux & Co. 18	Lymans, Ltd. 9	
Astley, J. W. 17	Dorr, Jno. V. N. 17	Lindsey, G. G. S. 18		
	Dwight & Lloyd Sintering Co., Inc. 13			
	Dodge Mfg. Co. 5			
B		E		M
Bath, Henry & Son 20	Electric Steel & Metals Co. 4	Morton, B. K. & Co. 13	Michigan College of Mines 6	
Balbach Smelting & Refining Co. .. 20				
Beatty, Blackstock, Fasken, Cowan & Chadwick 18	F		N	
Beatty, M. & Sons, Ltd. 9	Ferrier, W. F. 17	Nova Scotia Steel & Coal Co. 10	Nova Scotia, Province of 3	
Belleville Assay Office 18	Fleck, Alex. 6	Northern Canada Supply Co., Ltd. 6		
Berger, C. L. & Sons 14	Flory, S., Mfg. Co. 12			
Blackwell, Geo. G., Sons & Co. 20	Forbes, D. L. H. 17	O		
British Columbia, Province of 13	Fowler, S. S. 17	Orillia Molybdenum Co. 24		
Brown & Butters 17	Fraser & Chalmers of Can., Ltd. ... 4	Orford Copper Co. 8		
Buffalo Mines, Ltd. 10		Ontario, Province of 7		
Burchell, Geo. B. 17	G		P	
Boving & Co. of Can. Ltd. 8	B. Greening Wire Co., Ltd. 11	Plumb Jig Companies 8		
	Gwillim, J. C. 17			
	Guess & Haultain 17	Q		
C		Quebec, Province of 3		
Can. H. W. Johns-Manville Co. 16	H		R	
Campbell & Deyell Ltd. 18	Hardman, Jno. E. 17	Roessler & Hasslacher Chemical Co 24		
Canadian Copper Co. 8	Hassan, A. A. 17			
Canadian Explosives Ltd. 21	Hendrick Mfg. Co. 12	S		
Canadian Laboratories Ltd. 18	Hersey, Milton Co., Ltd. 18	School of Mining 8		
