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CONTENTS.

THE WAR AND ITS EFFECTS ON MINING

Suddenly and all unexpectedly the States of Europe have plunged into deadly warfare.

Austria considering herself wronged by Servia made several demands upon the Serbs. Servia agreed to some of Austria's demands, but refused to comply with others. Thereupon Austria took steps to punish her little neighbor. As a result came protests from Russia. In turn Germany protested against Russian mobilization. Soon all four nations were at war.

Germany proved to be ready to strike immediately. Not only Russia, but France also was invaded. The neutrality of Luxemburg and Belgium was not respected, as the Germans wish to cross Belgium to invade Northern France. Belgium protested and drew upon herself the wrath of Emperor William.

While evidently willing to wage war on France and Russia and the little States which barred the way to France, Germany showed some desire to avoid declaring war on Great Britain. According to the announcement of Earl Grey, Germany promised not to attack the north shore of France if Great Britain would remain neutral. Naturally Great Britain declined to make such an agreement. The occupation of Belgium by the German troops proved that any such agreement would have been very unwise.

Great Britain protested against Germany's breaking of the treaty which provided for the neutrality of Belgium. Germany refused to be restricted by the terms of the treaty. And so we are at war.

The series of events has taken such a brief time that it is yet impossible to understand what it all means. Some things are clear. A disaster that is likely to prove the greatest in history is upon us. The lives of thousands of men will be lost on the field of battle. Thousands will be wounded. Millions will suffer from lack of food and other necessaries. These things will happen even if by some fortunate but unseen means the war is soon brought to an end. As long as the strife continues the waste goes on.

In the financial world all is uncertain. Fortunately prompt action stayed a panic which began with the announcement of war, and which was ruinous to many in the few days that the exchanges remained opened. We are assured that our leading bankers have the situation well in hand and that the governments of English-speaking countries will be able to handle the emergency which has arisen. It may prove that the financial stringency of the past year has done as much as anything to help trade during the coming months, by having placed financial institutions in a strong position.

That the war will interfere with mining operations is to be expected. So far, however, the indications are that comparatively few Canadian mines will be closed down in the near future. Gold mining should be one of the most attractive industries in these troublous times. The market for silver is somewhat uncertain and the price is likely to vary greatly. It is probable, however, that the companies will venture to increase their stocks somewhat while awaiting developments. There should be a good demand for nickel. Copper has shown the greatest weakness and many United States producers are cutting down their output to one-half. Much of the copper produced in Canada is obtained from ores containing nickel or gold. The market for these metals being good, there will likely be considerable copper produced. The market for asbestos, in spite of General Sherman's admonition that "War is Hell" has not been good since war was declared. As most of our asbestos goes to the United States the market will depend largely on the state of trade in that country. Coal will be necessary as in times of peace, and the coal mines will continue to make large outputs.

The buyers of silver are at present out of the market and say that the price must come down. On the other hand the producers claim that silver will be used for coinage and that the price will go up. It is to be hoped that the producers are right.

While there will be much demand for nickel the market for it is not sure to be a good one, owing to the difficulty of making deliveries of nickel steel from the United States. The Mond Nickel company which treats its matte in England is likely to be kept very busy, but the International Nickel Co. has discharged several men.

OIL COMPANY PROMOTIONS

The public has refused to be taken in by the promoters of Calgary oil companies. In Calgary the citizens have contributed enough money to test the fields. They will not, however, find the market for shares very good. The invasion of the East by stock salesmen has failed. The industry has therefore a chance to be developed on its merits.

While many organizers of companies are disappointed with the reception accorded their glowing advertisements, they have only themselves to blame. The field has yet to be proven and any attempt to raise money by claiming that success is certain deserved to fail. At the time of our visit to the field, about a month ago, oil had only been found in one well, and yet four hundred companies had been organized and trading was in progress on four stock exchanges.

In contrast with the excitement at Calgary the scenes at Okotoks were pleasing. There was evidence that some of the money raised is being used to explore the field. Car loads of oil well supplies were on the sidings and workmen were loading wagons to be drawn across the prairie. The citizens of Calgary may not be able to dispose of their shares at a profit to outsiders without proving their value; but they will themselves reap the benefit if oil is found in large quantities.

This is as it should be. A sufficiently large number have invested in an enterprise known to be venturesome. Further appeals for support should not be made until it has been shown that the money already raised is being wisely expended. Then appeals may be expected to be listened to.

A PROSPECTORS' HAND-BOOK

The Geological Survey of Canada has issued the first of what promises to be a very useful series of handbooks for the prospector. This is a neat little booklet of twenty-six pages containing notes on radium bearing minerals by Wyatt Malcolm. There has been recently a great demand for information concerning the radium ores and the booklet meets this want.

Mr. Malcolm describes the uranium minerals from which radium is derived and the tests by which they may be recognized. He gives brief descriptions of the more important occurrences of uranium minerals in Portugal, Colorado and Utah, U.S.A.; Cornwall, Eng., and Joachimsthal, Bohemia. The places in which radium-bearing minerals have been found in Canada are: Madoc, Ont.; Mamainse, Ont.; Maisonneuve, Que.; Murray Bay, Que.; Snowdon, Ont.; Villeneuve, Que., and Wakefield, Que.

Up to date no important deposit has been found in Canada. The little booklet may assist some one to discover radium. The enterprise of the Geological Survey is therefore to be commended.

UNIT CONSTRUCTION COSTS

A paper containing a great store of useful information for metallurgists has been prepared by Mr. E. Horton Jones for presentation at the Salt Lake meeting of the American Institute of Mining Engineers. The data derived from the building of the Arizona Copper company's smelter at Clifton, Arizona, is given in great detail. In Chapter I—Unit Costs, are to be found the most elementary total unit costs which the accounts provide for. In Chapter II—Comparative Costs—these elementary costs have been classified, averaged and reported as labor and material unit costs. In Chapter III—Composite Costs are given. They are unit costs built up from several elementary units, and likewise units of larger dimensions and simpler application, valuable for checking estimates and obtaining approximations of total costs. In Chapters IV, V and VI are given the Wage Scale Material Prices, and a description of the conditions surrounding the making of every elementary unit cost, which will enable the estimator to judge of their use under

any circumstance. These unit costs are actual ones made in a period of two years. The paper contains cost sheets of all phases of the work and scores of detail drawings.

It is very very seldom that a company gives out such information as is contained in Mr. Jones' paper. It is a good sign that there is now a greater tendency to make public such valuable data. In this respect the copper metallurgists have long been in advance of others. It is not a mere coincidence that such great progress has been made in the metallurgy of copper.

FOREIGN WORKMEN IN THE MINES

Many of the miners now in Canada and the United States are Europeans. In some mines a large proportion of the working force is made up of men who are natives of the European countries now at war. Many of these men have already been called home and others are subject to call. More or less disorganization of the working force is sure to follow.

Some of the miners are Austrians, Hungarians or Germans. Many of them are well pleased with conditions in America and out of sympathy with the military madness of Germany. They are displeased with the prospect of having to leave their profitable employment to answer the call of the war lord; but many will go back, if they can, believing it to be their duty. Naturally the Canadian Government will not facilitate the transportation of men who return to fight against Great Britain. It would be perhaps advisable to afford these workmen an opportunity of declaring whether or not they are willing to remain here as peaceable citizens.

There can be little doubt that among the workmen there are a few who are quite in sympathy with Germany's war plans and who will do what they can to damage property or otherwise harm the country. Against these it is well to be on guard. It is to be hoped that nothing will occur to prove that the precautions already taken by the government are necessary.

Many of the workmen are natives of countries which are allies of Great Britain. These men will be given every facility to return home if they wish to assist in the defence of their countries against German invasion. They should be given first consideration when men are wanted after the war is over.

The war crisis has brought out a number of fine examples of Canadian patriotism. Hamilton Gault has offered to raise a regiment of infantry to the extent of 1,000 men all of whom have seen active service previously. This regiment will likely be known as Gault's Light Infantry, just as at the time of the Boer war another regiment was known as Strathcona Horse.

YE MARINERS OF ENGLAND

Ye Mariners of England
That guard our native seas!
Whose flag has braved a thousand years,
The battle and the breeze!
Your glorious standard launch again
To match another foe;
And sweep through the deep,
While the stormy winds do blow!
While the battle rages loud and long!
And the stormy winds do blow.

The spirits of your fathers
Shall start from every wave—
For the deck it was their field of fame,
And Ocean was their grave:
Where Blake and mighty Nelson fell
Your manly hearts shall glow,
As ye sweep through the deep,
While the stormy winds do blow!
While the battle rages loud and long
And the stormy winds do blow.

Britannia needs no bulwarks,
No towers along the steep;
Her march is o'er the mountain-waves,
Her home is on the deep.
With thunders from her native oak
She quells the floods below,
As they roar on the shore,
When the stormy winds do blow!
When the battle rages loud and long,
And the stormy winds do blow.

The meteor flag of England
Shall yet terrific burn;
Till danger's troubled night depart
And the star of peace return.
Then, then, ye ocean-warriors!
Our song and feast shall flow
To the fame of your name,
When the storm has ceased to blow!
When the fiery fight is heard no more,
And the storm has ceased to blow.

—Thomas Campbell.

COPPER QUOTATIONS.

The refusal of the Engineering and Mining Journal to name copper quotations since the first of August has caused considerable comment and criticism among producers. Copper men cannot recall when such a step was taken before.

The Boston News Bureau knows of transactions in electrolytic during the past week at from 12¾ cents, delivered 30 days, down to 12½ cents cash. Transactions were also effected at 12⅝ cents cash, and 12⅝ cents, delivered 30 days.

The bulk of this business was done in car lots, but there were individual transactions calling for shipment of 500,000 pounds of copper. Delivery for the most part was for August and September, but some October sold at the higher prices.

Inquiry of the Engineering and Mining Journal as to the refusal of that publication to quote daily prices since Aug. 1 brought forth the reply that "retail lots have not been used by us in compiling averages for the past 15 years."

It was called to the attention of the Engineering and Mining Journal that all producers were not con-

sulted each week in the compilation of the averages in question, to which the reply was "We see only those producers who let us inspect their books."

Two of the selling agencies, the American Metal Co. and L. Vogelstein & Co., it is understood, transact much if not all of their business on the basis of the Engineering and Mining Journal averages. They take in copper from the mining companies at these figures.

THE U. S. BRASS INDUSTRY.

According to the Thirteenth Census, in 1909 there were in the United States 1,021 firms that dealt mainly in brass and bronze. This total included jobbing foundries, manufacturing plants that both cast and machine a brass or bronze product, and rolling mills, but did not include iron foundries having nonferrous departments nor the numerous large brass-foundry departments of manufacturing plants that produce the castings used in the manufacture of electrical apparatus, cash registers, pumps, and the thousands of machines that require brass castings for their construction. Penton's Foundry List for 1910 gives about 1,150 exclusively nonferrous foundries and about 2,300 iron or steel foundries that also melt brass. If the rolling mills and jobbing foundries in manufacturing plants be included, and if due credit be given to the rapid growth of the industry in the last few years, largely through the stimulation of the automobile business, it is probable that not less than 3,600 plants are to-day melting brass or bronze.

The plants vary in size from the small shop using only one small furnace and employing only one or two molders to vast concerns melting ten, twenty, or even fifty million pounds of copper alloys a year. The alloys employed and their uses are legion, and the castings produced vary from tiny pieces weighing only a fraction of an ounce, such as buckles, up to huge 10-ton propellers for ocean liners.

FULLER'S EARTH.

Fuller's earth is a variety of clay that has high capacity for adsorbing basic colors and can remove these colors from solution in animal, vegetable, or mineral oils, as well as from some other liquids, especially water. It is valuable when its adsorptive powers are strong enough to permit it to compete actively with fuller's earth already accepted as of standard quality for refining oils.

Anlyses of various samples of fuller's earth vary so greatly that chemical analyses are now well understood to be no criterion whatever in determining whether or not a particular clay shall be classified as a fuller's earth. Like all other clays, fuller's earth is a hydrous, aluminum silicate containing small proportions of other substances. Most fuller's earths contain a higher percentage of water of composition than most clays, but this water is not an essential factor in the bleaching properties of all fuller's earths; some bleach fully as well after it has been driven off as before, and others lose much of their bleaching power when this water is removed.

FELDSPAR.

According to F. J. Katz, of the U. S. Geological Survey, the marketed production of feldspar in the United States in 1913 was 120,955 short tons, valued at $776,551. Both in quantity and in value this was the largest recorded annual production. Each important producing state—California, Connecticut, Maine, Maryland, New York, North Carolina and Pennsylvania—showed an increase in both quantity and value. During the year about 50 quarries marketed feldspar. Ten of them were new producers. Notwithstanding the increase in quantity and the production from new sources the average price per ton of the total production was higher than in any other year. The average price per ton of the combined crude and ground output was about 25 cents more than in the best preceding year (1911). The prevailing prices f.o.b. quarries for crude material were about the same as in previous years, but the average price f.o.b. mills of ground feldspar was considerably higher (10 to 12.5 per cent.), than in recent years. The feldspar market appears therefore to have been unusually strong and to have consumed an increased production at a rising price. The year should have been a profitable one for the feldspar grinders.

THE SOLIDIFICATION OF METALS.

According to a report presented by Cecil B. Desch at the annual general meeting of the Institute of Metals, held in London on March 18th, 1914, the arrangement of crystal grains in a metal or alloy has usually been accounted for by growth of crystallites from independent centres. Against this, Quincke has proposed the hypothesis of foam-cells. On this view, the liquid separates, immediately before crystallizing, into two liquids, which arrange themselves to form a foam, and crystallization then takes place within the foam-cells. Quincke has applied the hypothesis to the explanation of many of the properties of metals. Several recent writers have also sought to connect the cellular structure with the prismatic partitioning of cooling liquids by convection currents. Whilst this arrangement may possibly be traced in some metals when cast in thin sheets, it cannot account for the structure of ingots or other large masses. The passage of metals in certain cases through an intermediate liquid-crystalline state has also been assumed, but not yet established. A review of the existing evidence suggests that several distinct cellular structures have often been confounded, and that a common origin has been assumed for structures which have a merely geomatrical similarity.

INTERNATIONAL NICKEL.

The International Nickel Co. has made considerable curtailment of working forces at its mines at Copper Cliff, Ont., and at its plant at Constable Hook. This is usually a dull season with the Nickel Co., but the war in Europe with the resultant tie-up of shipping has brought about unusual dullness.

Creusot steel works presented to the French government 26 complete batteries of 105-millimetre guns ordered by a foreign government just before the war. The company informed the government that it stood ready to pay indemnity. The gift represents a value of more than $3,000,000.

The United States treasury has ordered San Francisco mint to buy 200,000 ounces of silver at 51½ cents an ounce, hoping to partly relieve conditions as affected by European war.

METHODS OF WORKING A THIN COAL SEAM AT JOGGINS, NOVA SCOTIA

By C. H. McL. Burns.

Although the history of coal mining in the Joggins area of the Cumberland coal field, like that of Cape Breton, dates back to the first settlement of the country by the French, the development of this field has been insignificant when compared with the latter. This inactivity can be attributed to a number of causes; but there is no doubt but that the chief of these has been the difficulty of profitably mining the thin seams of this basin by ordinary methods.

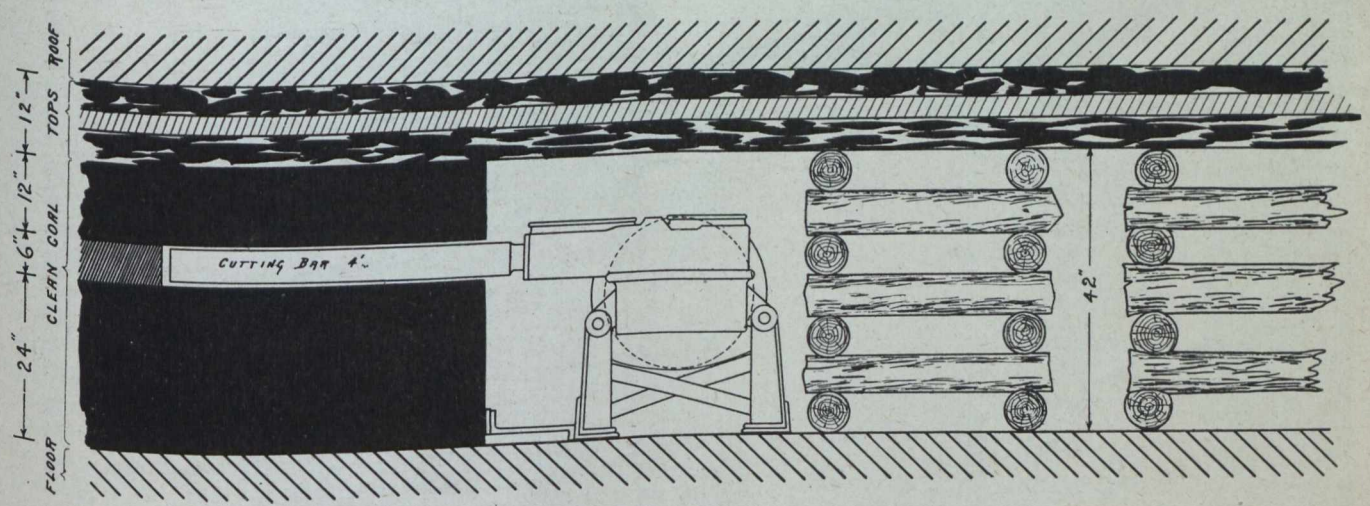
The Joggins area lies in the northwestern part of the country. The coal seams occur very regularly along the northern side of a synclinal basin of carboniferous measures for over twenty miles, showing on the shores of Cumberland basin a remarkable section in which between seventy and eighty seams are exposed. These are all comparatively thin, however, running from half an inch to five feet thick. Only about six can be considered workable. The six seams range from 30 in. to 5 ft. in thickness on the shore. Further inland two of these can sometimes be worked together, giving from 6 to 9 ft. of coal with a clay parting.

The first mining was carried on in the cliffs, and on the shore at Joggins; where the tide of the Bay of Fundy exposes the outcrops for nearly half a mile at low water. Later small pits were opened near the shore, but no attempt at systematic mining was made until the General Mining Association came into the field in 1827. During the Civil War in the United States, and in the years of reciprocity with that country, a number of small mines were opened on several of the seams at different Points. The loss of the United States market seems to have discouraged most of the operators. Since then, however, mining operations have been carried on at Joggins, River Hebert and Chignecto almost continuously. One company followed another with but indifferent success. None of the mining was deep. One slope after another was opened along the outcrop; long underground hauls making the cost of production prohibitive.

At Joggins practically all the openings have been on what is generally known as the "Joggins Main Seam." In Dawson's section of the shore he gives the thickness of this seam as follows: Coal 3 ft. 6 in., clay 1 ft. 6 in., coal 1 ft. 6 in. The outcrop on the shore was all worked out at this time, and the section must have been taken in one of the pits further east, where in places the clay thinned to six in. and the coal thickened to 6 ft. In the present mine, which is situated on the cliffs, the clay parting is nearly 20 ft. thick, and only the top seam is worked.

The coal dips south 25 deg., west 17 deg. The present slope is driven parallel to a fault 4,000 ft. to the eastward, and runs a little west of the line of dip, across the coal, giving the slope a pitch of 15 deg. 30 min., and keeping the east levels a uniform length.

The main slope, main hoisting slope and fan slope are parallel, with 50 ft. pillars between them. They

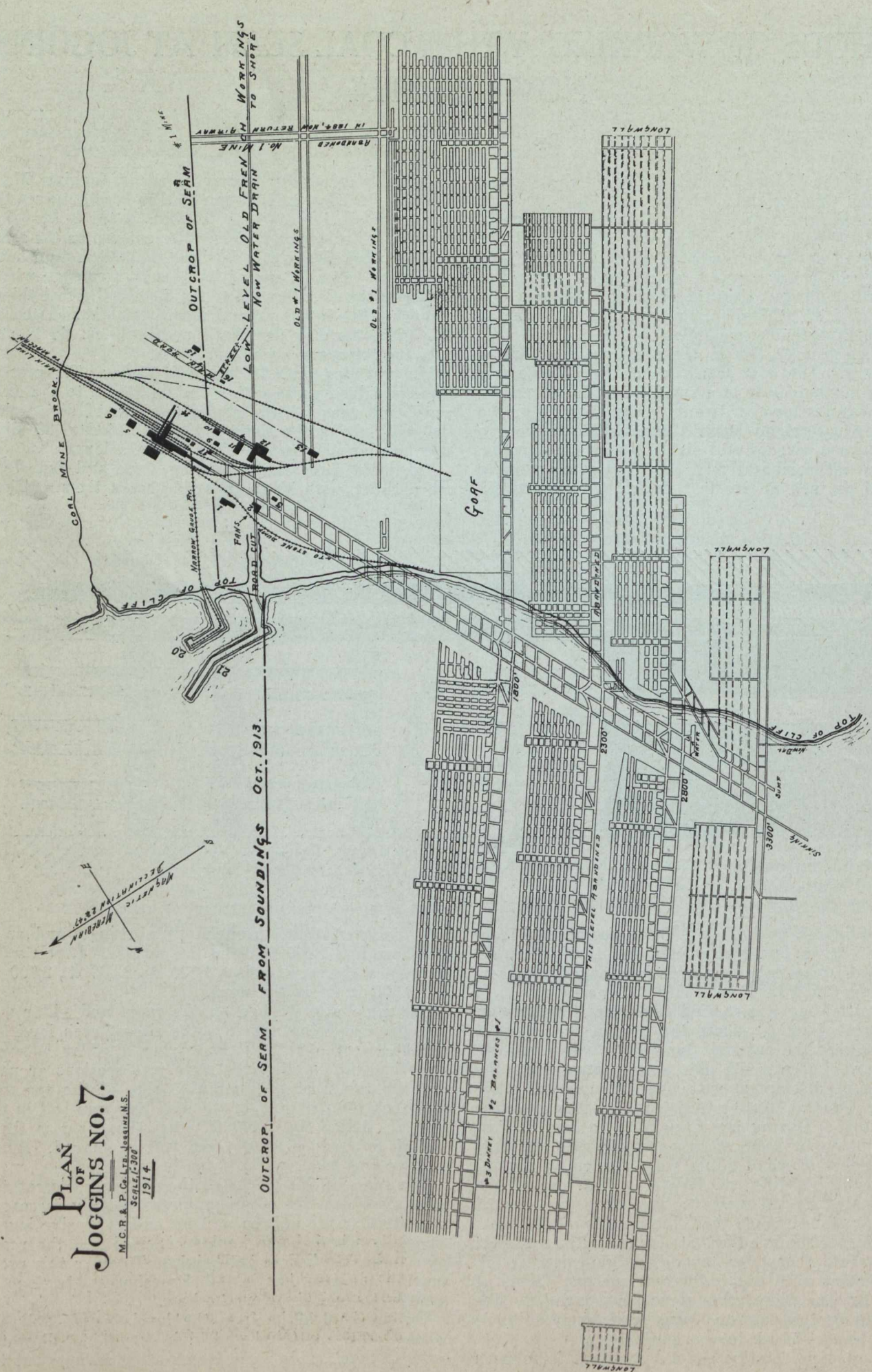


were driven 300 ft. through old workings, and cross the shore line 1,000 ft. from the surface. Levels were run east and west at points 1,800 ft., 2,300 ft., 2,800 ft. and 3,300 ft. down the slope.

The mine was worked on the room and pillar system, the coal being mined to the rise of each level for a distance of 400 ft., thus leaving a pillar between each lift and dividing the mine into sections or panels. On the west or submarine side of the two top lifts about 60 per cent. of the coal has been left in the pillars. Below the 2,300 ft. level the cover is thick enough to allow of all the coal being removed. Horse haulage was used on all of the levels.

In a seam of this thickness the distance between the main slope and the working places rapidly increases, necessitating the upkeep of long and expensive levels, especially where horse haulage is used and the roads have to be brushed to get height. To solve this problem the company has installed mechanical haulage in some levels and abandoned others.

For mechanical haulage the levels need only be brushed and kept timbered high enough to allow the boxes to pass. This alone means a big saving; but the



Plan of Joggins No. 7 Mine, Nova Scotia

greatest advantage is that the capacity of one road is so greatly increased that fewer are needed. So with the introduction of mechanical haulage on the 1,800 ft. level, the 2,300 ft. level was abandoned, and the coal is now worked from this lift by downhill heads from the 1,800 ft. level. These heads or "donkey balances," as they are called here, are kept about 400 ft. apart, and the coal is trammed from the face to the head by the loaders, where it is hoisted to the 1,800 ft. level with electric donkeys. The donkeys are 25 h.p. and handle about eight or nine boxes. This system has also been adopted on the 3,300 ft. level, and the slope will be sunk to the 4,300 ft. level before the next levels are broken off, making the lifts a thousand feet apart instead of 500, as formerly, with the coal worked to the rise and dip of each.

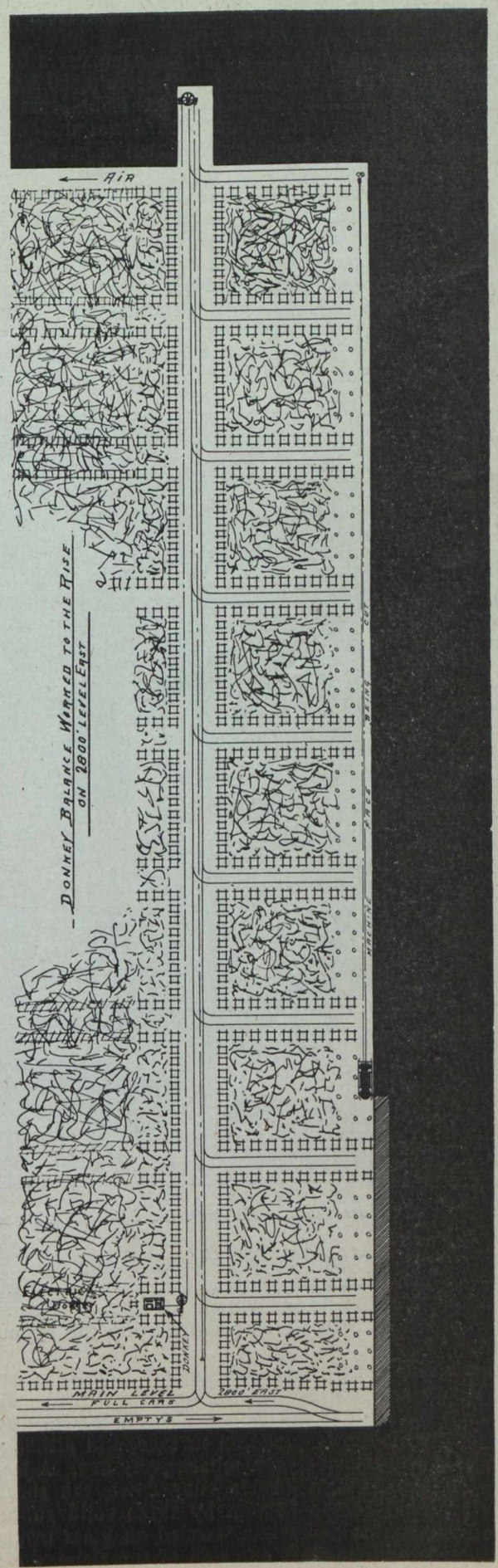
On levels which are comparatively straight, endless haulage has been adopted, and on others, where conditions are less favorable, main and tail is used. Both systems give good satisfaction; but the endless is probably the most satisfactory where it can be used. The rope runs continuously, but it can be stopped anywhere, signal wires running along the levels. Cars can be put on and taken off at any turnout without stopping the rope, and can be attached to the rope singly or in trips. Due to its continuous service a large capacity is maintained at a comparatively slow speed, thus saving both road and cars.

The 1,800 ft. and 2,300 ft. lifts are still worked room and pillar, but on the 2,800 ft. and 3,300 ft. lifts long-wall has been adopted. Mavor and Coulson electric bar machines are used. The first machine was started on the 2,800 ft. level east in 1911. There are four working at present, with two more ready as soon as places are available for them.

The machine starts at the level, or bottom bord of a downhill balance, and cuts uphill a distance of three hundred and fifty feet or three hundred feet, mining about one hundred and eighty tons of coal a shift. The accompanying sketch gives the general layout of a machine balance, which is practically the same whether worked to the rise or dip. The only difference is that, in working to the rise the electric hoisting donkey is placed at the bottom, and in working to the dip it is placed on the level above. This keeps the motor in the main airway. Bords or gateways lead from the balance to the face. They are about 30 ft. apart and are only brushed high enough to clear the boxes, removing the 1 ft. of top coal being sufficient in most cases. As the machine cuts up the face, butts are built at the bords and props set between, close to the face. The machines here overcut in a soft band of good coal. The tops are wedged down and the bench shot with bulldog powder and squibs.

The mine is not very gasy and is damp, requiring no sprinkling. Ventilation is supplied by a Capel fan, direct connected to a 95 h.p. electric motor and an auxiliary steam driven Sturtevent fan. The Main Haulage slope, Man slope and old Number One mine serve as return airways. This keeps these roads free from ice in winter. Thirty thousand cubic feet of air with a 2 in. water gauge is delivered per minute.

The main slope is equipped with endless haulage as far as the 3,300 ft. level, and has a capacity of 1,000 tons per eight hour day. The output a present runs from 500 to 750 tons. The rope is run by a slow speed tandem engine, 18 x 36. The coal is being hoisted at present from the sinking by a small electric hoist, but a 250 h.p. electric, endless haulage is being installed at



the 3,300 ft. level, and will handle the coal from here down as the mine is developed.

The power plant is situated at the company's Chignecto mine, 15 miles from Joggins. Here 2,800 h.p. is generated from culm burned under Robb-Mumford boilers. The boilers are fitted with Jones underfeed stokers and a forced draught. The coal is brought direct from the bank-head with a Jeffrey dick conveyor to the pockets over the fire doors. The feed water entering the boilers is at a temperature of about 121°F.

There are three units in the engine rooms. Two 500 kw. 11,000 volt generators, direct connected to Robb-Armstrong, vertical, inclosed, high speed, compound engines and one high pressure steam turbine driven generator of 1,000 kw. capacity.

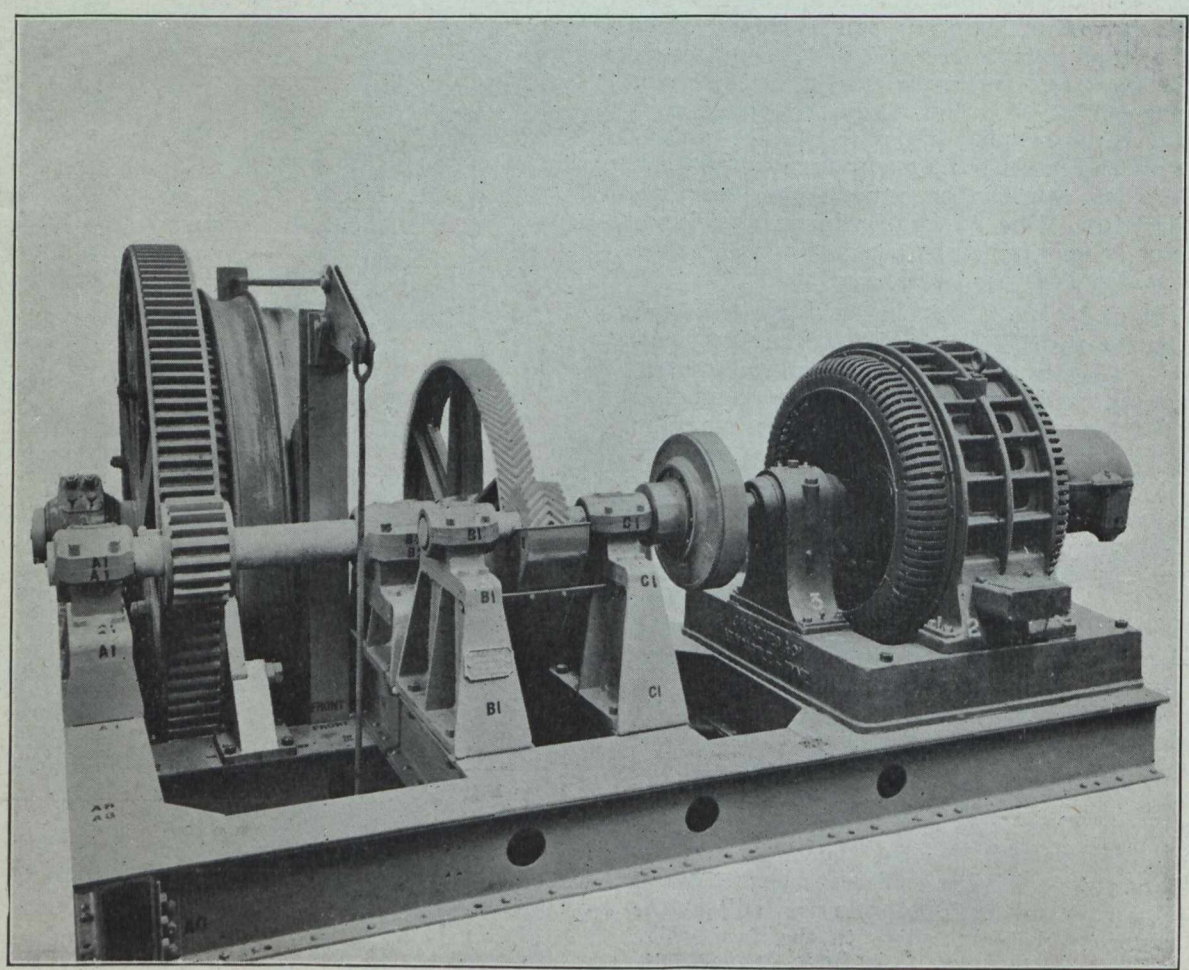
The current is transmitted to the sub-station in Joggins at 11,000 volts, where it is stepped down to 2,200 volts. The motors on the surface run at this voltage, and a line runs down the fan slope to a small sub-station at the 2,800 ft. level, where the voltage is again stepped down to 220 volts for distribution throughout the pit.

The air slope only comes within 300 ft. of the outcrop, where a water drain (the low level of the old workings) runs out to the shore. A shaft connects the slope here with the fans on the surface, and although the shaft is wet the slope is comparatively dry. A lead covered paper insulated cable runs down the shaft; but is replaced at the bottom by three solid rubber covered double braided wires, carried on glass insulators on two cross arms at one side of the slope, down to the sub-station at the 2,800 ft. level.

The transformers are oil cooled and have a much larger capacity than the peak load, and as the air here is always cold and direct from the fan slope there is very little risk from fire. The loss on a line 2,800 ft. long is considerable and as the mine is developed the high tension line will be carried down.

The main lines from here are carried in the haulage roads. Three rubber covered double braided stranded conductors, tied to glass insulators with tarred marlin, are carried on the props by ordinary side pins. The pins are nailed to the props and will readily pull off before the wire breaks in case of a fall. Leather and canvas suspenders and long wooden cleats were previously used; but none of these methods have proved as satisfactory here as the present one.

At each head or balance an armored cable laid along the roadbed leads from the main line to a gate-end switch, usually situated in a bord about half way up the balance, and from here the trailing cable leads to the machine at the face.



New Endless Haulage for 3300 ft. Lift, to Operate on Main Slope Below 3300 ft. Level

Two direct coupled, motor driven turbine pumps are used in the sinking and pump to the 3,300 ft. level. The water is pumped from a lodgment here to one at the 1,800 ft. level by an electric pump of the same type with a capacity of 100 gal. per minute. A three throw ram pump of 125 gal. per minute handles the water from here to the surface.

The pump and endless haulage motors are of the short circuited rotor type. On the hoists, coal cutters and main and tail haulage, where a variable speed is

required, machines with the wound rotor and slip rings are used.

Electric lights are used on the main slope, at the landings of the balances and in the pump and hoisting motor houses.

The electrification of this mine has placed it on a profitable basis, and will admit of a much larger development of the submarine areas than would otherwise have been possible. Although the machine coal costs almost as much at the face as that from the hand picks, the output is very much larger per man employed underground. The large output cuts down haulage costs and the machines save considerable office expense over hand picks with the same capacity, so that the coal is landed on bank at a greatly reduced cost per ton.

There is no doubt that where conditions are favorable the great flexibility of the equipment makes electricity the ideal power, especially in submarine workings where power will have to be transmitted long distances from the supply, and in thin seams such as this where cramped working conditions prevail.

MINING OPERATIONS IN QUEBEC, 1913.

The Department of Colonization, Mines and Fisheries of the Province of Quebec, has issued a report by Theo. C. Denis, Superintendent of Mines, on the mining operations, mineral production, and geological field work of the Province of Quebec during the calendar year 1913. A preliminary statement by Mr. Denis was given out in February, and published in the Canadian Mining Journal. The present report supersedes the preliminary statements, and gives final figures.

According to the revised report the value of the products of the mines and quarries of Quebec reached a total of $13,119,811 during the year 1913. It is the highest annual production recorded to date, and exceeds that of 1912 by $1,932,701. Since 1904 Quebec has shown an unbroken series of increases of each year over the preceding one. In ten years the mineral production of the province has been more than quadrupled. Compared with 1912 Quebec shows a higher proportional increase than any of the other provinces.

During 1913 no geologists were working at the regular field work, owing to the International Geological Congress then taking place in Canada. Late in the season Dr. J. A. Bancroft began an investigation of the copper deposits of Weedon and Stratford townships.

The report contains a statement on accidents in mines.

Under the heading of Mining Operations an account is given of the asbestos industry and the copper and sulphur ore industry. Dr. Bancroft presents a preliminary report on some copper deposits of the Eastern Townships. Notes are given on gold, silver, iron, chromite, graphite, lead, zinc, ochres, mica, kaolin and structural materials.

A useful feature of the report is a list of the principal mineral producers in the Province of Quebec.

A considerable proportion of the report is devoted to a description of the excursions of the International Geological Congress, and to geological descriptions of some of the areas visited on those excursions.

BUILDING AND ORNAMENTAL STONES OF THE MARITIME PROVINCES.

For some years Dr. W. A. Parks, of the University of Toronto, has been preparing for the Mines Branch, Ottawa, reports on the building and ornamental stones of Canada. Vol. 1 of this report, containing general information on the industry and an account of the building and ornamental stones of Ontario was published some time ago.

Vol. 2, building and ornamental stones of the Maritime Provinces, has just been issued by the Mines Branch. Like the preceding volume, it is well printed and well illustrated, containing several colored plates. In the preparation of this report, Dr. Parks visited about 60 quarries as well as a considerable number of abandoned quarries and prospects. While the report is not confined to quarries in actual operation, it makes no pretence of including every opening that has been made for the production of building stone. It is thought, however, that every important district is represented by a typical example, and that every stone commercially available at the present time has received due consideration.

The various stones are treated according to the class to which they belong, eg., granite, sandstone, etc., and according to the more or less geographical areas into which the quarries naturally fall. In order to give prominence to the economic and commercial aspect of the work, the quarries are described under the name of the owner wherever possible.

The general plan of description of individual properties is: quarry observations, description of stone, economic remarks and statistics, examples of the use of the stone. Following the description of the various areas there is inserted a short summary to which the general reader, not desirous of detailed information is referred.

Several maps accompany the report. These are designed to show the general geology of the region, but more particularly to point out the location of the important quarries.

THE PRE-CAMBRIAN GEOLOGY OF SOUTH-EASTERN ONTARIO.

The Ontario Bureau of Mines has issued a report by Dr. W. G. Miller and Cyril W. Knight, on the geology of a section of Ontario where several series of pre-Cambrian rocks occur.

Seven distinct areas were selected, which were considered to present the best conditions for the study of the characters and relation of the rocks. The areas lie in the counties of Peterboro, Hastings, Addington and Frontenac, within 30 or 40 miles of the north shore of the east half of Lake Ontario.

A geological map has been made of each of these seven areas. The maps range in scale from 800 ft. to one-half mile to the inch.

The region has received much attention from students of pre-Cambrian geology, and the recent work of Dr. Miller and Mr. Knight will be of interest to many who have endeavored to read the history of these old formations.