Can. Ingersoll-Rand Co., Ltd. 1	Heyes, Thomas & Son 18	Segsworth, R. F. 18		
Can. Mining & Exploration Co. .. 17		Smart-Turner Machine Co. 12		
Canada Metal Co. 11	I		Smith & Durkee, Diamond Drill Co. 18	
Carter & Smith 17	Imperial Bank of Canada 11	Smith & Travers Diamond Drill Co. 18		
Cohen, S. W. 17	Industrial & Technical Press, Ltd. 6	Smith, Thos. & Wm., Ltd. Inside Back Cover		
Consolidated Mining & Smelting Co. 20	International Nickel Co. 8	Smith Sydney 17		
Coniagas Reduction Co. Ltd. 20		Standard Diamond Drill Co. 14		
Constant, C. L. & Co. 20	J		Sullivan Machinery Co. 2	
Curtis's & Harvey Outside Back Cover	Jeffrey Mfg. Co. 15	Summerhayes, Maurice W. 17		
	James Ore Concentrator Co. Outside Back Cover	Stanley, W. F. & Co., Ltd. 12		
	Johnson, Matthey & Co., Ltd. 18	Standard Underground Cable Co. of Canada 9		
	Jones & Glasco 15			
D		T		U
Dept. of Mines Co. Canada 19		Tyrrell, J. B. 17		
Deloro Mining & Reduction Co. ... 20				
De Pencier, H. P. 17		University of Toronto 9		
Diamond Drill Contracting Co. 14				

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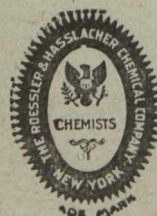
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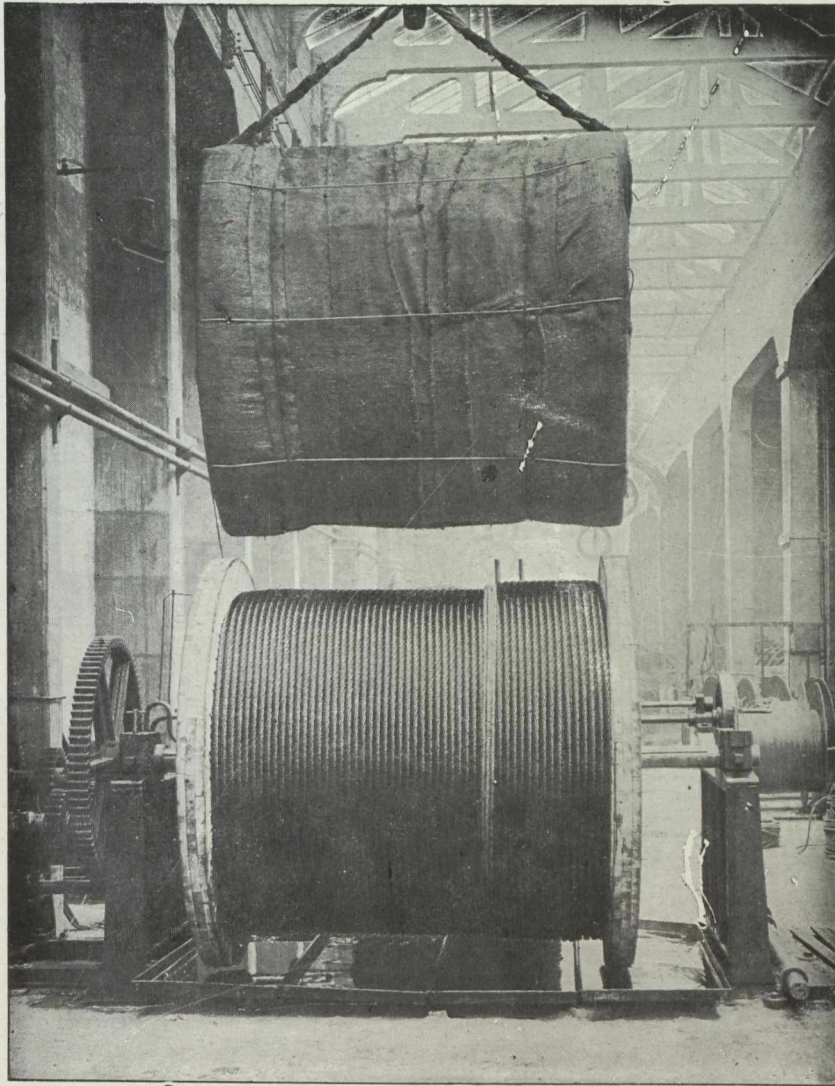
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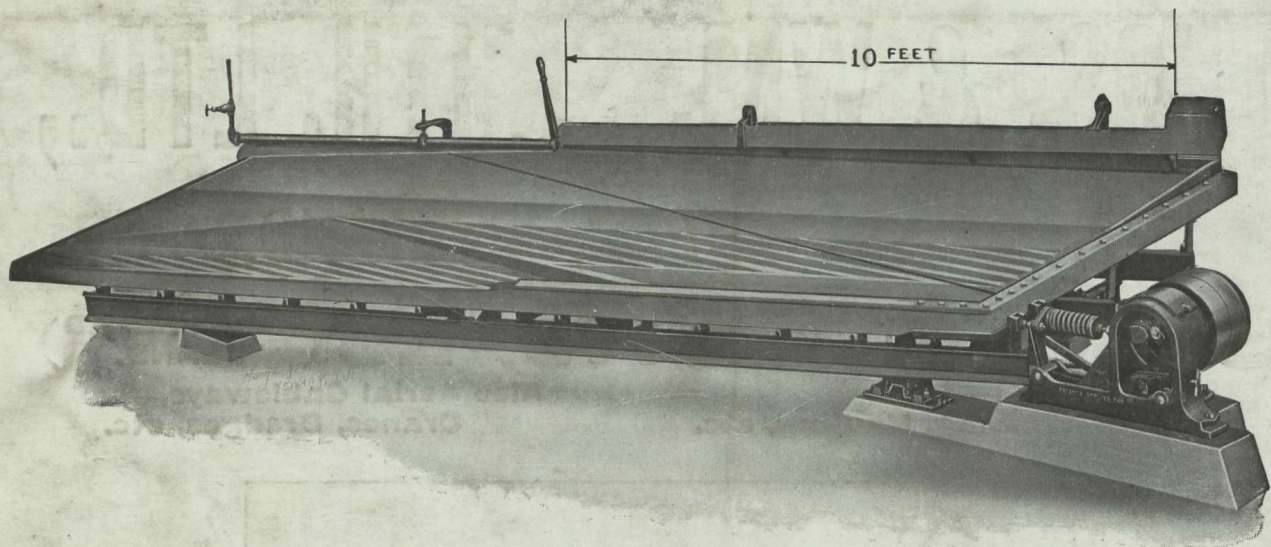
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