The conclusions arrived at by the authors are presented in the following summary:

"The chief results of our work are the following:

"1. It has been proved that rocks of Keewatin age, similar in character to those of northern Ontario and the Lake Superior region, occur in large volume in

southeastern Ontario. Heretofore it has been held by certain writers that Keewatin rocks do not occur here and that no basement for the Grenville sediments was to be found in this part of the Province. In some areas, rocks that in the past were called amphibolites, and were considered to be in whole or in part of sedimentary origin, are found to be more or less highly metamorphosed Keewatin lavas.

"2. The Grenville sediments have been classified and their relations determined. These sediments were deposited on the surface of the Keewatin lavas, and consist, normally, at the base of greywacke or quartzite, fine in grain, rusty schist (clay rock), and iron formation (banded chert or jaspilyte); the last named rock had not previously been recognized in southeastern Ontario. Although at times the sediments may be more or less mixed or interbedded, above those mentioned come crystalline limestone that is essentially magnesian, and finally crystalline limestone that is essentially non-magnesian. No unconformity has been observed within the Grenville.

"While it seems likely that eroism of part of the surface of the Keewatin preceded or accompanied the deposition of the Grenville sediments, an unconformity has not been proved to exist between the latter and the Keewatin lavas.

"It is also not unlikely that sedimentation and the outpouring of lava took place partly contemporaneously. Sediment, especially the finer fragmental material, from submarine lavas is difficult to distinguish, under conditions in which the Grenville rocks are now found, from land-derived sediment. It is believed by most authorities that clays and certain other materials in the deeper parts of the ocean are formed, by decomposition in sea water, from fragments of submarine lavas and from other inorganic material transported from a distance. If such sediments were submitted to the extreme metamorphism that the Grenville rocks have undergone, they would, in all probability, be indistinguishable from ordinary land-derived material.

"3. Granites of two ages have been recognized. The older of the two (Laurentian), which is gneissoid in character, intrudes both the Keewatin and the Grenville, but is older than certain pre-Cambrian conglomerates and other sediments of the region. The younger granite intrudes all the sediments. Granites of both ages are extensively developed, and, heretofore, they have not been differentiated as regards their age.

"4. Conglomerates and other pre-Cambrian fragmental sediments of the region were at one time grouped with the less highly metamorphosed, or blue, crystalline limestones, and the name Hastings was applied to them. We place most of the blue limestones in the Grenville and restrict the name Hastings to the conglomerates, with some limestones, and other sediments that we have proved to be post-Laurentian in age. The Hastings rocks, as here defined, have been found at various places across a strip of country sixty-five miles in length, from the township of Belmont in Peterborough county on the southwest to the township of Palmerston in Frontenac county on the northeast. On following pages reference is made to the views that have been held concerning the Hastings and Grenville series.

"5. Intrusives, later in age than the Hastings sediments, are represented by gabbro with extrusive facies (basalt and tuff), and granite.

"6. The crystalline limestones and other Grenville sediments in southeastern Ontario constitute a series of great thickness, and are found to be of pre-Laurentian age. The great volume of the sediments older than the Laurentian appears not to justify the separation of the Laurentian and earlier rocks from those of later pre-Cambrian age. In other words, a dual subdivision of the pre-Cambrian into an upper characteristically sedimentary group above the Laurentian and a lower igneous complex, including the Grenville, is not logical. Hence the writers do not make use of the terms Algonkian and Archean, or Proterozoic and Archeozoic, employed by many authors."

The conclusion of the authors that many of the rocks in this area are of the same age as the Keewatin rocks of northern Ontario and the Lake Superior region, should help geologists in comparing the geology of different pre-Cambrian areas in Ontario.

Apparently the very thick Grenville sediments occupy a position similar to that of some of the sedimentary rocks found with Keewatin lavas in northern Ontario.

GRANBY.

Granby Consolidated Mining, Smelting & Power Co. will put into effect a drastic curtailment of production. This, in brief, will probably result in the cessation of operations at the old mine and smelter at Phoenix.

Efforts of the mine management will concentrate temporarily on operations at Anyox where the new Hidden Creek smelter has been in operation since the middle of last March.

Word has already been sent to the mine by the New York management to wire quickly the status of conditions and outlook for the immediate future. Upon receipt of reply in the East the old property will close its plant.

Insufficient labor and current copper market conditions led the directors to take the steps noted. Hungarians and Austrians constituted a large part of the working force, and with the outbreak of war hostilities they made preparations to go back to Europe.

The result was that the working force was reduced to a number that could run only one plant, and it was decided to keep the new smelter at Anyox in operation, as it could produce copper cheaper than could the Phoenix plant, and would, furthermore, give the mine management opportunity to tune the Hidden Creek furnaces up to capacity, grade and mixture of ores.

With copper metal below 13 cents, the Phoenix operations have not been showing much profit. The July cost is understood to have been reduced below 10 cents, but that was lower than usual.

On the other hand, the Anyox operations have been profitable almost since the first furnace blew in. At the moment all three furnaces are in operation at the new smelter, but capacity has not been reached.

June production of the old smelter was 1,757,560 lb. of copper, 36,452 oz. of silver and 3,431 oz. of gold.

Copper output of the two Granby plants has been as follows (lb.):

	Phoenix.	Anyox.	Total.
January	1,793,840	.....	1,793,840
February	1,661,212	.....	1,661,212
March	1,775,852	.....	1,775,852
April	1,692,102	440,767	2,132,869
May	1,669,334	773,960	2,443,294
June	1,757,560	949,035	2,706,595

No decision has yet been reached by the directors relative to the next dividend, but with the sudden disappearance of demand for copper and one half of its plant shut down, the board will have much to take into consideration before declaring another dividend.

IMPORTANCE OF BORE-HOLE RECORDS AND CAPPING OF GAS WELLS

By W. J. Dick.

Mining Engineer of the Commission of Conservation, Canada.

Accurate records of bore-holes made on Crown lands in Canada have never been kept. Abandoned gas and oil wells, as well as test wells, are never marked, and, in time, all knowledge of their situation is lost. With the single exception of Ontario, no province even requires that such wells should be plugged. As a result, such bore-holes become sources of serious danger to those who may be, at a later date, exploiting other minerals in their vicinity. At the same time, the Governments are neglecting a valuable means of obtaining information with respect to the geology of the country.

It is the purpose of this paper, therefore, to show the necessity that exists for filing with the Governments concerned all records of bore-holes made on Crown lands in Canada. While special mention is made of wells drilled in prospecting for natural gas and oil, nevertheless the same arguments hold good, to a greater or less extent, with regard to holes drilled for other purposes such as prospecting for coal, water, salt, etc.

In Manitoba, Saskatchewan, Alberta, the North-west Territories, and in the Railway Belt and Peace River Block in British Columbia, mining rights are under Federal control, while in the other provinces they are subject to Provincial regulations. In Ontario, ample statutory provision is made to guard against the waste of natural gas and for the plugging of all abandoned wells, but no province requires the lessees of mining rights to file a record of the actual situation of bore-holes or logs of bore-holes showing the thickness and kind of formations passed through.

In the case of wells drilled for water, etc., for municipal purposes, it would be advisable for the Commission of Conservation to send a memorandum to all municipalities, pointing out the importance of obtaining the bore-hole records and advising them to require this information from the well-drillers as a part of the drilling contract.

For reasons, stated later, and on account of the activity in oil and gas prospecting in provinces in which mining rights are disposed of under Dominion regulations, it is necessary that provisions be made in those regulations covering the recommendations contained herein.

Federal Regulations for the Disposal of Petroleum and Natural Gas Rights.

The following is a brief resume of the more important provisions of the Dominion Regulations for the Disposal of Petroleum and Natural Gas Rights.*

1. The petroleum and natural gas rights, which are the property of the Crown, may be leased to applicants at a rental of twenty-five cents per acre for the first year, and fifty cents per acre for each subsequent year, the rental to be paid yearly in advance. The term of lease is twenty-one years, renewable for a further term of twenty-one years, provided the lessee can furnish satisfactory evidence to the Minister of the Interior to show that, during the term of the lease, he has complied fully with the conditions of such lease and with the provisions of the regulations in force from time to time during the currency of the lease.

2. The area leased shall not be greater than 1920 acres and the length of the tract shall not exceed three times its breadth. No person shall be permitted to acquire a greater area except by assignment; provided that a person who has been granted a lease for location, and who subsequently abandons or assigns the same may, after the expiration of twelve months from the date of the lease apply for an area not greater than that abandoned or assigned, provided further that such rights shall not be granted unless all payments on account of rent or other liability to the Crown have been fully made.

3. The petroleum and natural gas rights do not include the surface rights, but provision is made for the acquisition of whatever area of available surface rights the Minister of the Interior may consider necessary for the efficient and economical working of the rights granted.

4. No application for a lease shall be accepted or recorded unless accompanied by the full amount of the rental for the first year.

5. If during the term, the lessee shall fail to pay rental in advance for each subsequent year, within thirty days after the date upon which the same became due, the lease shall be subject to cancellation at the discretion of the Minister.

6. Provided, that if the lessee, in consideration of the expenditure to be incurred in actual boring operations, makes application, at or before the beginning of the second and third years, respectively, of the term of the lease, for an extension of time for the payment of rental, the Minister may grant such extension in writing; and if the lessee, before the end of the year in respect of which application was made, submits evidence to the Land Agent of the district that at least $2,000 has been spent on actual boring operations, the amount expended, exclusive of the cost of machinery and casing, may be deducted from the rental.

7. Within one year from the issuance of the lease, prospecting machinery of the value of at least $5,000 shall be installed.

8. Within fifteen months, the lessee shall commence boring operations and if he ceases to carry on the same for a period of more than three months, the lease shall be subject to cancellation. Provided, however, that if at least $2,000 has been expended in actual boring operations, such expenditure shall be accepted as compliance with this provision for the year during which such expenditure was incurred.

9. A lessee, who has acquired by assignment or otherwise more than one lease may be permitted to consolidate his operations and expenditure, and to install machinery and equipment on one or more of the locations described in the lease affected. Provided that such consolidation shall apply only to the second and third years of the term of the leases and shall comprise only such basis as may at that time, be included in such consolidation. The group shall not exceed an

*Order in Council, Jan. 19th, 1914.

area of 20 square miles, nor shall the locations be separated from one to the other by more than two miles.

10. The lessee shall at all times take reasonable measures to prevent the injurious access of water to the oil-bearing formations. Upon a well proving to be unproductive, or ceasing to yield oil in paying quantity, or being abandoned for any cause, the lessee shall be at liberty to withdraw the casing from the said well, but in order to prevent water gaining access to the oil-bearing formation, the lessee shall immediately close the well by filling it with sand, clay, or other material which may have the effect of preventing water from gaining access thereto.

In case natural gas is discovered the lessee shall take all reasonable and proper precautions to prevent the waste of gas, and his operations shall be so conducted as to enable him, immediately upon discovery, to control and prevent the escape of gas. Should salt water be encountered, the lessee shall immediately and effectively close the well at such a depth as may prevent such water from gaining access to the oil-bearing formation.

The Minister may, from time to time, make such additional regulations as may appear to be necessary or expedient, governing the manner in which boring operations shall be conducted, and the manner in which the wells shall be operated; failure on the part of the lessee to comply with such requirements will render the lease subject to cancellation.

11. No royalty shall be charged upon the sales of petroleum up to January 1st, 1930, but a royalty at such rate as may be specified by Order in Council may be levied on the natural gas products of a leasehold.

12. Any company acquiring leases shall at all times be and remain a British company, registered in Great Britain or Canada; the chairman, and a majority of the directors shall, at all times, be British subjects and the Company shall not at any time become, directly or indirectly, controlled by foreigners or by a foreign corporation.

13. The Minister may at any time, if considered necessary by the Government of Canada, assume absolute possession and control of any location, together with plant, equipment, etc.

14. If oil in paying quantities is discovered the lessee shall work the wells uninterruptedly in accordance with the provision of these regulations and to the satisfaction of the Minister so long as the wells yield oil in paying quantities.

15. At the end of each year of the term of the lease the lessee shall furnish a statement, supported by affidavit, showing the number of days during the year that operations were carried on upon the location; the number of men so employed; the character of the work done; the depth attained; the total expenditure incurred; a detailed statement setting out fully the purpose for which such expenditure was incurred; the quantity of crude oil or natural gas obtained; and the amount realized from the sale thereof. Failure to furnish such yearly return will render the lessee subject to a fine of ten dollars ($10.00) a day for each day's delay in furnishing the sworn statement, and after three months delay the lease shall be subject to cancellation.

The provisions of these regulations are such as to encourage prospecting for oil and gas and, to a certain extent, protect the rights of the people. Although the terms of the lease are very favorable to the lessee no provisions are made with regard to obtaining additional information from the lessee for the public good.

The following important provisions should be added to all boring regulations:

1. Exact locations of all bore-holes shall be filed with the Government.

2. Logs of all bore-holes, giving the kind and thickness of all formations passed through shall be filed with the Government.

3. All abandoned natural gas wells shall be plugged in a proper manner prior to abandonment.

4. A royalty shall be levied on natural gas, but subject to a rebate of all or part of the same if the gas is used.

Records of Bore-Hole Locations.

In order to establish the position of a bore-hole its situation should be referred to a permanent monument erected near the bore-hole. It is also desirable that the position of the monument be referred to a prior land survey or to some prominent landmark or topographical feature. This could be done at little additional cost to the lessee.

Records of all the holes drilled through coal formations in the West should be filed with the Government, in order to protect future coal mining operations. If holes are drilled through coal measures in order to reach the oil or gas zone below, and, after finding natural gas, the casing is withdrawn and the well abandoned, the gas "feeders" will be of great danger to future coal mining unless accurate records are kept. When one considers that one volume of methane mixed with seventeen volumes of air is inflammable, it can be seen that it requires but a small addition of natural gas to the mine air in order to make the mine unsafe.

Records of Bore-Hole Logs.

A well-driller generally keeps an accurate log of the hole drilled, showing the depth of the hole and the thickness and kind of formations passed through. In other words, the log gives a vertical section of the formation at that point. The information thus obtained, if filed with the Government, would prove to be of great value for the following reasons:

The Dominion Government is expending large sums of money in mapping the geology of the country, and the information thus obtained is largely areal. If the information contained in bore-hole logs were available it could be co-ordinated, and thus facilitate the working out of the stratigraphy, thereby promoting economy and efficiency. The co-ordinated information would not only materially assist the actual drillers in an oil or gas field, but would also be of value to companies contemplating drilling operations in a field that had been drilled before. If the information on file were adverse, it would save such companies much trouble and expense incident upon duplicating the work.

Records of bore-hole logs would also give the Government more information concerning the value of coal seams on public lands. As bore-holes in Western Canada are drilled on lands in which the mining rights are held by the Crown, it would not be too much to ask the drillers to furnish information which they already have and thus make it available for the public good.

Plugging of Abandoned Gas Wells.

In the past, enormous quantities of natural gas have been wasted both in Eastern and Western Canada. In a gas-field, a careless driller may either lose control of the well through carelessness or ignorance, and abandon it without plugging it. Not only is his own pro-

perty destroyed, but the surrounding area is also drained, thus injuring the entire community through the carelessness of a single individual. His acts thus become a matter of public concern and a proper field for legislative control.

The province of Ontario has reduced the waste of natural gas to a minimum, by causing all abandoned wells to be plugged and by levying a tax of two cents per thousand feet, with a rebate of 90 per cent. when the gas is used.

A natural gas well at Pelican Portage, Alberta, has been burning and wasting gas for the last fifteen years. Although there is, at present, no market for this gas, such a circumstance demonstrates the possibilities of waste under existing laws. No one can doubt that, in the near future, there will be an enormous market for this valuable mineral resource.

Royalty on Natural Gas.

A royalty should be levied on all natural gas obtained from an oil or gas well. The purpose being not to raise a revenue by such tax, but to guard against waste. All or part of the royalty should be refunded if the gas is used for other than wasteful purposes.

In Ontario, an Act was passed in 1907, levying a tax of two cents per thousand feet on natural gas with a rebate of ninety per cent. when the gas is used in Canada.

PROPOSED GENERAL STRIKE IN BRITISH COLUMBIA.

The following information concerning a "Special Convention of the British Columbia Federation of Labor," opened in Vancouver, B.C., on the morning of July 13, has been taken from lengthy reports published in a provincial labor newspaper.

Delegates from labor unions in every part of the Province assembled in the Labor Temple on Monday morning, in response to a call for a special convention by the executive of the Provincial Federation of Labor. More than sixty are representing unions in the cities of Victoria, New Westminster, and Vancouver, and forty others from Vancouver Island and interior points.

After the convention had been called to order, Mr. Robert Foster, of Cumberland, Vancouver Island, president of District 28 of the United Mine Workers of America, explained why the call for a special convention had been issued. He stated that the miners now on strike on Vancouver Island were primarily responsible for the call, as they were satisfied now that a change of policy was needed in the methods to be adopted to bring this strike and consequent troubles to a finish. Persuasion and pleading methods had utterly failed to produce anything approaching solution, so the miners desired to consult the members of other organizations in the Province with a view to taking some common action. Appealing to the convention in a general way for assistance, he indicated that what they were now looking for was not new laws, as they had been unable to enforce what they had, but as the workers comprised 80 per cent. of the voters of the Province that combined action should be taken at the ballot box, in order to ensure a satisfactory settlement. Concluding, he offered this as a possible remedy for existing conditions, and stated that in calling a special convention the object aimed at was to devise ways and means of taking joint action throughout the Province in this direction.

At the afternoon session the first speaker was Mr. Chris. Pattinson, ex-organizer of the United Mine Workers on Vancouver Island, and now editor of the Nanaimo "Labor Telegram." Emphasizing the incidents and lessons of the strike, he appealed to the representatives of the other organizations to note that if it was found to be possible to crush a section of the Canadian workers when they were backed by a powerful organization such as the United Mine Workers of America, then it was equally possible to do so with all others.

Mr. Frank Farrington, of Seattle, Washington, in response to calls from delegates, addressed the convention. After relating efforts made by miners on Vancouver Island to organize under an International Union and making statements against the Canadian Collieries Co. and the Dominion Minister of Labor, he said that the strike on Vancouver Island had to date cost the United Mine Workers $1,250,000; they had been disbursing a weekly amount averaging more than $16,500. This money, he asserted, "has been wrung from the sweat and small wages of men who need it almost as much as the miners to whom it has been paid, but it has been subscribed willingly and there is more where it came from." He bitterly referred to the administration of British Columbia laws in regard to mining, and particularly instanced the granting of 90 certificates at one sitting of the examination board to Chinese strikebreakers, and added "every one of which certificates was issued in direct violation of the Coal Mines Regulation Act."

(Note.—The assertion about 90 certificates having been issued to Chinese strikebreakers at one sitting of the examination board is a characteristic misstatement, of which prominent men among the strikers have several times been guilty.

The Chief Inspector of Mines assures us that the largest number of men who presented themselves for examination at any sitting of the board was 63. This official, availing himself of his right to do so, attended that meeting and declined to allow 13, who could not prove that they had worked 12 months in the mines, to be examined. Of the remaining 50 men, 14 failed to pass. The 36 who were given certificates of competency comprised 18 whites, 17 Chinese, and 1 Japanese, all of whom fully met the requirements of the Coal Mines Regulation Act. From Sept. 1, 1912, to date, only 93 Orientals have been given certificates of competency).

Discussion was continued at Tuesday's sessions, and on Wednesday morning a vote was taken on a substitute motion submitted by Delegate Pattinson which included the following: "That this convention advise labor in the Province of British Columbia to engage in a general strike, and further that four men be sent out to propogate the idea of a general strike, and on an educational tour." This motion was carried by 48 in favor to 36 against. About 20 delegates did not poll their votes, owing to absence from the convention or other reasons. An analysis of the published "roll call vote" gives the following results: New Westminster, 1 for and 5 against; Victoria, 7 for and 8 against; Vancouver, 14 for and 21 against (12 did not vote); Vancouver Island coal mining centres, 21 for and 1 (typographical union) against. Fernie, Crowsnest district, none for and 3 against. Several other centres, 5 for and none against. Of the 48 who voted in favor of a general strike, 22 were Vancouver Island delegates of the United Mine Workers of America, and four were delegates from Western Federation of Miners' unions in the metal mining districts of the interior of the Province. Of six delegates from Trades and Labor Council, two voted for and four against. Summarizing the result, it is seen that outside of the 26 delegates representing miners' labor unions, only 22 of more than 50 remaining delegates voted in favor of a general strike.

CAUSES AND PREVENTION OF TUNNEL ACCIDENTS*

By D. W. Brunton and J. A. Davis

(Continued from Last Issue)

Haulage.

A large proportion of the injuries attributed to tramming is caused by the practice of riding on the cars, especially loaded ones. When riding on the top of a full trip, a man is always in danger of a serious injury at every low place in the roof, and if he is riding between the cars (or any place but the rear end), he is liable to be jarred from his foothold and dragged under the cars, and in case of derailment he has little chance of escape. The risk of derailment is unavoidable in tunnel work, partly because of the insufficient illumination under which tramming is generally carried on, and partly because of the difficulty of keeping the roadbed in good condition or the track clear of small obstructions. Even when riding on empty cars there is serious risk whenever the miner sits on the ends or sides and allows his feet to hang over; the safest way is to sit inside of the car and to crouch low enough to avoid being struck by any jutting place in the roof. The arms and hands should be kept inside of the car to avoid the possibility of being caught between the car and the wall at a tight place. The driver or "mule skinner" is usually compelled to ride on a loaded trip and sometimes at the front end of the train in order to be near the animal he is driving; the extra hazard of this position should be fully realized and extra precautions taken. The dangerous practice observed on the part of some drivers, of riding with one foot on the bumper and the other on the chain by which the mule pulls the trip, is every obvious and can not be too strongly condemned. This act should be made sufficient cause for instant dismissal. It ought not to be necessary to mention the danger of attempting to jump on or off a moving trip of cars, because the chances in such a case of a man missing his footing and being caught or dragged under the cars, or of breaking an ankle or leg in the uncertain light, should be so clearly seen that no one ought to consider the risk worth taking; but the number of injuries arising from this cause shows only too well that this precaution is habitually disregarded.

Great care is necessary during the operation of placing a derailed car back upon the track. It is very easy for a miner to strain or otherwise injure himself if he attempts to do this without getting some one to assist him. Also in handling a derailed car that is full of rock there is danger of the block or crowbar slipping and allowing the car to drop suddenly on the miner's foot or hand, if indeed it does not topple over completely and crush him against the side of the tunnel.

Failure to allow sufficient room to a passing trip of cars is also a frequent source of injury. Before going into a strange tunnel the miner, if he is not accompanied by some one familiar with the tunnel, should always ascertain upon which side of the track there is the most room, and in meeting a passing trip should always give the animal pulling it all the space possible, so as to avoid being tramped on or kicked, or being caught between the cars and the walls of the tunnel. It is also advisable to hide any light when meeting a horse or mule, for there are some animals that are especially afraid of the high-powered acetylene lamps that are coming to be used almost entirely in tunnel work. If the animal balks when coming toward a light a serious mixup may occur, as the cars behind can not always be stopped at once. In a tunnel as on the surface, attention should always be given the heels of animals whether moving or at rest, and it is best to speak to animals when approaching them from behind, for many serious injuries have been caused by passing too close to nervous animals without warning. When turning a horse or mule around in a heading, the driver should watch carefully to see that he is not stepped on; inane as this advice sounds, many really serious accidents have resulted from just this simple cause.

Electricity.

An examination of reports of electrical accidents in tunnel work shows that in most cases the shocks were caused by the trolley wire. This is not surprising when one considers the many factors that unite to make an electrically charged wire especially dangerous underground. The earth is almost always used to complete the return circuit and, therefore, if the miner inadvertently touches any part of an electrical apparatus that is charged with current, and if he is not well insulated from the ground, he will certainly get a shock, the intensity of which will depend on the voltage or pressure of the electric current and the incompleteness of his insulation from the earth. Some trolley wires carrying a current as high as 600 volts have no insulating or protecting covering whatsoever and most of them are without a guard or shield of any sort, although they are sometimes placed less than a man's height from the floor and directly over the rail. Then, too, tunnels are generally damp or wet, so that a man is rarely well insulated from the ground. As the light at best is poor, one can not always see the wire as he approaches it, and the space is so restricted that a man walking in the tunnel must keep his head close to the wire when at the same time the most of his attention must needs be given to his footing. Moreover, in climbing into or riding in the cars, most of which in tunnel work are of metal and furnish excellent electrical connection with the rails, one's head must pass close to the live wire. The carrying of metal tools, such as crowbars or drill steel, also picks and shovels with wet wooden handles, is also the cause of many shocks through their accidental contact with the trolley, especially if such tools are carried on the shoulder. It is therefore important, when walking in a tunnel where a trolley wire is installed, constantly to bear its existence in mind and take every precaution to avoid contact with it either by hand, wet clothing, or tools.

In addition to the trolley wire there are in tunnel work other sources from which electrical shocks may be received. Wherever the heading is illuminated by electricity, the lights are usually grouped in a cluster and connected to the main circuit by means of a flexible cable, so that they can be removed easily to prevent breakage during blasting. The wires of the cable are, of course, insulated, but owing to rough usage the

*Extract from Bulletin 57, published by the U.S. Bureau of Mines.

insulation is often damaged or scraped off, leaving the bare wire exposed. Even a slight damage of the insulation is often sufficient to permit a considerable leakage of current from which a person handling the cable may receive a severe shock. Such wires are the more dangerous because, supposing them to be protected, one is more apt to handle them carelessly. The men who remove these wires preparatory to blasting and afterwards replace them or otherwise adjust them should examine them closely and not touch any place where the insulation has become damaged.

Shocks are also caused by motors, transformers, or other pieces of electrical equipment that are supposed to be safe but have accidentally become charged, and by switches and other similar devices during adjustment or repair. In handling apparatus of this sort a workman should carefully insulate or otherwise protect himself from the current and should try to handle the apparatus in such a manner that any involuntary muscular reaction from a shock will throw him clear of its live parts, rather than bring him more closely in contact with them. Although electric locomotives are usually in such perfect contact with the rails that a person touching any charged part of the frame will rarely receive a shock, there are times (as, for example, when there is a considerable amount of dirt or sand on the rails) when the locomotive is almost completely insulated from them; in such a case anyone coming in contact with a live part of the frame or of the drawbar, or even with one of the cars coupled to the locomotive, may receive a severe shock, which is apt to be all the more serious because it is unexpected. For this reason the touching of such equipment should be avoided unless actually necessary.

Mention should be made here of the immediate steps to be taken in case a man has received a severe electric shock and is perhaps lying unconscious and seemingly dead, for it is often possible by prompt treatment to revive and restore a man in this condition who might otherwise fail to recover consciousness. Methods recommended by the bureau are described in Miners' Circular.

Fire.

The chief danger from fire to the men in a tunnel is the possibility of the buildings at the surface becoming ignited. These structures are, of course, subject to the same causes of fire as ordinary buildings, such as the careless handling of matches or lights, spontaneous combustion of oily waste wherever it is allowed to accumulate, or the short-circuiting of electric wires, not to mention the risk of forest fires in heavily timbered regions. At a large majority of tunnels now being driven the blacksmith shop, the storeroom, the boiler house, and other buildings are situated much closer than the 200 ft. that should separate them from the tunnel portal, and in many districts, especially where the winter snowfall is heavy, they are directly connected with the tunnel by snowsheds constructed of wood. At such tunnels, also, means of exit other than the portal are seldom provided, so that in case of fire in these buildings men are penned up in the tunnel and in the customary absence of a fire door, are in serious danger of suffocation from the gases and smoke produced by the conflagration. It is therefore essential, and in some States it is required by law, that in all tunnels where combustible structures must be erected nearer to the portal than 200 ft. there should be a separate exit at least 200 ft. away, and that a fireproof door that can be closed from a distance should also be provided. A sufficient water supply should always be maintained to put out a fire, and hydrants with a coiled 1½ in. hose and a nozzle should be placed not less than 40 ft. and not more than 100 ft. from each building or group of buildings.

Most tunnels, except where timbered, are practically fireproof, and hence underground fires are not common in tunnel work. It is nevertheless important to guard against the dangers of underground fire. Whenever such fires do occur they usually start in some small way, either from candles or lamps being placed too near the posts or caps of a timber set, or from a match or the coals from a pipe thrown into a pile of rubbish, hay or other combustible material that may in turn ignite the timbering. Although such fires can usually be extinguished before any great damage has resulted, provided their presence is discovered soon enough and there are means at hand to extinguish them, it is much better to prevent the ignition by obviating causes. Therefore, combustible rubbish should not be allowed to accumulate in the tunnel, and any supply of hay for the use of the mules or horses underground should be carefully stored in a shed provided for that purpose, and open lights or smoking should not be permitted in its neighborhood. Candles or torches should never be left burning near timbers, and the practice of wedging a lighted candle between two nails driven into a post should be sufficient cause for the instant dismissal of the guilty person.

Water.

Water under pressure is another source of danger in tunnel work. Men may be hurt in jumping back to avoid the rocks and other debris often carried with it, or perhaps buried under an accompanying rush of mud and sand. A good example of this may be found in the records of a foreign railway tunnel, where a cleft filled with water, sand and gravel was encountered and the ensuing sudden and violent imburst filled up more than a mile of the tunnel in a very few minutes, burying 25 workmen beyond all hope of recovery. A somewhat similar occurrence in one of our American tunnels was likewise due to water. The tunnel caved in at a point about 4,000 ft. from the heading, but the men working there were warned in time to escape, although they had barely reached safety before the tunnel became entirely closed. When this happened the mass of muck, composed chiefly of soft clay and running shale impervious to water, formed a dam that cut off from the main part of the tunnel the flow of approximately 2,700 gallons per minute. As soon as the part of the tunnel between the cave and the heading became filled with water, the full pressure of the head in the mountain over the tunnel was exerted against the dam, forcing it down the tunnel until the pressure was relieved. The additional length of the debris then offered greater resistance, and it remained stationary until the pressure had again accumulated enough to move it. This process was repeated until 440 ft. of tunnel had been filled. Several attempts were made at first to relieve the pressure by inserting a section of ventilating pipe at the top of the dam; but after several men had narrowly escaped being buried by the rush of mud as the dam moved forward this scheme was abandoned and the tunnel was sealed up by a concrete bulkhead, the men being protected by a temporary bulkhead of wood during the construction of the permanent one.

In driving through limestone and dolomite it is not unusual for a tunnel heading to tap immense caves filled with water, mud and sand. The volume of the fluid mass flowing into the tunnel is determined by the size of the opening, and its velocity is proportion-

ate to the head. Under the pressure of a head of 300 or 400 ft. the cutting action of the rock particles and sand carried by the water soon enlarges even a drill hole to a size that permits the filling up of the heading in an incredibly short time. When a round of shots breaks into a cave of this kind, the heading and perhaps the completed tunnel for a distance of hundreds and even thousands of feet back from the face may be filled so fast that the escape of the workmen is impossible if they are at the face. Fortunately, however, during shot firing, the time of the greatest danger, the men are always out of the heading.

When an underground cave or reservoir filled with water, mud, sand and loose rock is tapped in a tunnel heading, one of two things occurs; generally the cave or reservoir empties itself completely into the tunnel and, after the flow is over, the solid matter that the flood leaves behind can easily be shovelled up and hauled out. Sometimes, however, the volume of solids is so great that the tunnel is completely choked before the reservoir is emptied. In these cases, when the flow of water ceases, the men are usually set to work cleaning up the material with which the tunnel has been filled, but when this cleaning process advances sufficiently to weaken the dam that holds back the flood a new outburst occurs and, because the passageways have already been opened, the second outbreak is often more violent and dangerous than the first. If this operation were repeated often enough, the cave or reservoir would, of course, be drained and the heading be regained, but in many instances the operation of attempting to regain the heading has been found so dangerous that it has been abandoned and a curved tunnel has been bored to pass around the danger point.

In the dolomite in the Cowenhoven Tunnel, at Aspen, caves of this kind filled with water and dolomite sand were frequently encountered. It was no uncommon thing after a round of shots to have the tunnel completely filled for hundreds of feet back from the face. As soon as the water from the cave that had been tapped drained off, the mud and sand were easily loaded and work in the face was resumed.

An immense cave was tapped by a drill hole in a long crosscut that was being driven from the tunnel to the Della S. mine. The drill hole, under the pressure and cutting action already described, enlarged so rapidly that the men fled from the face, and a few seconds after the opening must have enlarged to a size that permitted the filling of the tunnel with such rapidity that the tunnel cars were hurled back and flattened against the posts. Several unsuccessful attempts were made to regain the face, which finally had to be bulk-headed and the tunnel run around it, as at the Simplon tunnel in Switzerland.

Numerous caves were encountered in the 1,200 ft. level of the Free Silver mine, which was also run through dolomite; but, fortunately, although they must have extended to great heights, their horizontal cross section was very much less than that of the caves 1,200 ft. above. When these reservoirs were tapped with a drill hole, the water would spout out with such velocity that it was impossible to stay in the face, and in a short time the opening would be worn to a size which sometimes increased the amount of water to be handled by the pumps to 3,000 and even 4,000 gallons per minute. At first the noise from the inrushing volume of water was exceedingly terrifying to the men, but in a short time whenever a cave of this kind was tapped the men simply joined hands to assist each other in maintaining their footing and waded back with the torrent as they would do in crossing an extremely rapid stream. Many narrow escapes occurred, but, due to the precautions taken by the management and workmen, no serious accidents occurred during any of these inrushes.

Intoxication.

Although few accidents in tunnel work are traced directly to intoxication of employees, the extent to which it contributes to many mishaps that are attributed to other causes is perhaps too little appreciated. The fact that a man who has put an "enemy into his mouth to steal away his brains" is then much more liable to be careless or negligent of his own safety and the lives of the men around him is so true as to be almost axiomatic. Even a slight amount of intoxication, which might be allowable if the work was to be done on the surface, is dangerous under ground, where it is very apt to be aggravated greatly either by the lack of fresh air or by the heat, neither of which is unusual in tunnel headings. Therefore it is essential that a man in such a condition should not be permitted under ground and, if discovered there, should immediately be sent out of the tunnel by the foreman. Repeated offences should result automatically in dismissal.

Prevention of Accidents.

In discussing the prevention of accidents in tunnel work, little is to be gained by arguing whether the manager, the foreman, or the miner is solely to blame for their occurrence. The greater responsibility lying, as ever, with those who have the broader vision, the manager or the superintendent is in duty bound to see that the place where the men are to work shall be made as safe as possible and to insist that they themselves exercise the greatest care and caution in conducting their work. Upon the foreman falls the responsibility of carrying out the manager's orders, of seeing that the men are instructed in the proper precautions to be taken, and that they are constantly and consistently exercised, and, if necessary, of discharging either temporarily or permanently any man who wilfully or habitually disregards them. As for the miner, whose business is shown by statistics to be a hazardous one at best, it is only through the most extreme care on the part of each man, not only for his own welfare, but for the safety of his co-workers, that he can hope to escape from the dangers that surround him. Each one, therefore, has his share of the responsibility, and it is only by co-operation between all parties concerned that any progress can be made toward the prevention and reduction of the fatalities and the injuries now encountered in tunnel driving. As it is impossible to reiterate too often the methods of obviating accidents, the following paragraphs are addressed directly to the parties most concerned, in the hope of bringing home to them once more some of the more important preventive measures.

Precautions for the Manager or Superintendent.

Insist that necessary timbering be done promptly, and always keep an adequate supply of lumber at hand so that no delay may ensue from the lack of it. See that the minimum quantity of explosive is used (in order to prevent unnecessary shattering of roof and walls) and inaugurate a systematic and regular examination of the roof to insure the timbering of loose pieces at once. Have all bent or breaking posts or caps promptly replaced by new ones.

Provide suitable magazines and thaw houses for explosives.

Do not permit any disregard of the proper precautions as to handling, storing and using explosives, and see that each man is provided with a copy of such precautions. Do not permit the transportation of detonators or primers to the heading in the same bundle with the remaining supply of explosive for the blast. Have careful tests of the burning rate of the fuse made periodically, especially when a different brand of fuse is purchased, and warn the men of any discovered irregularity. Destroy any damaged fuse at once. Do not store fuse near any source of heat. Prohibit the reloading of a bore hole before it has had time to cool from a previous blast. Give the man who makes the primers the necessary equipment and tools and have him carefully taught how to prepare and waterproof the primers.

Do not purchase caps weaker than 5X for use with gelatin dynamite. See that the proper precautions are taken whenever a missed hole or evidences of one are discovered.

Institute a regular and frequent inspection of the valves on the air compressor and insist that any defective valve be promptly and properly repaired even at the cost of a possible shutdown, that there may be no explosion of gas or burning of grease in the receiver or pipe line to produce harmful gases and jeopardize the safety of the men at the heading. Do not delay the installation of adequate auxiliary ventilating equipment when natural accumulations of harmful gases are encountered in the tunnel, particularly when such gases are of an explosive nature. When explosive gases are present, none but safety lamps or their equivalent should be permitted under ground.

Prohibit the men from riding on loaded trips, and, whenever possible, provide special cars for their use, either propelled by hand or drawn by a motor. Do not permit the men to jump on or off moving cars, nor the drivers to "ride the chain." Tell all new men the proper side of the tunnel to take when meeting a trip, and caution them to shield any bright light when so doing.

If there is a trolley wire or other electrical apparatus in the tunnel, caution the men against its danger, and do not allow them to carry tools on their shoulders when passing in or out. See that the cable or wires leading to any temporary or movable cluster of lights in the heading is kept in good repair. Instruct the men, especially the foremen, as to the proper methods of resuscitation in a case of electric shock.

Prohibit the accumulation of combustible rubbish any place in the vicinity of buildings or timbering and see that the supply of hay is properly confined to prevent danger from fire. Unless absolutely necessary, do not construct any wooden buildings nearer than 200 ft. to the mouth of the tunnel. If wooden buildings must be built near the mouth, provide a separate exit from the tunnel at least 200 ft. away, with a fire door that is arranged to be closed from a distance. In either event, provide an adequate water supply, with hydrants and hoses, at suitable distances from the several buildings.

Exercise great precaution when driving toward a place where a flow of water is likely to be encountered that might carry with it a rush of mud, sand, gravel or other debris, and take immediate steps for the safety of the men as soon as such a flow is struck.

Prohibit the drinking of intoxicating liquors on property controlled by the tunnel company and institute a system of inspection to prevent any intoxicated man from working in the tunnel, discharging habitual offenders against this rule.

Precautions for the Foreman.

Insist that the least amount of dynamite required for loading "back" holes shall be used. Do not return to the face after blasting nor permit the men to return without first examining the new roof. Upon arriving at the heading immediately detail as many men as may be required to clean the roof before attempting any other work under it. When passing in or out of the tunnel never fail to inspect the roof, testing any doubtful piece for possible vibration. See that any loose piece of rock is either pulled down at once or properly supported, and never take any chances by postponing the work of timbering no matter how pressing other matters may be, because a few minutes' delay in timbering may cost several lives. Have any timbers showing the effects of too great pressure relieved properly as soon as they begin to fail. When timbering is necessary close to the face, see that the front sets are thoroughly braced and blocked before firing. When the roof "breaks high" fill the space between the lagging and the roof with broken rock or blocking to prevent a large rock from crashing through the lagging upon the men beneath.

See that the men read the precautions to be taken in handling explosives, or have a copy read to them. Do not permit any instance of careless or reckless handling of explosives to go unchallenged and do not fail to discharge men for the first grave offence of this character. Never permit a man to handle dynamite recklessly, either for the purpose of scaring someone or for any other reason. See that the detonators and primers are transported to the heading in boxes separate from the rest of the supply and that they are not placed side by side after arriving. Insist that proper care be used in loading holes and that the tamping be done by pressure rather than by impact. Never allow anything but wooden bars to be used for this purpose. Do not permit a bore hole to be loaded before it has had sufficient time to cool completely from the previous blast.

Warn the men of any change in the rate of burning of fuse. See that they do not mutilate the fuse by rough handling and that they do not crack or break it by placing the primer in the hole fuse end first, or by uncoiling the fuse roughly in cold weather. Do not use fuse that has been stored or kept near a boiler, steam pipe, or other source of heat, or that has been exposed to moisture. See that the fuse is properly coiled close to the hole before blasting, in order that it may not be torn out by the blasts in a nearby hole. Instruct the men as to the proper way to prepare a primer. See that the fuse is cut squarely; that an inch or so of it is discarded; that the grains of powder do not leak out of the end that is inserted into the detonator; that the crimping is done carefully with the proper tool; that the detonator is not buried too deeply in the dynamite; and that caps of sufficient strength are used.

Always count the holes as they are blasted and never fail to inspect the new face for evidences of missed holes. See that any such are detonated properly as soon as they are discovered, even at the possible cost of some delay. Insist that the shovelers use their picks properly when picking down the muck pile. Keep a close watch for any unexploded dynamite in the muck and have the men do likewise. When such

is found remove it carefully to a place of safety and be particularly cautious when a piece of fuse accompanies it. Never start a new hole in the remains of one that has ever held dynamite.

When the presence of any amount of dangerous gases, either from explosives or from natural sources, is suspected see that the men are supplied with fresh air, either by opening the compressed air line or by breaking into the ventilating pipe, if the current is in the right direction. Do not knowingly remain or permit the men to remain in any atmosphere that will not support a candle flame, because there is no way to determine how bad it may be after the light becomes extinguished. See that the men do not use anything but safety lamps, or their equivalent, in tunnels where explosive gases are encountered, and do not permit any matches or other means of striking an open light to be carried into such a tunnel.

Have the track and roadbed kept in as good condition as possible in order to lessen the risk of derailments. Do not permit men to ride upon loaded trains unless it is absolutely necessary, and in such cases warn them carefully as to the risk being taken. Insist that the men riding in an empty car keep their feet and hands inside the car and that they watch carefully for low places in the roof. Never fail to discharge any driver caught "riding the chain." See that the men give an approaching train of cars plenty of room, and if animals are used to draw the cars see that the men hide their lights when the animals approach.

Warn the men of the danger from the trolley wire. Familiarize yourself with the proper means of resuscitation after an electrical shock. See that the men are not permitted to carry on their shoulders tools or other instruments that are conductors of electricity. Inspect regularly any cables or wires used for carrying electricity to lights in the heading, or any others that have to be moved frequently, and see that all worn parts are covered with insulating material or replaced if necessary. Do not permit the men to ride on electric locomotives.

See that no piles of combustible rubbish are allowed to accumulate underground, and do not permit the use of candles or torches in the vicinity of hay or other inflammable substances. Do not fail to discharge any men guilty of leaving candles or torches burning near timbers, especially when a candle is wedged between two nails driven into a post.

Exercise special precautions when approaching a place where an inrush of water is to be expected.

Be particularly cautious about drunkenness. Note the men when coming on shift and do not permit a man even slightly intoxicated to go underground. If such a man is discovered in the tunnel send him to the surface at once. Discharge those who are habitual offenders in this respect.

Precautions for the Miners.

Do not return to the face of the tunnel without testing the newly exposed roof for loose rocks, and, if any such are discovered, either clean them down yourself or report them to the foreman. Form the habit of carefully examining the roof as you pass in and out of the tunnel, testing doubtful places for vibration; call the foreman's attention at once to any ground that you think should be timbered or to any timbers that need relieving to prevent their breaking.

If you are called upon to use dynamite, do so with great care, observing the precautions outlined in previous paragraphs. Never attempt to scare anyone by reckless handling of explosives and never treat dynamite with roughness. Never place or carry detonators or primers and the rest of the supply of dynamite for the round in the same box or bundle. If it is your duty to assist in the loading of the holes, do this with care, using pressure rather than a blow to tamp the powder in the hole, and be careful never to use too much force in pushing it.

Inquire as to the rate at which the fuse burns, especially when a new brand is being tried, and see that the fuse is cut long enough to give you and your companions time to reach a place of safety. Protect the fuse from mechanical injury, such as scraping, blows, or too great pressure either from falling rocks or from the tamping bar; never use a fuse that has been thus damaged. Never reload a bore hole before it has had time to cool. Do not use fuse that you know has been stored near a boiler, steam pipes, or other source of heat or one that has been exposed to moisture. If you prepare the primer, see that an inch or so is cut squarely from the end of the fuse before it is put into the detonator; that no powder runs out of the end of the fuse during this process, and that the detonator is properly crimped round the fuse. Under no circumstances use anything but the regular crimping tool for this purpose.

Always inspect each new face for evidences of a misfire, and, if one is discovered, call the foreman's attention to it immediately, so that he may have it detonated. Never attempt to pick out the material in such a hole; either explode it with a primer, or, if this can not be done, drill and fire another hole at least 2 feet away. Use great care in removing any unexploaded dynamite from the muck pile, and be especially cautious if a piece of fuse is discovered near it, for this may mean that there still is a detonator in the cartridge. Never handle a pick like a sledge hammer; pull or scrape the material down rather than strike it with the pick. Do not start a new hole in the remnants of a former one that has ever held dynamite, for there is always a chance that the dynamite may not have been detonated.

Whenever you feel that you are inhaling fumes from dynamite that has burned, or any other harmful gases, try to get to fresh air as soon as possible; the quickest way to do this is often to open the compressed-air line, or to break the ventilating pipe, if you know that the current is in the right direction. Never use anything but a safety lamp or a portable electric lamp in a tunnel where explosive gases ar known to exist, and do not carry any other means of striking a light into such a tunnel.

Never attempt to ride upon a full car or a loaded trip; and when riding in empty ones see that your feet and hands are well inside and that your head is low enough to clear the roof at all places. Learn which side of the tunnel has the most room, and when a trip of cars approaches allow yourself as much clearance as possible. If the trip is drawn by an animal, hide any bright light you may be carrying. If it is your duty to drive a horse or mule or to run a locomotive, try to do everything possible to prevent derailments; report any places where the track or roadbed is in bad condition. Remember that the front end of the trip is the most dangerous place you can stand, so that if this is necessary you must take extra care; never under any circumstances ride with one foot on the chain by which the cars are being pulled. Take care that the animal does not step on you or kick you, and speak to him before approaching him from the rear. In placing a derailed loaded car back upon the rails, take care not to strain or otherwise injure yourself in so doing; keep your feet and hands in a safe position, and see that the car does

not topple over and crush you against the sides of the tunnel.

Bear constantly in mind that the trolley wire is dangerous and that you must pass within a few inches of it when going in and out of the tunnel, often when your attention must be given to your footing. This danger should be especially avoided when climbing into cars. When you are in a tunnel where there is a trolley wire never carry tools, drill steel, or anything else that is metal or wet on your shoulders. Do not handle any electrical equipment unnecessarily nor ride on electric locomotives. Never cause anyone to receive an electric shock; it is never possible to foretell its results. If it is your duty to repair electrical apparatus, see that you are properly insulated, or that the current is cut off and can not be turned on without your knowledge; keep your hands and body in such a position that a recoil from an accidental shock will throw you clear of any charged part of the apparatus. In removing and replacing the temporary cluster of electric lights in the heading be careful not to touch any bare or injured place in the wires, and call the foreman's attention to any damaged place you may discover. Familiarize yourself with the methods of reviving a person injured by electric shock and put them into practice as soon as possible whenever necessity occurs.

Do not smoke or throw a lighted match near any pile of inflammable rubbish either in a building or near timbering, and do not carry a candle or a torch near any piles of hay. Never wedge a candle between two nails on a post or other piece of timber; many disastrous mine fires have started in just this way.

Never take a drink of liquor before or during working hours, and do not hesitate to report any man you see doing so or who is in an intoxicated condition; your safety and perhaps your life may be sacrificed to his carelessness when under the influence of liquor.

THE LATE DEAN GALBRAITH

Dean Galbraith, beloved of 'School' men, passed away at his summer home, Go-Home Bay, on Wednesday, July 22nd. Few men have left their mark on so many young engineers. 'Johnny' Galbraith, as he was popularly known among students at the University of Toronto, will live long in the hearts of the men who came in contact with him.

Dr. Galbraith had not been well for some years, but he kept his troubles very much to himself, and attended to his duties unflinchingly. The summer vacation afforded a welcome respite, and his friends hoped that the rest would restore him to health. Such hopes proved, however, unavailing.

The story of his last hours is fittingly told in "Applied Science," the organ of the University of Toronto Engineering Society:

"On the evening before his death, while he was having dinner on the verandah of the cottage with members of the family and friends, he remarked on the quiet beauty of the evening and thought that surely no one could wish for anything nicer than what had been their lot that day. He was in great spirits and sat on the verandah until late in the evening admiring and enjoying, with the true appreciation of a lover of nature, the quiet solitude of the surroundings as the sun in all its splendor, sank behind the horizon.

"When he had retired a short while he was seized with a chill, no doubt due to a weakening of the heart, but he soon felt better and insisted that they should retire again, stating that he would be quite well in the morning. However, about four o'clock the family were summoned to his bedside and he peacefully passed away without awaking from a quiet sleep. In the quiet solitude of the early morning a noble life in all its splendor sank behind the horizon of mortality to cast off the earthly burden of clay, and awake arrayed with celestial radiance, in the Mansion which he had been building with his good and noble deeds on earth.

"The remains were brought to Toronto on Thursday evening, and after the funeral service on Saturday afternoon at the Church of the Redeemer, were conveyed to Mount Pleasant Cemetery for interment. It is certain that a more impressive or more representative funeral was never held in Toronto. Every engineering class since the founding of the 'School' was represented and engineering organizations throughout and beyond the Dominion paid tribute to the father of engineering in Canada. The Provincial and Dominion Governments expressed their appreciation of one of the greatest builders of the country which they represent. Prominent engineers from Canada and the United States attended, to show their respect for the leader of the profession in Canada. The floral tributes from the numerous engineering organizations and the various year classes of graduates and undergraduates, as well as from personal friends and many other sources, expressed in no uncertain tone the continent wide admiration with which the Dean was regarded, and the deep regret which was felt at his unexpected death."

Dr. Galbraith was born of Scotch parentage in Montreal on September 5, 1846. He received his early education at Port Hope and registered in arts at the University of Toronto in the fall of 1863. In 1868 he graduated, receiving the degree of B.A., with a double scholarship in mathematics and general proficiency. He was a gold medallist in Honour Mathematics, and he won the Prince's prize for highest general proficiency, established by the late King Edward VII during his visit to Canada, when he was Prince of Wales. He received the degree of M.A. from the University of Toronto in 1875. In 1902 the honorary degree of LL.D. was conferred upon him by his alma mater, and in 1903 Queen's University honored him with the same degree.

In 1886 he married Miss Emily Stupart, youngest daughter of the late Capt. R. D. Stupart, R.N. His widow and one daughter, Beatrix, and two sons, John Stupart, of the engineering staff of the Toronto Harbor Commission, and Douglas, an undergraduate in civil engineering at the University, survive him.

Dr. Galbraith was one of that body of eminent men whose working life has been contemporaneous with that of the Dominion, and who with quiet and consistent patriotism have struggled for its upbuilding and have prospered with its growth. With the establishment of Confederation there came an outburst of engineering activity, especially in transportation work, throughout the settled portions of Canada. Upon graduation, Dr. Galbraith found employment in the railroad field, getting his professional training as apprentice to Professor L. B. Stewart's father, Mr. Geo. A. Stewart, at that time chief engineer of the Midland Railway, and also an engineer and surveyor of extensive private practice. He completed his apprenticeship, qualifying as provincial and also Dominion land surveyor. In 1871, after a year's service as contractor's engineer on the construction of the Intercolonial Railway, then being built by the Dominion Government, he returned to the Midland Railway as resident en-

gineer, and afterwards division engineer, on the Midland Railway extension to Georgian Bay. From 1875 to 1877 he was employed on surveys for the Canadian Pacific main lines, then under direct government control, and for the projected Georgian Bay branch of that undertaking.

Upon the founding of the School of Practical Science in 1878, Dr. Galbraith was appointed to the chair of engineering and in 1889 was made Principal of the "School." In June, 1906, the "School" became the Faculty of Applied Science and Engineering of the University of Toronto, and Dr. Galbraith was appointed Dean of the Faculty, which position he so ably and nobly filled until the time of his death.

His activities were by no means limited to his academic work, although it received his first attention, he having consistently refused to undertake professional work as a consulting engineer whenever it was likely to interfere with his work at the "School." He has occupied many honorary positions, including those of vice-president of the Ontario Land Surveryors' Association, vice-president of the Engineering Section of the British Association for the Advancement of Science, vice-president of the Engineering Section of the American Association for the Advancement of Science, and vice-president of the Canadian Institute, Toronto. He was an associate member of the Institute of Civil Engineers, England, and was one of the founders of the Canadian Society of Civil Engineers, of which society he was a councillor for many years, and of which he was elected president in 1909.

When, in 1907, the engineering world was startled by the fall of the Quebec bridge, it was recognized in Canada that the disaster must be investigated by commissioners of unquestioned impartiality and integrity and of sound engineering knowledge, whose conclusions would be unhesitatingly received by the country at large, the undertaking having been practically a Government work. Dr. Galbraith was appointed a member of the commission to inquire into the cause of the disaster, his ability as an engineer having long before been realized by the engineering profession. The thoroughness and comprehensiveness of their report speaks volumes for the capable and painstaking work of the commission, and contributes a valuable addition to the engineering literature of to-day.

On November 4th, 1908, the graduates and undergraduates in engineering presented the University with a large portrait of their Dean, in recognition of the unselfish interest which he had always taken in them, and of the true worthiness of the subject of the portrait.

Although he had not quite lived the allotted span of three score years and ten, we must remember that there is breadth and depth to life as well as length. His life was broad in every sense of the word, his influence reaching out to every class of men, for he manifested an interest in every movement which appeared to be in the interests of humanity. Through his strength of mind he could control the strongest men, and revelled in the intricacies of the many weighty problems connected with his work and profession, while his kindness and largeness of heart made him the idol of children and rendered him appreciative to the fullest degree, of the beauty and healing influences of God's teacher, Nature. His benign influence penetrated the deepest depths of every heart which came within the sphere of his life, and his comprehensive understanding fathomed the deeper problems of life, and won for him a place among the men whose efforts have enthroned them on the pedestal of honor and respect.

In his demise the engineering profession has lost a leader. He had undoubtedly accomplished more in the interests of the profession in Canada than any other individual. At the time of the founding of the S. P. S., engineering education had not been introduced in Canada, and by many was not deemed practicable or worthy of serious consideration, but in spite of discouraging circumstances it was fostered by Dean Galbraith until he finally proved the justification of his contentions, which were prompted by a foresight reaching far into the future. He built up the "School" until to-day it stands among the foremost engineering colleges of the world. He has prepared thousands of young engineers to go out and develop the wealthy resources of the Dominion.

The loss to the University is indeed a serious one. His name inspired confidence in the manufacturer and in the commercial man, and as a result the University enjoyed the accumulated patronage which was the outcome of credit reflected upon it by the life and associations of Dean Galbraith. He had effected a bond among the graduates in engineering, which fostered a loyalty to their alma mater such as is not evidenced in any other faculty or in any other University.

He had always been the students' friend. He was one of the very few men of our universities, who properly appreciated the position and capacity of the undergraduate. In preparing a curriculum he always gave the students' needs his first consideration. He won many a concession for the undergraduates quite unknown to those whose cause he had championed. He always had a willing and sympathetic ear for a student in trouble, and his kind and helpful attitude won their confidence, with the result that he was looked upon by them as a real friend in whom they could confide, and whom they could approach with difficulties which confronted them. He will be missed, and sadly missed, in the corridors of the old "School" where he had been the constant recipient of well merited respect since the founding of the institution which he fostered and fashioned until his death.

His many worthy characteristics were developed and manifested to the greatest degree in his home. To those who knew him,—and our readers all knew him well,—it would be superficial to try to convey an impression of the kindness and unselfish love and companionship, which he afforded the members of his family. He was a companion to his boys and spent many days with them alone, in the pleasant retreats of Northern Ontario. He was an inspiration for good to the whole household, and his greatest enjoyment was derived from his home life.

His eulogies were spoken while he lived. Homage and tribute were paid him throughout his life, the crowning mark of respect probably being the banquet tendered to him last December in the Engineering building, by the graduates and undergraduates in engineering, in celebration of the fiftieth anniversary of his entrance to the University, and of the thirty-fifth anniversary of his appointment as head of Engineering in the University. It was a happy family reunion when over six hundred of his boys assembled, and hundreds of others too far away wired messages of appreciation, to pay tribute to the grand old man to whom they owed so much.

As President Falconer has said, he was a thoroughly trustworthy man, thorough in training, honesty, and patience. His name will be handed down to posterity as an emblem of true worth, and his life will find a prominent and enviable place in the pages of history.

LODE MINING IN YUKON TERRITORY

The British Columbia correspondent of the Journal writes: During the week ended July 9, there was included in the ore receipts at the Consolidated Mining and Smelting Co.'s smeltery at Trail, British Columbia, a shipment of ore from Mayo Landing, Yukon Territory. As this was probably the first ore of that kind to reach Trail from so far north the following information, taken from "Mining and Scientific Press," San Francisco, California, may be of interest.

"Sixty-five tons of silver-lead ore, assaying $250 to the ton, has ben hauled from the Silver King claim to Mayo landing on Stewart river for shipment to the Consolidated Mining and Smelting Co.'s smelter at Trail, B.C. The Silver King is situated 28 miles northeast of Mayo landing. The vein where opened is 4 ft. wide, striking approximately south 15 deg. west with a dip of 62 deg. east. Both walls are well defined. The hanging wall is schist and the foot wall quartzite. Development work is being done through an incline shaft, which has reached a depth of 70 ft. The owner of the property, H. W. McWhorter, intends to this summer continue sinking the shaft to a depth of 300 ft.

"On the Adam claim, 2,300 ft. from the shaft on the Silver King, Mark Evans has uncovered a vein 5 ft. wide, with two bands of galena in it, varying from 1½ to 3 in. wide, which assay high in silver. As he is prospecting nearly in line with the strike of the Silver King vein, it is no doubt a continuation of the same. Owing to there being from 10 to 29 ft, of frozen gravel (glacial drift) to sink through before reaching solid formation, and which makes prospecting for the vein both slow and expensive. Jack Alvinson and J. E. Ferrel, owners of the Web Foot claim, adjoining the Silver King on the northeast, have fitted up a churn drill to prospect with. Grant Huffman, on the Mable claim, has a shaft down 28 ft., and intends to drive and try to crosscut the vein. Fifty-four claims have been staked and recorded in the neighborhood of these properties. Not having a summer road, quite a number had provisions and supplies hauled in before the snow melted and will prospect during the summer.

"The Yukon Council has voted for an expenditure of $17,000 for roads in this district this summer, $5,000 of which will be spent in construction of a road to the silver-lead properties. The appropriation of $17,000, while not sufficient to build many miles of wagon road in a country like this, is evidence, however, that the Dominion Government will be willing to do more as development of the district proceeds. The opening of rich silver ore has attracted a great many prospectors, and quite a number are out in the hills around here this summer. The outlook for the future is bright for this district. A stampede is neither expected nor desired. As yet the properties are in the earliest stage of development. A prosperous and steady producing mining camp will be here in the near future."

Our correspondent adds to this that from time to time he hears of progress in Whitehorse copper camp, in Southern Yukon. An output of copper ore from the Pueblo mine, which is being operated by the Greenoughs and associates from Spokane and other parts of the Northwestern States, is being regularly maintained, the ore being sent to the Tacoma smelting works, Puget Sound, in the State of Washington.

McGILLIVRAY CREEK COAL AND COKE CO., LIMITED

The fifth annual report of the McGillivray Creek Coal and Coke Co., Ltd., for the fiscal year ended March 31, 1914, was submitted at the annual meeting of shareholders held a few weeks ago in Spokane, Washington, U.S.A.

The company's coal mine is situated at Carbondale, near Coleman, Southwest Alberta. It is connected by an electrically operated railway with the Canadian Pacific Railway Co.'s Crowsnest Railway. As described by Mr. W. J. Dick, mining engineer to the Commission of Conservation, there are two seams of coal separated by about 100 ft. of strata, but only the lower seam, No. 2, is being worked here; the average thickness of this seam is about 9 ft. 6 in. The seams have a strike of north 7 deg. west, a dip of 30 deg. to the west, and are occasionally broken by upthrow and downthrow faults of small magnitude.

The entrance to the mine is by a slope 280 ft. long. The system of mining is pillar-and-stall, the stalls really being chutes driven up the pitch. The chutes vary in length up to 550 ft. The main entry is driven 11 ft. wide and the rooms 8 ft. wide. Crosscuts 8 by 8 ft. are driven every 60 ft. The room pillars are 50 ft. wide. No gas has been found in the mine, but Wolf safety lamps are used exclusively underground. The blasting is done under the supervision of shotfirers by means of a battery and Monobel powder. There are three shotfirers on each shift. The tamping material is clay, which is sent into the mine for that purpose. The roof is shale, with a cap rock of shale from 1 to 3 in. in thickness. The floor is smooth and hard. The mine is ventilated by means of a Sirocco fan used as a force fan, delivering 45,000 cu. ft. of air per minute, with a water gauge of 1 in. The output capacity of the mine is 2,000 tons a day, but the daily average last year was a little less than 750 tons for every day worked.

The coal is hauled nearly two miles from the mine to the steel tipple erected alongside the Crowsnest Railway, by means of two 100 h.p. electric locomotives operating on rack rail. The tipple is well constructed to handle a large output. It is equipped with a Greene patent dump, and shaking screens and picking table for dry-cleaning the coal. Railway box cars are loaded by an Ottumwa box car loader. When visited by Mr. Dick the power plant included one 40 and one 30 h.p. boiler at the mine and two 150 h.p. boilers at the power house near the tipple, in which house also were a 150 kw. generator, 550 amperes, 250 volts, driven direct by an 18 by 18 in. 267 h.p. steam engine. The electricity generated is used for supplying power for locomotives, tipple and machine shop, and current for lighting purposes.

The Directors' Report.

The report of the president, Mr. Lorne A. Campbell, of Rossland, B.C., and directors, under date June 3, 1914, is as follows:

"The directors beg to present to the shareholders the Fifth Annual Report, for the year ended March 31, 1914, together with the statement of assets and liabilities.

"In presenting this report to the shareholders we beg to state that the development work as carried on for the past year has turned out to the entire satisfaction of the company, as the advance given below will show:

	Mar. 31. 1913.	Mar. 31, 1914.
Main entry, north	4,695 ft.	7,108 ft.
Main entry, south	588 ft.	588 ft.
Totals	5,283 ft.	7,696 ft.
Counter entry, north ...	4,622 ft.	7,076 ft.
Counter entry, south ...	501 ft.	501 ft.
Totals.	5,123 ft.	7,577 ft.

These figures show a footage of 10,406 ft. as at March 31, 1913, as compared with 15,273 ft. as at March 31, 1914—a difference of 4,867 ft. in favor of the latter year.

"The total quantity of coal marketed during the last fiscal year was 198,179.65 short tons, which was distributed in Alberta, Saskatchewan and the States of Washington and Idaho. In addition to the tonnage as stated, we had on March 31st, last, ready for immediate extraction, 659,728 tons.

"During the past year we added to our equipment 30 steel pit cars, each of 4 tons capacity, a 65 h.p. boiler, a 160 h. p. engine, a 100 kw. generator, motors having a capacity of 75 h.p., and, for haulage underground two 6 tons electric storage battery locomotives. In addition to the foregoing, many other expenditures on the plant were made, so that throughout it is in good operating condition.

"During the year the mine was worked 274 days, which shows that delays were very few during the operative period.

"From the satisfactory profit for the year, you will observe by comparison of Annual Statements a corresponding decrease in liabilities and an increase in assets to which the same was applied."

Balance Sheet. March 31, 1914.

Liabilities.

Accrued payrolls	$16,471.03	
Accrued accounts payable..	18,908.25	$ 35,379.28
Bills payable—loans		61,499.00
Townsite sales	23,463.87	
Less expenses	587.64	22,876.23
Net profit for year		87,377.02
Capital stock		3,000,000.00
Contingent liability on bills receivable discounted	1,196.45	
		$3,207,131.53

Assets.

Cash in bank	$ 42,448.80
Accounts receivable $53,468.18, less $1,205.69 reserve for bad and doubtful debts.	94,711.28
Insurance unexpired	139.24
Merchandise inventories	18,198.78
Water supply, cottages, furnishings ...	14,745.17
Northeast Quarter Sect. 7, Township 8-4	9,431.40
Plant, buildings, roads, and railway sidings.	211,261.21
Treasury shares unsold, at par	560,920.00
Coal lands	2,297,724.45
	$3,207,131.53

THE KIEL CANAL.

There is a very strong sentiment in the highest financial circles that the German emperor with all his protestations of peace has been playing a war game from the beginning and has simply bided his time.

Realizing that his ambitious program might antagonize the whole world he has had to make full preparation to that end.

While crying for peace to the outside world he has been steadily stimulating the war sentiment of his empire and educating his people to believe that they are invincible before the world and that the Supreme Ruler of the Universe is on the side of Germany.

After Napoleon really believed and dared to declare that there was but one ruler in Heaven and that there ought to be but one on earth it took some time to surround him at Waterloo.

In the case of the present German emperor the commerce and the material civilization of the whole world depends upon the battle soon to be fought in the North sea against the new imperial navy of Germany.

Of course, the war party of Austria never sent its ultimatum to Servia without the backing of the German emperor and the vital evidence in the situation is the completion of the Kiel canal.

Information reaches the Boston News Bureau that the deepening of the Kaiser Wilhelm canal running from Kiel on the Baltic to the North sea at the mouth of the river Elbe was substantially completed fourteen days before the beginning of the war.

This so-called Kiel canal is the vital feature in German naval strategy.

The original canal, which is 61 miles long, had a depth of 29½ feet and bottom width of 72 ft. and a surface width of 219 ft. The improvements which have been in process for five years and have been carried on without interrupting traffic were designed to give the canal a draft of 45 ft., a top width of 400 feet and a bottom width of 150 ft.

The new locks which are bigger than the locks of Panama are 1,082 ft. long, 147½ ft. wide and have a mean depth of 45 ft. of water over the sill. The new locks, one on each end of the canal, were built beside the older and smaller ones.

With this canal completed Germany is able to transfer the largest warships or merchant ships as well between the Baltic and the North sea.

The canal was orginally built in 1895 at a cost of $40,000,000. The improvements just finished have cost an additional $55,000,000.—Boston News Bureau.

HILLCREST COLLIERIES.

Mr. J. M. Mackie, managing director of Hillcrest Collieries, states that the company is recovering from the effects of the disaster at the mines. Shipments today are 700 tons per day compared with 1,250 tons daily before the disaster. Shipments will be increased to 1,000 tons daily within the next two weeks.

PETERSON LAKE.

A dividend of 1¾ per cent. on the capital stock of the Peterson Lake Co., has been declared. It is payable on Sept. 2nd to shareholders of record at the close of business on Aug. 19.

D. Lorne McGibbon, who is an Honorary Lieutenant-Colonel of the 6th Brigade Canadian Field Artillery has more than risen to the occasion. He has made an offer to care for the families of all the men of the Brigade who are called to war.

THE MILL AND METALLURGICAL PRACTICE OF THE NIPISSING MINING CO., LTD., COBALT, ONT.*

By G. H. Clevenger.

This paper cannot fail to be of great interest and value to all who are interested in the cyanide process, on account of the important development which it records. Mr. Johnston is to be commended for the large amount of detail which he gives, and the company and its management for permitting the publication of data of this character, which while of great value to others could well be considered private property.

It might be discussed from a number of standpoints: First, as an example of recent practice in mill and cyanide plant construction; second, the mill practice; third, the cyanide practice; and fourth, the new features in cyanide treatment involved. Perhaps a more vivid way of expressing it would be: First, the equipment or tools with which the various operations are carried on, are they the best and most efficient which could have been selected for their respective uses; and, second, is the best use in every case made of these tools? It may be well inquired is the highest possible recovery of silver made at the lowest cost per ounce recovered? For the making of the greatest ultimate profit is inseparably associated with successful metallurgical practice. There must therefore be at all times a careful balance maintained between recovery and cost of obtaining it.

I wish to call attention in a very general way to the equipment used and to an anticipation of questions which are bound to arise in this connection. However, the bulk of my discussion will be confined to the presentation of certain additional data, together with a more or less general discussion showing the line of development which leads up to the present practice and the applicability of certain features of it to similar problems elsewhere.

There are a number of vital points of broad general interest involved in Nipissing low-grade practice upon which metallurgists will by no means be agreed to. I wish to call particular attention to these points in the hope that it will lead to the presentation of data by others of practice in other districts which will assist in reconciling this divergence of opinion.

Crushing equipment.—It will be noted that the crushing equipment closely follows recent South African practice. The use of a silex lining in the tube mills might be questioned from the standpoint of economy; but quite aside from this point, upon which I am not prepared to give authoritative data, there are perhaps two distinct advantages possessed by this type of lining in this particular case. With the very fine grinding practised at this plant there would be, with iron or steel liners, a much larger proportion of finely divided iron in the pulp. My experience with the treatment of the high-grade ore showed that the presence of iron interfered with the extraction of the silver. It is also a well-known fact that metallic iron in an extremely finely divided state may cause an important cyanide consumption. The installation of the old type of mechanical agitator will be questioned by many operators, particularly as there is an air lift used in each tank in addition to the mechanical stirring gear.

Filtration.—There has been considerable misconception regarding the character of the low-grade ore, and certain writers have made rather sweeping statements regarding the non-suitability of Cobalt ores for vacuum filtration, presumably upon the assumption that the low-grade ore had a heavy gangue similar to the high-grade ore. The specific gravity (2.70 to 2.72) of the low-grade ore is not very different from that of the siliceous ores of other districts. My own experience in making the large-scale tests was that it was a most favorable ore for vacuum filtration. This statement I do not wish misconstrued as meaning that the vacuum type of filter is unqualifiedly the best for Cobalt ores for so far as I am aware comparative tests of the different types of filters have never been made in this district.

Early methods.—Briefly the status of metallurgical practice in the Cobalt district at the time that we began the investigation of the treatment of Nipissing ores was as follows: The high-grade ore was separated by sorting and pigging at surface plants, and sold to smelters outside the district, there not being up to the time of the advent of the Nipissing high-grade mill any of this ore treated locally. The low-grade ore, the dumps, and the low-grade material taken directly from the mine, was originally treated exclusively by concentration, the concentrates being sold to smelters. Later certain of the concentration mills provided cyanide annexes for the purpose of making a further saving from their tailings. Then came the building of mills which were primarily cyanide plants in which concentration was to be depended upon for the removal of the refractory minerals, and the major portion of the silver recovered as bullion through the medium of the cyanide process.

While the mills using the cyanide process unquestionably made a higher ultimate recovery, the mills which had confined their efforts to the development of their concentration practice, although realizing a lower recovery, appeared to be making as great and in some cases a greater ultimate profit than the mills employing a combination process. In other words, the greater recovery, which necessarily required a greater capital expenditure, did not in all cases mean a greater ultimate profit.

Improvements.—Early in the course of our work we considered the treatment of the low-grade ore and in this connection made a number of small-scale tests. These clearly indicated that the ore could be treated by cyanidation, but they had not proceeded far enough for us to determine certain difficulties, and problems, which even at this early date, we were quite sure would arise on account of the experience of others in the district. At this time we had not worked up to the maximum extraction or assured ourselves that concentration could be dispensed with. It might be mentioned that from the first we were determined to treat all the ore produced by the Nipissing company by hydrometallurgical processes and that nothing but refined silver was to leave the premises. Shortly after making the preliminary tests mentioned our efforts were centered upon developing and getting into successful commercial operation the process for treating the high-grade ore. This fully occupied our time until late in the summer of 1911, when the treatment of the high-grade ore was upon a well-

*A discussion presented at Salt Lake Meeting, A. I. M. E., August, 1914, continuing the discussion of the paper of James Johnston, presented at the New York meeting, February, 1914. and printed in Bulletin No. 85, Jan., 1914, pp. 107 to 133.

established commercial basis, and we again turned our attention to the treatment of the low-grade ore. After a thorough study of the practice and results of other mills in the district, the management and ourselves were unanimous in the opinion that the issue lay squarely between the relative economy of straight concentration and a process, preferably as near straight cyanidation as possible, which would produce only refined silver.

Objections to combination process.—The middle ground involving concentration and cyanide treatment did not appear attractive for various reasons. The object of concentration in cases where it is practised in conjunction with the cyanide process is to recover gold and silver and not soluble in cyanide solution, or to remove interfering elements, but experience shows it to do this but imperfectly, and further, it invariably removes gold and silver which are readily soluble in cyanide solution, which could be to better advantage dissolved by the solution and recovered as bullion. In cases where it is feasible to concentrate after cyanide treatment this last objection of course is not valid; but this cannot be readily done for it means repulping of the tailing and provision for a regular feed to the concentration devices. Moreover, the conditions of fine grinding which make for the best results in cyanide treatment are not those most conducive to the best work in concentration. A more or less complete concentration plant means a greater capital expenditure and it further means the control of two separate operations which involve entirely different principles and methods of operation. Generally you are attempting to operate a concentrator and a cyanide plant with neither up to full efficiency. The conditions of the two processes are therefore at variance and it is the constantly growing opinion that concentration in connection with cyanide treatment should only be turned to as a last resort.

Many small-scale tests were made involving various combinations of treatment. The results of these, together with the other data which had been collected in the district, led us to make the first large-scale tests along rather conservative lines, particularly as regards the removal of the native silver and dyscrasite. The preliminary examination of these ores indicated that the silver occurred in three general forms: First, native silver, of greater or less purity, and dyscrasite, which on account of their coarseness would not readily pass into solution; second, silver minerals readily dissolved by cyanide solutions; and third, some combination of silver which resisted ordinary cyanide treatment and was dissolved only after extremely fine grinding, and a long period of agitation.

Large-scale tests.—In order to show the general character of the low-grade ore, the results of four large-scale tests made upon lots of ore representative of the type of ore produced by the Nipissing company, and involving a total of about 36 tons are quoted from rather fully.

Each lot of ore was first sent to the sampler where it was weighed, crushed to 4-mesh and the assay sample separated. It was then transported to the point where the tests were to be made. It might be explained that these large-scale tests were run in the high-grade mill and the time available for them was determined by the time necessary to make certain necessary alterations and repairs to the mill. The tube mill had just been relined and therefor contained no amalgam. Agitator tanks, settler and other equipment were cleaned out very thoroughly and before running the tests proper, low-grade ore was passed through the entire system. I have every reason to believe that in general there was no salting except in the case of perhaps four or five samples. At any rate, if there was any error the probability would be that the residues actually assayed higher than the true value, therefore the percentages of extraction noted would be lower than those to be expected in actual practice, when employing the same method.

The general method of procedure in each case was to grind the ore, two tons at a time, with a ton of solution, the proper amount of lime, and a part of the cyanide, for a period of four hours. The time of grinding has been previously determined by grinding a sample of the ore in the tube mill for varying lengths of time and making sizing tests. The aim was to have practically everything pass a 100-mesh screen. This method of unit grinding had to be adopted on account of there being no arrangement for the ordinary method of continuous feed and discharge. After grinding, each charge was dumped into a settler containing 522 lb. of mercury, and after each charge the tube mill was rinsed out with cyanide solution which was also allowed to run into the settler. The oak-shod muller was raised well above the bottom of the settler so that there would be no grinding effect upon the mercury. Each charge was agitated in the settler for a period of one hour. It will be noted that no mercury was used during the grinding. The idea was to give an opportunity for any particles of metallic silver or dyscrasite, which might have resisted grinding, to settle out so that they would not be carried down into the treatment tanks where they would cause trouble. The mercury at the bottom of the settler simply acted as a collector for these particles. Particles of native silver and dyscrasite fine enough to remain in suspension in the pulp during agitation were assumed to be fine enough for satisfactory extraction by solution in cyanide. My idea of this operation was that it was a mechanical method, involving settling rather than amalgamation, of seperating a portion of the silver which would either not be dissolved in the treatment tanks or would require an undue amount of grinding to reduce to a state of subdivision fine enough to be readily dissolved. After agitation in the settler the pulp was drawn off into agitator tanks of the ordinary mechanical type fitted with means of introducing air and so connected that the charges could also be agitated with a centrifugal pump. The process of the treatment was recorded by determinations made upon samples taken every six hours. The effect of various forms of agitation was studied and in this connection pump agitation was found to be the most effective for the refractory silver minerals which dissolved very slowly at the last. A small amount of air was introduced during the whole agitation period. Pump agitation was not resorted to until at the last.

Distribution of the Silver.—The following assays of the four lots of ore treated show the distribution of the silver:

	Lot A	Lot B	Lot C	Lot D
	oz. per ton	oz. per ton	oz. per ton	oz. per ton
Pulp.	29.70	30.10	47.80	27.10
Metallics on 100 mesh	0.01	0.01	0.16	0.05
Metallics on 20 mesh.	....	....	0.19	0.07
Metallics on 8 mesh..	4.18	3.23	5.29	2.79
Metallics on 4 mesh..	1.24	1.33	0.46	0.98
Commercial assay ...	35.13	34.67	53.90	30.99
Correction on pulp..	1.30	2.00	2.90	1.10
Corrected assay	36.43	36.67	56.80	32.09

Composition of Low-grade Ore.—The following analysis by James Denny of a sample of the low-grade ore will show its general composition.

	Per Cent.		Per cent.
Silver	0.106	Lead	0.064
Copper	0.270	Calcium oxide	9.020
Arsenic	1.880	Magnesium oxide	4.330
Iron	1.920	Aluminum oxide	10.030
Sulphur	0.640	Carbon dioxide	11.060
Bismuth	0.010	Mercury	trace
Nickel and cobalt	0.730	Insoluble	59.840

An analysis made by Johnson and Sons upon a sample of the residues from the high-grade ore, shows antimony 3.8 per cent., bismuth 0.09 per cent., tellurium 1.39 per cent., and traces of tin, zinc, and manganese. These elements are all undoubtedly present in the low-grade ore as there is, unavoidably mingled with it, more or less high-grade ore.

I have also observed the presence of a small amount of graphite in Nipissing ores.

Extraction.—The extraction of the silver by settling averaged 46.7 per cent., and the total extraction by settling and cyanide treatment at the end of four hours of grinding and one hour of settling, averaged 66.5; 19.8 per cent. of the silver was dissolved during this period by cyanide. At the end of the first six hours of agitation, the total extraction had reached 76.3 per cent. At the end of the next 30 hours of agitation or a total agitation period of 36 hours, the extraction was 87.6 per cent. To raise the extraction 4.2 per cent. or to reach a total extraction of 91.8 per cent. required a long additional agitation period. Of the 8.2 per cent. of silver remaining after long-continued agitation, 3.7 per cent. was soluble in hot dilute nitric acid. The average total percentage of silver which could be extracted by combined settling, cyanide treatment, and dilute nitric acid was 95.5 per cent. The proportion of silver extracted during four hours of grinding and one hour of settling with lots C and D, which were similar in character, was considerably higher than with lots A and B, but the extraction curves for C and D as the cyanide treatment continues, straighten out and soon fall below the curves for A and B. A continued slow increase in extraction was particularly noted with lot C, which contains a somewhat higher proportion of silver. The peculiar character of these extraction results is doubtless due, at least to a certain extent, to the presence of a large proportion of dyscrasite, the coarse portion of which settles readily, while the finely divided portion dissolves very slowly in cyanide solution.

Fine Grinding.—Although these results clearly indicated that a cyanide plant would be most advantageous, it was the general concensus of opinion that more experimental work should be carried on to simplify and improve the process, if possible. From the first, there was a strong prejudice against the use of mercury in the low-grade mill. This is best appreciated by those who have had experience in handling large amounts of mercury in mill practice. Although certain of my early small-scale experiments had not been very promising when it was attempted to treat the whole ore directly by cyanidation, Mr. Butters strongly adhered to the idea of grinding the whole ore, native silver, dyscrasite, etc., to such a degree of subdivision that all the silver could be dissolved by cyanide. Tests were accordingly made in this direction, and through the guidance of Mr. Butters, gradually led into the present system of treatment where the same idea of grinding the native silver and dyscrasite to a state of subdivision such that it can be dissolved by cyanide solutions is practised, the desulphurizing treatment being only effective in altering the sulphides and sulpho-antimonides.

Now I wish to make this point very clear, for this problem of handling metallic gold and silver in ores which are cyanided, is one that has often perplexed metallurgists and one that has resulted in a variety of solutions. The usual answer to this problem although other methods have been used, is either amalgamation or concentration. On the one hand, we have Mr. Butters who has taken the extreme view that an ore containing native silver and dyscrasite, some of which will remain upon a 4-mesh screen, can be ground and cyanided direct, on the other hand, we find some metallurgists amalgamating comparatively low-grade gold ores preliminary to cyanide treatment, where the actual weight of metallic gold to be ground would be many times smaller than the weight of the metallic silver in Nipissing ore and everything considered much easier to grind and dissolve than Nipissing silver.

Mr. Butters has demonstrated that his plan is possible with Nipissing ore, for the results being obtained in the mill bear testimony to that fact; but quite naturally, it will be asked at what cost? Is the ore ground excessively simply that the more resistant metallic silver and dyscrasite may be reduced fine enough to pass readily into solution and the whim of recovering everything by cyanidation be satisfied? It is true of course that selective grinding can be practised to a considerable extent with heavy brittle minerals, but this is less true of the metallic silver and dyscrasite of Nipissing ore. By selective grinding, I mean grinding of an ore consisting of a relatively light gangue and a heavy brittle mineral so that the mineral becomes more finely divided than the gangue. This automatically takes place in a closed circuit of classifiers, other than screens, and a tube mill. This often causes a mineral to be ground down sufficiently fine for satisfactory extraction of gold and silver without excessive grinding of the gangue.

As a result of the first experiments which were made upon this ore, I called particular attention to the necessity of extremely fine grinding and this point has been confirmed by all who have since investigated its treatment. Now bearing in mind the necessity for this extremely fine grinding, presumably for certain of the brittle silver minerals, it is readily conceivable that when this necessity for fine grinding is satisfied in a closed circuit of tube mills and classifiers, all of the metallic silver and dyscrasite will also have been reduced to a degree of subdivision, such that it readily passes into solution. After all, Mr. Butters may be right in this case, due to the formation of the ore by "Dame Nature" to fit his metallurgical ideas, or he may have recognized this peculiarity from the outset, and as all wise men should do, has taken advantage of it. Under other conditions than those which *possibly* obtain with Nipissing ore, such a procedure could readily lead to poor economy through the excessive grinding of worthless gangue in order that metallic gold or silver might be dissolved by cyanide solutions, and other methods of recovery dispensed with.

The so-called desulphuring process is of interest as being the first large-scale application of the use of a reducing agent to effect certain chemical changes prior to cyanide treatment. To the thinking operator, it is indeed refreshing in this day of excessive oxidation and aeration in cyanide treatment to note that at times there may be virtue in reduction. I might mention that this mania for oxidation has even gone so far that

certain operators have aerated their pregnant solutions prior to precipitation. When it is remembered that precipitation is distinctly an operation of reduction, the fallacy of this course is apparent. That the deleterious effect of air upon precipitation is no mere theory, will be confirmed by operators using zinc-dust precipitation who have experienced air leaks in the suction of their precipitation pump.

The idea of using a preliminary treatment involving the use of aluminum and caustic soda in connection with the treatment of precious metal ores, is by no means new or original as many have supposed. Over 10 years ago W. Walker published an account of experiments made in this direction by himself and Martin. As cyanide operators generally are not familiar with this work, I will quote from it at some length.

"In an experiment designed to determine the effect of chlorine and cyanogen at the moment of liberation at the anode, ore was spread on a piece of platinum foil immersed in a solution of salt and potassium cyanide. The electrode intended to act as cathode was suspended from above. Through an error the feed wires were crossed and the platinum plate on which rested the ore was made the cathode. Almost immediately after turning on the current a purplish-red color was observed around the plate and subsequently a black cloud was thrown off. Upon removing the ore the gold was found securely plated upon the platinum, while the black cloud, when collected and analyzed, proved to be tellurium. To prove that the anions Cl and CN played no part in the reaction, caustic soda was substituted as electrolyte and identical results obtained. Evidently the gold was being recovered by cathodic reduction alone. It was found, that in general, any method which subjected the telluride to the action of nascent hydrogen in an alkaline solution would effect the reduction; or to put it differently, whenever gold telluride in the presence of alkali came in contact with a metal from which hydrogen was being liberated, tellurium was set free, metallic gold appearing on the metal. Thus for example, when powdered telluride is placed upon metallic aluminum and moistened with caustic soda decomposition immediately takes place. The same is true of zinc, although the reaction is much slower. Sodium amalgam breaks up the grains of telluride with great ease. When an electric current is used the reaction seems to be independent of the metal forming the cathode, and to take place in any neutral or alkaline solution.

"When a dilute acid was used as an electrolyte a reduction of the gold was effected with the greatest difficulty. Only by employing a very dilute acid and a large current density could any apparent decomposition be obtained.

"A possible explanation of the reaction taking place is the following: The hydrogen evolved first untied with the tellurium, forming hydrogen telluride and free gold. In the presence of alkali this compound is immediately broken up with the formation of an alkaline telluride which is easily soluble, and thus removes the tellurium from the sphere of action. This alkaline telluride is in turn oxidized with the formation of free alkali, and metallic tellurium. In the presence of acids, however, the hydrogen telluride is immediately broken up and the free tellurium deposited *in situ*, as it were, upon the gold, thus protecting it from further action. This is indicated by the fact that a silver-white piece of gold telluride becomes black when placed upon the cathode in an acid electrolyte, and also by the fact that when the amount of activity of the acid is decreased by diluting the solution a slight deposition of gold can be obtained.

"When the rate of decomposition is rapid the gold in the small pieces of mineral is not evenly deposited, but frequently retains the original shape of the mineral fragment.

"Quantitative runs were made on a rather rich sulphotelluride with caustic soda as electrolyte, and mercury for the cathode. By maintaining gold agitation it was not difficult to obtain an extraction of 93 per cent. of the assay value. The presence of finely divided tellurium in the electrolyte seemed to cause excessive flowering of the mercury and much trouble was experienced from this cause. When lead or other solid metal was used as cathode much gold was lost by the abrasion of the moving ore.

"Good results were also obtained by agitating the ore with aluminum shavings in the presence of caustic soda solution, washing out the tellurium and amalgamating the free gold."

(To be continued.)

NOMENCLATURE OF ALLOYS.

At the annual general meeting of the Institute of Metals, held in London on March 18th, 1914, a committee consisting of representatives of The Institute of Metals, The Institution of Mechanical Engineers, The Institution of Electrical Engineers, The Institution of Naval Architects, The Institution of Engineers and Shipbuilders in Scotland, The Northeast Coast Institution of Engineers and Shipbuilders and The Society of Chemical Industry, (Chairman, Dr. W. Rosenhain, F.R.S.), presented a unanimous Report in which they recommend the adoption, first of a systematic nomenclature in which alloys are denoted by the names of their constituent metals in English, arranged in increased order of percentage present in the alloys. This systematic nomenclature is intended chiefly for scientific and other purposes where its precise character more than outweighs its cumbrousness. The committee next recommends that a system of "practical" nomenclature should be set up consisting of "practical" names which are to serve as everyday abbreviations of the systematic or scientific names. The definition of current practical names on this basis has so far only been attempted in regard to the two important terms "brass" and "bronze." The definition of "brass" adopted by the committee is that it is to be used as an abbreviation of the words "zinc-copper" as employed in the systematic nomenclature; when employed alone it indicates that the alloys are pure zinc-copper. Where the presence of other metals is to be indicated their names are to be prefixed to the term, forming such words as tin-brass, aluminum-brass, manganese brass, etc. Similarly the term "bronze" is defined as an abbreviation for "tin-copper" as used in the systematic nomenclature, the definitions in other respects being identical as that for "brass." The committee is not yet prepared to recommend definitions of further practical terms, but the two terms defined represent the most widely used alloys, and their general adoption as thus defined would do much to remedy the state of confusion which exists at the present time. The committee, therefore, appeals to all those interested in the progress of the industries and sciences connected with metals to use their best endeavors to support and carry out the recommendations of the committee.

PERSONAL AND GENERAL

Mr. Ralph Arnold, of Los Angeles, California, geologist and petroleum engineer, has been examining lands in the Flathead country, Southeast Kootenay, owned by a British Columbia company, and believed to be oil-bearing.

Dr. Alfred H. Brooks, geologist in charge of the work of the United States Geological Survey in Alaska, was in Seattle, Washington, about the middle of July, on his way north. His season's itinerary in Alaska includes visits to Valdez, Chitina, Ruby, Iditarod and Nome. He will not return until the autumn.

Mr. C. P. Browning, one of the Britannia and Smelting Co.'s mining engineers, was among the British Columbia visitors to the campus of the University of Washington, Seattle, at the time of the State-wide Mine-rescue and First-aid demonstration held there on July 22 and 23.

Dr. C. W. Drysdale, of the Geological Survey of Canada, has completed his work in Rossland camp, and has gone to Ymir, in Nelson mining division of West Kootenay, to study the ore deposits of that camp.

Mr. Charles Graham, superintendent of the Corbin Coal and Coke Co.'s colliery in the southeastern part of the Crownsnest district, B.C., has been spending a short vacation at Nanaimo and Victoria, Vancouver Island, B.C.

Mr. Thomas Graham, of Victoria, Chief Inspector of Mines for British Columbia, while attending the Mine-rescue and First-aid demonstration held at Seattle, Washington, on July 22 and 23, under the auspices of the United States Bureau of Mines, acted as judge of the contests in Mine-rescue events. At the request of the committee, Mr. E. Jacobs, who was also a visitor from Victoria, was official scorer throughout the two days' meeting, which was attended by more than 50 competitors in the various events and numerous friends from different parts of the State.

Mr. John Hopp, who is the largest hydraulic mining operator in Cariboo district of British Columbia, after having been detained at the Coast owing to non-receipt of a lot of casing required for use in testing the gravel at "the Meadows" on Williams creek, near Barkerville, where drills are being operated to determine the suitability or otherwise of the ground for gold-dredging purposes, has gone to Cariboo to keep in touch with work on his several hydraulic placer mines being operated near Barkerville.

Mr. Randall H. Kemp, a pioneer of Ainsworth, Slocan and Nelson districts, in British Columbia, and later mining journalist and frontiersman in Alaska, is a patient in the Royal Jubilee Hospital, Victoria, undergoing radium treatment for a cancerous affection of his tongue.

Mr. J. D. MacKenzie, of the Geological Survey of Canada, and Professor V. Dolmage, of Columbian College, New Westminster, B.C., are reported to have been injured by an explosion of natural gas at an old coal prospect at the southern end of Graham island of the Queen Charlotte group, British Columbia. Prof. Dolmage was spending a vacation with Mr. MacKenzie, who was studying the coal deposits of Graham island. A newspaper account of the accident says: "Accompanied by Mr. MacDonald, resident engineer at Wilson camp, where exploration is in progress, Messrs. MacKenzie and Dolmage went to examine an exploratory working to the south of Queen Charlotte City. Almost immediately after the party entered the working with lighted candles they were hurled backward 30 ft. and covered with debris. Two were under fallen rock, and they were dug out and assisted to the hospital. All three suffered severe cuts and bruises, but they are now out on crutches."

Mr. Frank E. Pearce, formerly of Baker City, Oregon, who was last year in charge of development work at the Inland Empire mine, in the western part of Trail Creek mining division, B.C., is now directing development work on the Pingree, in Nelson division.

Mr. Robert T. Turner, of Nevada, was in San Francisco recently, after having been in British Columbia for men interested in mining property in that Province.

Mr. C. S. Verrill, of Vancouver, B.C., has been assisting Mr. A. G. Larson, who was employed by the Department of Mines of British Columbia to make an investigation of the ore production probabilities of Franklin camp.

The American Association of State Geologists will hold its first annual summer field meet in Michigan, Aug. 27 to Sept. 1.

The Herbert Morris Crane & Hoist Co. has issued bulletin Z13, describing a small telescopic hoist.

The Salt Lake meeting of the American Institute of Mining Engineers, was held August 10 to 14. A series of papers of unusual interest to metallurgists was presented.

LIEGE.

Strategic points in the importance of Liege, the Belgian city before which the German advance is reported to have been checked, and where, according to European dispatches, the first great battle in force of the impending war may be fought, are numerous, says the New York Journal of Commerce. Principally it is the most strongly fortified obstacle to the supposed plan of the Germans to cut across the lower half of Belgium into French territory, but in addition to this the city is of itself a prize in many ways.

In its surroundings it is the Pittsburg of Belgium. For miles to the southeast of the city, along the banks of the river Meuse, there are scores of blast furnaces, puddling furnaces, rolling mills and forges. It is the site of the famous Corkerill works, said to be the largest manufactory of machinery in the world. The Lion, erected as a monument on the field of Waterloo, some sixty miles distant, was made here.

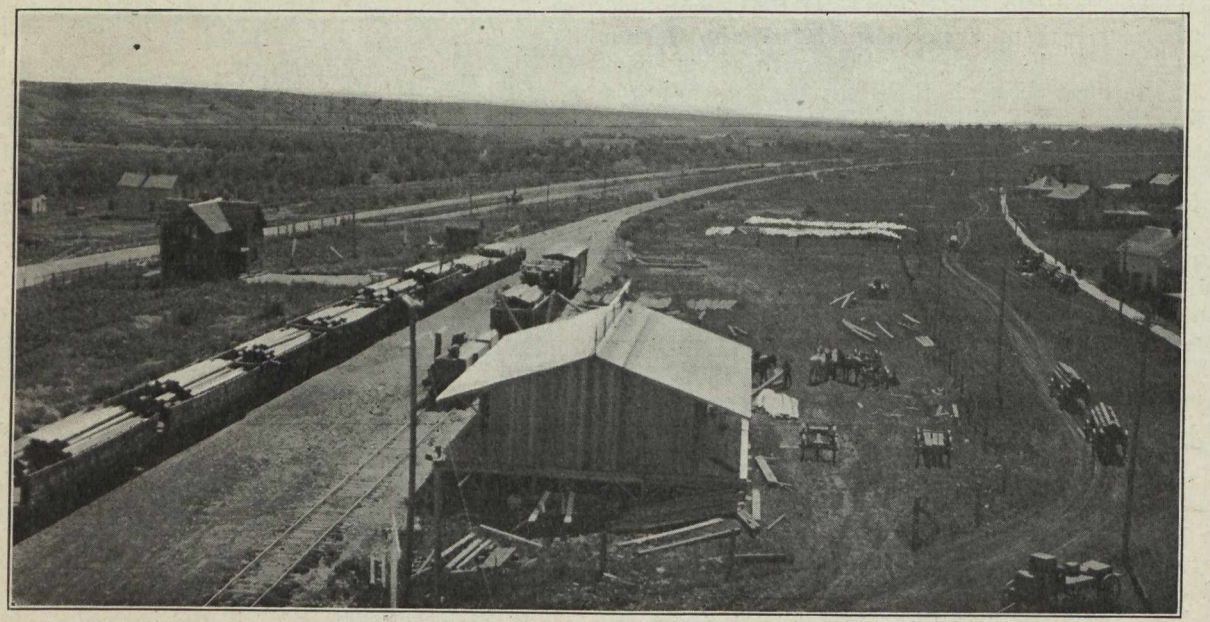
Liege proper, with a population of 168,000, lies at the junction of the Meuse and the Ourthe, in a basin margined by hills. Many handsome buildings and gardens strive to keep themselves handsome against the tremendous odds of coal dust. All around the city is a wealth of coal and iron ore; the mines are run even under the city and river. These natural riches, in connection with the favorable situation of the city at the junction of two navigable rivers, have given rise to the extensive manufacturing industry in the city itself.

The products are varied, but the principal one, and that which would make Liege a valuable prize of war, is that of firearms. More than 20,000 persons in and around the city are employed in the manufacture of guns, ranging from small arms to the largest modern weapons. There is a royal cannon factory and a small arm factory also in the suburb of St. Leonard.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Reports received from the more important mining district of the Province are generally favorable as regards metalliferous mining, but less satisfactory where coal mining is concerned. From the placer gold camps of Cariboo and Atlin the news is, in effect, that having a sufficient supply of water for gravel-washing, there is the customary summer activity, with a fair amount of gold being recovered. It is not the summer operations, however, that usually determine whether the full season's results are good, but those of the autumn. If much rain falls after the summer water supply from melted snow has been exhausted, and before the early frost comes, then the year's placer mining is prolonged proportionately, but when a dry autumn is experienced a short hydraulicking season results, and the gold yield is adversely affected accordingly. The accounts thus far brought to the larger cities of the Coast have told of operations being actively carried on, and expectations general of a good season. Whether the latter will be realized remains to be seen. Lode mining in Kootenay, Boundary and Coast districts appears to be progressive, and since it is from these districts that practically all the ore produced is mined, the outlook for the year's total production from lode mines seems to be good.



Unloading Oil Well Supplies at Okotoks, Alberta

East Kootenay.

There has been a substantial increase in the quantity of lead ore shipped during recent weeks from the Sullivan Group mines to the Consolidated Mining and Smelting Co.'s smelting works. The total quantity of Sullivan ore received at Trail during 26 weeks ended July 2 was 10,063 tons, an average of 387 tons a week. The quantity for four weeks ending July 21 was 3,682 tons—an average of 920 tons a week. Twice during that four-week period the weekly total was in excess of 1,000 tons—for the week ended July 2 it was 1,018 tons, and for that of July 16 1,012 tons. If it were practicable to also utilize the zinc ore occurring in these mines, a much larger weekly output could easily be maintained, but pending the discovery of a process suitable for treatment at low cost of zinc-lead ore that cannot now be shipped to United States zinc reduction works at a profit, ore of this class must be left in the mine. Exploration of new ground in the St. Eugene mine is being continued, meanwhile occasionally a car of ore is shipped to Trail, rather more than 700 tons representing the output for the first half of this year. District newspapers report new discoveries of placer gold on two streams, and in Fort Steele mining division a resultant staking of a number of placer claims.

West Kootenay.

Ainsworth.—The greater part of the ore production of this division is still that of the Highland and No. 1 silver-lead mines, both operated by the Consolidated Mining and Smelting Co., and the Bluebell mine, situated on the opposite side of Kootenay lake to the town of Ainsworth. All three mines are regular producers. The Consolidated Co. is also working the Banker and Maestro mines, and making small shipments of ore from them now and then. Other mines in this camp are the Silver Hoard and the Florence Co.'s group, both held by Spokane men; these properties are expected to be on the list of shippers before the end of the ensuing autumn.

The completion of the work of reconstruction of the Kaslo and Slocan Railway from Kaslo to Whitewater has provided transportation facilities for mining properties on the south fork of Kaslo river, the Utica mine, a few miles farther west, some claims in Jackson basin, from which a small quantity of zinc ore has been shipped recently, and several mines in the neighborhood of Whitewater. There is now railway connection without break from Kaslo, on Kootenay lake, past New Denver and Rosebery on Slocan lake, and through to Nakusp on Upper Arrow lake, Columbia river.

Slocan.—The Rambler-Cariboo mine and concentrator are being operated to present capacity of the mill.

Particulars of this property were printed in the Journal of July 15 (p. 480). Deep level exploration work in the Payne mine has not yet resulted in discovery of much ore; it is probable that connection will be made between the low level adit and the workings 600 to 700 ft. above, and the ore shoot opened in the old 800 ft. level be followed down. If the suggested connection be made, both good ventilation and drainage will be established, and development from the old workings downward be made much less difficult than under present conditions. Progress at the Slocan Star mine and mill is reported to be satisfactory, for much of the concentrating ore opened by the development work of the last year can now be turned to profitable account. The quantity of silver-lead ore, suitable for shipment in its crude state to the smeltery, taken out in the course of development, has not been large, receipts at Trail from this mine having averaged only about 100 tons a month during the seven expired months of the current year. However, with the mill running steadily, an output of both silver-lead and silver-zinc concentrates is being made continuously. The latter product is shipped to Bartlesville, Oklahoma, U.S.A., for treatment there.

Other mines in the neighborhood of Sandon also being worked are the Richmond-Eureka, Ruth-Hope and Wonderful, and several properties on which lessees are at work; each of these groups mentioned has sent 250 to 300 tons of silver-lead ore to Trail during seven months, but the total from all other properties not included in the foregoing notes has been small. Near Cody, the Surprise is the most active, having shipped approximately 500 tons of silver-lead ore this year to date, and stored a lot of lead-zinc ore for concentration whenever facilities for treatment of this ore shall be provided. It is stated that arrangements are being made for shortly putting in a concentrating plant, much ore of milling grade having been opened in the mine during the last year. Driving the deep level crosscut adit on the Noble Five group is being continued, and prospects are reported to be good for this work proving of much importance, for there are several known ore-bearing veins to be cut by the adit. Lessees of a part of the Reco property are stated to have found another shoot of ore of shipping grade. Work has been resumed on the Noonday. Lessees of a part of the Idaho-Alamo group are busy now that the snow has melted. Progress with development of the Apex, near New Denver, and on the Hartney and Capella properties, represents the chief mining activity of that part of Slocan district. In Silverton camp, back from Slocan lake, the Standard Silver-Lead Mining Co. is a long way in the lead, with an output of ore for the year to the end of July much in excess of the combined production of all other Slocan mines in the same period. Shipments of silver-lead ore and concentrate to Trail for seven months have totaled approximately 9,000 tons, beside which there has been a considerable quantity of silver-zinc concentrate shipped to United States zinc reduction works. The Silverton Mines, Ltd., is continuing its efforts toward making a steady output of high-grade crude silver ore and both lead and zinc of concentrates. The expectation is that 150 tons of ore a day will be regularly sent down from the Hewitt-Lorna Doone group of mines, and that the mill will be found equal to treatment of that quantity. Shortness of ore at the Van Roi mine recently necessitated a temporary suspension of milling operations, but development work in progress is expected to bring about an early return to normal conditions. Work is being continued on the Lucky Thought, near Four-mile creek, and local men have arranged to reopen the old Wakefield mine, which in past years was a profitable ore-producer. Lower down the lake, the Eastmont, on Ten-mile creek, and the Ottawa, on Springer creek, and several other properties in Slocan City division, are being worked.

Nelson.—With the exception of that of the Silver King mine, which is being operated by the Consolidated Mining and Smelting Co., little ore has been shipped from mines near the town of Nelson during recent months. However, that mine has made a much larger production this year, for its output for seven months shows a total of about 12,000 tons, as compared with 3,780 tons for the whole of 1913. The Eureka and Queen Victoria copper mines and the Granite-Poorman gold mines are inoperative now. Work is being continued at the Venus, California and Perrier, and quite lately men were put on to further develop the Pingree. Farther afield, the Molly Gibson is again giving employment to a number of men, repairs to aerial tramway and other plant damaged by winter snowslides having been effected. While there is production in Ymir camp, development work has opened much ore in the Wilcox, Dundee and Yankee Girl mines, and several prospects in the neighborhood are promising. Shipments of lead ore from the Emerald, H. B. and Zincton mines, within a few miles of Salmo, received at Trail this year to July 21, total 3,039 tons, in the following proportions: Emerald 1009 tons, H. B. 1,674 tons, Zincton 356 tons. Gold-bearing ore is still being mined on the 600 ft. level of the Queen mine, Sheep creek, where there has been opened a shoot of ore 25 to 30 ft. in width and already stoped along a distance of 60 ft. The Motherlode mine and stamp mill are being operated as usual, a reserve of ore having been made during the latter part of the winter when the weather was too cold for the water-power plant of the mill to be run; development work is being continued in the deeper parts of the mine, to add to the supply of ore. Prospecting is being done on several other claims in Sheep Creek camp, but no ore from them is being either milled or shipped to the smeltery. In Erie camp the Second Relief is being worked and the ore taken out put through the stamp mill.

Rossland.—The only present productive mines in Trail Creek mining division are those at Rossland, namely, the Consolidated Mining and Smelting Co.'s Le Roi and Centre Star-War Eagle groups and the Le Loi No. 2 Co.'s Josie group. The approximate output of ore for the expired seven months of this year has been as follows: Centre Star-War Eagle group, 92,000 tons; Le Roi group, 40,000 tons; Josie group, 12,000 tons. These figures show the ore from these several mines received at the smeltery at Trail. The quantity of ore taken from the Josie group was larger than that shipped to Trail, but the lower grade ore was concentrated at the mine, and the product included in the total of ore shown above as having been shipped. All these mines look well for continued production. Much ore has been found on the 14th level of the War Eagle and work in progress on the 16th level indicates that the ore may be expected to continue to that depth at least. A fine shoot of ore is being explored in the Le Roi No. 2 Co.'s Annie claim from workings that are an extension of the Le Roi 1,650 ft. level; this shoot appears to come in from the Le Roi Black Bear claim, so most likely will be productive in that property as well.

Lardeau and Revelstoke.—Small shipments of ore are being made occasionally from the Ajax and another property of the Ferguson Mines, Ltd., but outside of these there are few productive mines in this district now being worked. The reports of a discovery of tin-bearing ore on a tributary of Fish river, 20 miles above Camborne, has been confirmed, but when the claim was visited the snow still covered the ground, so little could then be learned of the value of the find. Reports from the Big Bend of the Columbia, north of Revelstoke, are to the effect that a number of men are employed on one of the gold-bearing creeks and that prospects are favorable for good results being obtained.

Boundary.—There is little change in mining matters in this district. The Granby Co. is maintaining its output of between 3,000 and 3,500 tons of ore a day from its big copper mines at Phoenix. The British Columbia Copper Co. is stated to intend shortly closing its smelting works at Greenwood, but so long as it is keeping some of its furnaces in blast, local people are hopeful that operations will be continued despite reports to the contrary. Ore is being hauled to Lynch creek in wagons and thence by rail to one or other of the smelters; this ore is from the Union mine in Franklin camp, North Fork of Kettle river, in which part of the district prospecting is again active, and several finds of ore giving high assay returns have been reported lately. The Jewel gold mine maintains an output of about 1,400 tons of ore a month, and keeps its 15-stamp mill going continuously. There is some activity in the West Fork country, about Beaverdell and Carmi; ore is being treated at the Carmi mill and fair results are reported.

COBALT, SOUTH LORRAIN, GOWGANDA

The outbreak of the general European war has had a most serious effect upon the Cobalt camp inasmuch as it has materially affected the price of silver. For a time, indeed, there was almost a panic here, but gradually as the worst effects were realized more sanity prevailed.

Three mines have closed down ostensibly for reasons connected with the war, all the others will remain open for a month or six weeks at all events, by which time the situation should have cleared and markets should again be available.

The reasons for the closing down of the Kerr Lake mine are not apparent. The Kerr Lake mine has made greater gains underground than any other property in the first six months of this year, and it has a good surplus. The action of the directorate in closing down is not connected with the camp in any way. The Drummond Fraction, which is partly under their control has also closed down. The Crown Reserve is keeping on all married men and gave single employes a week to find work, during which time they could stay in the company bunkhouses at the company's expense.

The Beaver has also closed down by order of the president, Mr. Frank Culver. Other mines have restricted operations, but none have closed down, and the situation now is much easier. There are, of course, many idle men around town.

The reassuring news that the British Government would take over and pay for all the silver that was in London and the resumption of quotations from London did much to bring the camp back to equilibrium. The United States is also taking a million ounces a week for two weeks, which will help the situation greatly. A market is being sought and has been found via San Francisco to China. Two hundred thousand ounces was sold at current quotations via this source. There is also a project to arrange operations through New York. The scheme which has been outlined is that the ore should be treated in the camp at one of the custom smelters and shipped to New York, where it would be stored at the customer's disposal. In the meantime the banks concerned would advance the companies 25 cents an ounce, or a little better than working expenses for the silver, charging the current rate of interest. When quotation resumed or the markets opened or at the call of the customers they could get the bullion and sell it.

Probably the development which most alarmed the camp was not the cessation of the shipping of bullion, which was generally believed to be temporary, but the refusal of the one big smelting trust operating in the camp to take ore or concentrates. At first this trust stated that it would take the silver, pay 25 cents an ounce and settle for the rest when quotations were resumed. This was not entirely satisfactory to the producers, but all consideration of it was stopped when a message was received next day that the trust absolutely refused to take either ore or concentrates, and cancelled their contracts. The Canadian smelters at Thorold and Deloro are not taking on any further contracts, but they are carrying out those they have made already.

The Huronian Belt Company, which is taking over the Keeley on an option basis is pleased with the results obtained there to date. This last of the producers in the South Lorrain camp has six ore shoots underground ranging from a few feet long to 200 feet. A shoot from 150 to 200 ft. long has been developed on the Josey Wood's vein. The vein varies very materially both in width and values, but it is all high grade ore. It is in places six inches wide. A surface discovery has also just been made in the extension of an old trench. The vein had shown only cobalt ore with a low silver content in the old trench, but when it was followed up it was found to be quite rich and of considerable length. There was little doubt before the war broke out that the Huronian Belt would have taken advantage of the option. It is not quite known what will be done now. In spite of the fact that the Huronian Belt has large interests in Russia which will be materially affected the company has so much confidence in their investments in the north country both at the Keeley in South Lorrain, and at the North Thompson at Porcupine, that it has decided to keep the work going, though operations will be confined to places where it is most likely to be immediately productive.

The ore shipments from the Cobalt camp for the first week of the war, ending August 7, did not show any material decrease from the average, but they will be low this week. Bullion shipments have ceased altogether.

The Cart Lake Cobalt Mining Company working under the direction of the General Assets Company has let the sinking of a shaft on the Gould lease on Cart lake. This shaft is being sunk on the east side of the lake in ground which is quite unexplored as far as the Gould is concerned.

The Cart Lake company has cut the vein at the 332 ft. level, where it is an inch to an inch and a half wide of high grade ore. 741 pounds of high grade ore has been shipped to the Nipissing for treatment purposes.

Casey—As a part of the general scheme of develop-

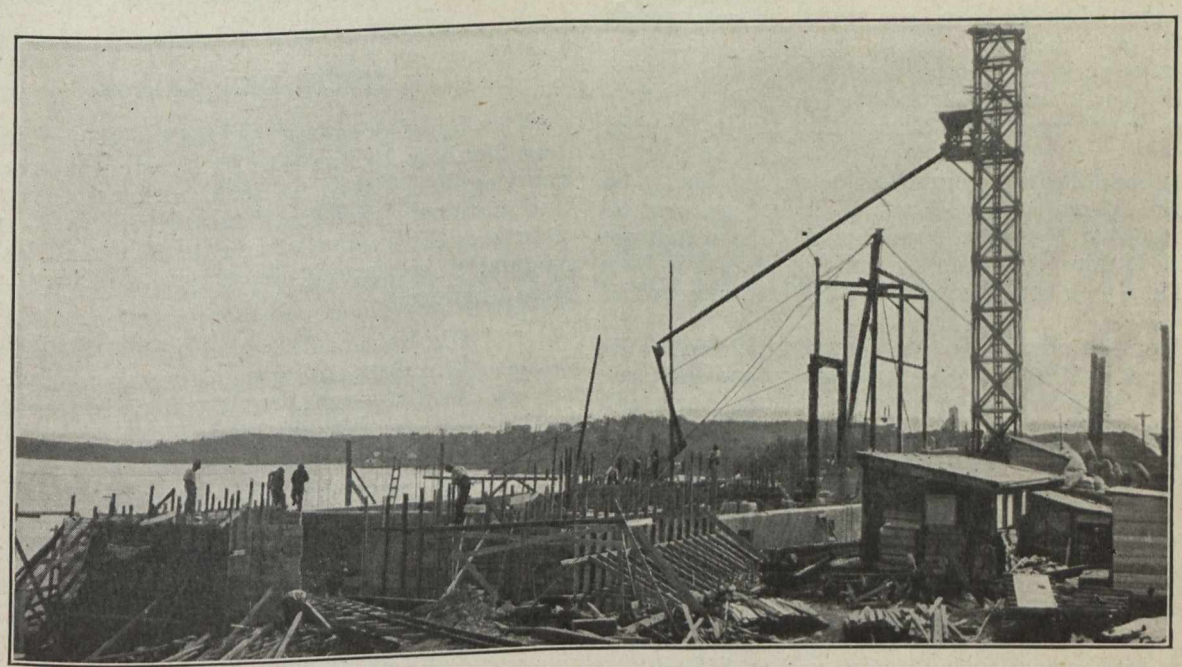
ment on the Casey Cobalt mine a shaft is being sunk on the east claim. This shaft is being put down in the clay in order to cross-cut a vein which has been found in a diamond drill core and appeared very promising.

The Crown Reserve has renewed the lease of the Silver Leaf, as it had the right to do under the original agreement. This agreement which was made on Dec. 4, 1909, was for five years on a royalty basis of 25 per cent., with an option for renewal of for five years on a royalty of 35 per cent., the lessee spending $20,000 the first year and $10,000 any succeeding years in work on the property. Mr. W. H. P. Jarvis was elected a director of the Silver Leaf at the recent annual meeting in Toronto.

Bush fires have done much damage to mining plants in the Elk Lake camp. The plants of the Fleur de Lys, North American, Otisse, Motherlode and the bunk houses of the Mapes Johnston were destroyed.

The Hollinger has cut the main vein at the 675 ft. level, where it appears the usual grade of ore and about the same width. The extension to the mill should be running next week and the foundations for the 20 Acme stamps will be commenced at once so that the entire plant may be in operation early next year, probably February.

The Tough-Oakes had some delays in getting to work under the new and enlarged scheme of operations owing to various breakdowns at the Charlton plant. These have now been repaired. The English company controlling the Tough-Oakes, the Sylvanite and the Burnside has decided to keep the mine open and to rush work on all drifts and developments that promise immediate returns. Exploration work will be restricted until the horizon clears a little. The Tough-Oakes mine has recently shipped 101,845 pounds of ore which will run over $500 to the ton.



Constructing New Power Plant for Hollinger and Acme Mines, Porcupine

Teck-Hughes.—The Nipissing has already taken over the Teck-Hughes and a development scheme on a vigorous scale has been planned. So far only lateral development has been attempted. From this time forward all extension will be made to open up further levels.

PORCUPINE, KIRKLAND LAKE AND SESIKINIKA

All mines on a self supporting basis in the gold camp or camps of the north will be affected hardly at all by the European war, which is hitting all other industries so hard in the Dominion. The example par excellence is the Hollinger, where not a man has been laid off and the great scheme of development planned last month is being rushed forward with all haste. The McIntyre is also now on a self supporting basis. So are the Porcupine Crown and the Dome. As these four mines employ the greater part of the men in the camp the war in Europe will make very little difference to mining north of the height of land.

Other prospects not depending on the sale of stock or borrowed money for their operations will not be in the least affected and on the whole the depression and industrial stagnation characteristic of the country will find very little reflection in Porcupine.

GOLD THIEF CAPTURED

The recovery of bullion and arrest of the thief who purloined $4,000 worth of gold from a guard on the trail between Telegraph Creek and Deace Lake has been reported to Superintendent Colin Campbell, head of the Provincial Police Department by wire from Telegraph Creek.

The message stated that a Frenchman, named DeForrest, was captured on Saturday at a point twenty-six miles from Telegraph Creek, and that the prisoner had been brought into that place. All the gold was recovered. De Forrest had about seventeen ounces on his person when arrested, and the balance was found at a spot where the prisoner had cached it following the robbery.

TORONTO MARKETS.

Aug. 12—(Quotations from Canada Metal Co., Toronto)
Spelter, 5½ cents per lb.
Lead, 5 cents per lb.
Tin, 75 cents per lb.
Antimony, 25 cents per lb.
Copper, casting, 14¼ cents per lb.
Electrolytic, 14¾ cents per lb.
Ingot brass, yellow, 10; red, 13 cents per lb.
Aug. 12—Coal—(Quotations from Elias Rogers Co., Toronto).
Anthracite, $7.50 per ton.
Bituminous, lump, $5.25 per ton.

METAL PRICES ADVANCE.

Boston Aug. 10.

Sensational advances have been scored in metal prices during the past week.

Ferro-manganese now costs about $125 a ton, whereas a week ago it could be purchased for $38 to $40 a ton. This metal comes from England for use in the steel industry.

Seventy-three cents a pound has been paid for tin in New York, as compared with a high record price of 63 cents established Thursday. Metal houses believe that not more than 20 tons of Straits tin could be bought in New York. They look for 75-cent tin, a hitherto unheard of price.

Antimony has advanced from 7 cents to 12 cents a lb. No large spot holdings exist in this country and the trade has become apprehensive as to when further stores will arrive from China.

The market for silver has disappeared, with no demand existing at the moment. Quotations have been discontinued. Predictions have been made by producers that the price will go to 60 cents an ounce as compared with 52 cents, owing to probable Continental demand for coinage.

A new high power water pump, with a capacity of 30,000,000 gallons a day, built by the Allis-Chalmers Co., was recently installed under the supervision of Mr. Wayne W. Mackey, erecting engineer of the company, at the Broadway pumping station of the Toledo Water Works, Toledo, Ohio. It has the distinction of being one of the greatest pumping engines of its class ever constructed, and cost $83,000.

The pump is of vertical triple expansion design. All of the cylinders, heaters and steam lines connected with this giant pump are insulated with J.-M. coverings, furnished by the H. W. Johns-Manville Co.

At a meeting of the local organization of the United Mine Workers of America held at Nanaimo, Vancouver Island, B.C., on the night of July 20, the members were informed by letter from Frank Farrington, member of the headquarters executive board (and the one chiefly responsible for many of the island miners having gone on strike May 1, 1913, notwithstanding that in doing so a considerable number of them broke their agreements with the operators in leaving their work at that time), that no more strike money would be paid to the men on strike, owing to the unfavorable condition of the finances of the International union. An exception was made in regard to a sum of $15,000 to be available for special relief in cases of emergency. The position of the strikers is a serious one, for only one of the four companies operating on Vancouver Island has complied with the demands of the union, and that one, the smallest company. The other three have all the men they can find work for, and many others on their waiting list if at any time there are vacancies. The demand for coal is not now sufficient to keep all the mines working full time, the market having been partly lost to the island companies after the production of coal was stopped by last year's strike.

ANGLO-FRENCH EXPLORATION CO.

In our June 1 issue it was stated that the capitalization of this company is £15,000,000. We are advised by the Canadian representative of the company, Mr. J. B. Tyrrell, that the capitalization is £1,000,000.

HOCK! DER KAISER.

(This bit of doggerel, written by Rodney Blake and read publicly by the late Rear Admiral Joseph Bullock Coghlan, U.S.N., in 1899, with the result that an international "incident" nearly followed, probably expresses the opinion of a large portion of the world's population concerning the present attitude of the German war lord.)

Der Kaiser of his faterland
Und Gott on high all dings command,
Ve two—ach! Don't you understand?
Myself—und Gott.

Vile some men sing der power divine,
Mine soldiers sing "Der Wacht am Rhine."
Und drink der health in Rhenish wine
Of Me—und Gott.

Dere's France, she swaggers all aroundt;
She's ausgespield, of no account,
To much we dink she don't amount;
Myself—und Gott.

She will not dare to fight again,
But if she shouldt, I'll show her blain
Dot Elsass und (in French) Lorraine
Are mein—by Gott!

Dere's Grandma dinks she's nicht small beer,
Mit Boers und such she interfere;
She'll learn none owns dis hemisphere
But me—und Gott.

She dinks, good frau, fine ships she's got,
Und soldiers mit der scarlet goat.
Ach! We could knock them! Poof! Like dot,
Myself—mit Gott.

In dimes of peace, brepare for wars,
I bear de spear und helm of Mars,
Und care not for a thousand Czars,
Myself—mit Gott.

In fact, I humor efery whim,
Mit aspect dark und visage grim;
Gott pulls mit me, und I mit him,
Myself—und Gott.