CANADIAN MINING JOURNAL

Vol. XL GARDEN CITY PRESS, Ste. Anne de Bellevue, DECEMBER 3, 1919. No. 48.

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PROVINCE OF ONTARIO

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G. H. FERGUSON, Minister.

Ontario's Mining Lands

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Thos. W. Gibson,
Deputy Minister of Mines,
Toronto, Canada

More than ever the Mill determines the profit

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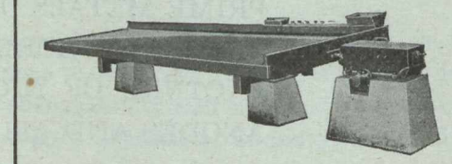

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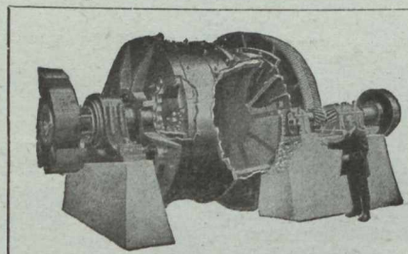

The New 86 Marcy Ball Mill showing grates, liners and balls

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Published every Wednesday by The Mines Publishing Co., Limited, at the Garden City Press, Ste. Anne de Bellevue, Que. 'Phone 165.

J. J. Harpell, Managing Director.

A. S. Christie, Eastern Manager,
Room P.-30, Board of Trade Building, Montreal.
'Phone Main 2662.

H. W. Thompson, Western Manager,
1402 C.P.R. Building, Toronto.
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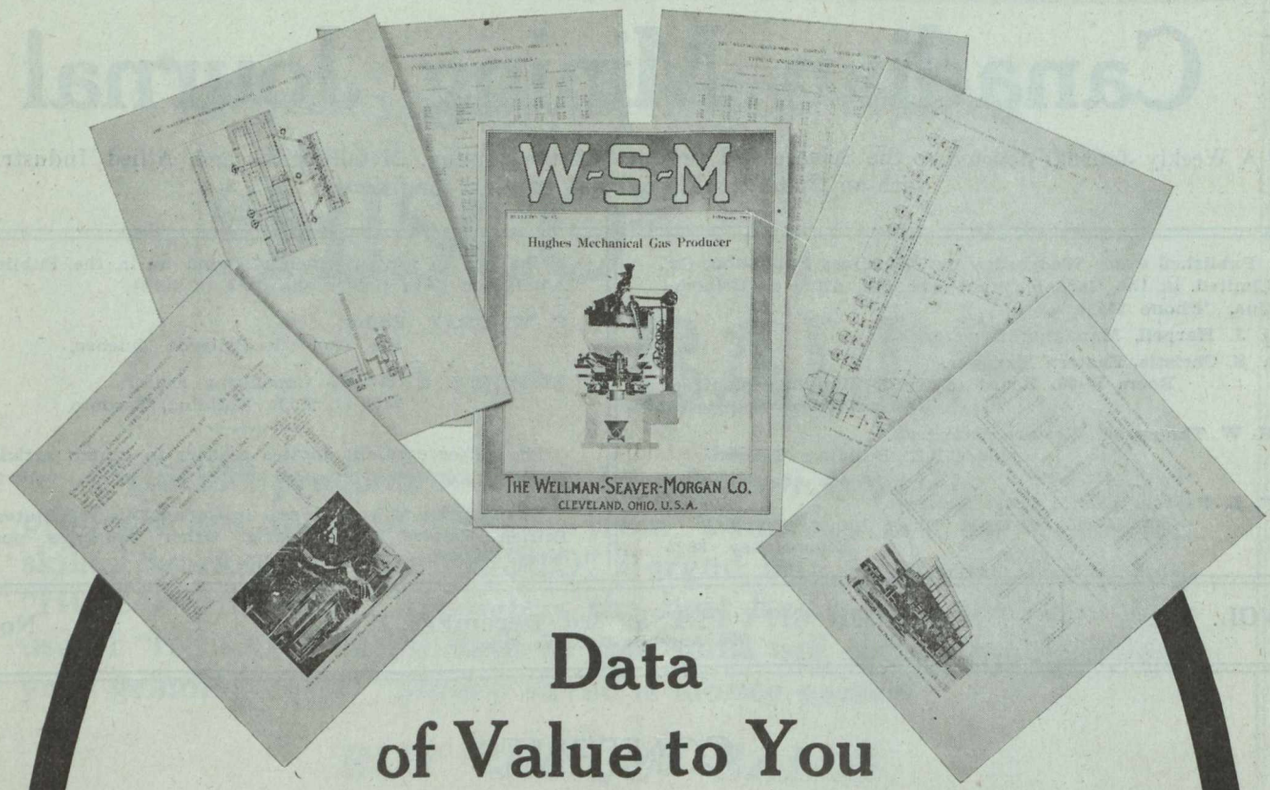
VOL. XL. GARDEN CITY PRESS, 3rd December, 1919 No. 48
Ste. Anne de Bellevue, Que.

CONTENTS

Pages 897 to 916.



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EDITORIAL

A Graphical Summary of the Chronology and Progress of Canadian Mining

(By the Editor.)

Most essays and articles are illustrated after they are written, and pictures or diagrams are used, as the term signifies, for the purpose of throwing additional light on the subject discussed, but in the present instance, the graphs which are herewith reproduced were drawn first, and they constitute the main purpose of this article, which is, indeed, but comment suggested by the tendencies disclosed by the graphs. They are compiled from the statistics of the Division of Mineral Resources of the Mines Department at Ottawa, the value of which statistics we desire to acknowledge, together with the unfailing courtesy of its Chief, Mr. John McLeish.

Figure 1 shows the value of the mineral production of Canada over the last twenty years. The most striking disclosure of this graph is the predominance of Ontario. Quebec shows a gradual, but healthy, growth. The growing importance of Manitoba is reflected in the rise of the combined curve of the Prairie Provinces and the Yukon, but the scale is too large to show how Manitoba is making up for the falling off in the Yukon gold production. We venture to forecast that some day the value of the coal production of Alberta alone will exceed the value of the mineral production of any other single province of Canada, unless maybe it shall be British Columbia. The import of the concentration of the coal resources in the Province of Alberta is not by any means realized by the Canadian public. The combined curve of the Maritime Provinces is not, we believe likely to increase greatly, first, and chiefly of course, because of the comparative territorial smallness of these provinces, and, secondly, because the bulk of the value of their mineral production is derived from coal; and, in our

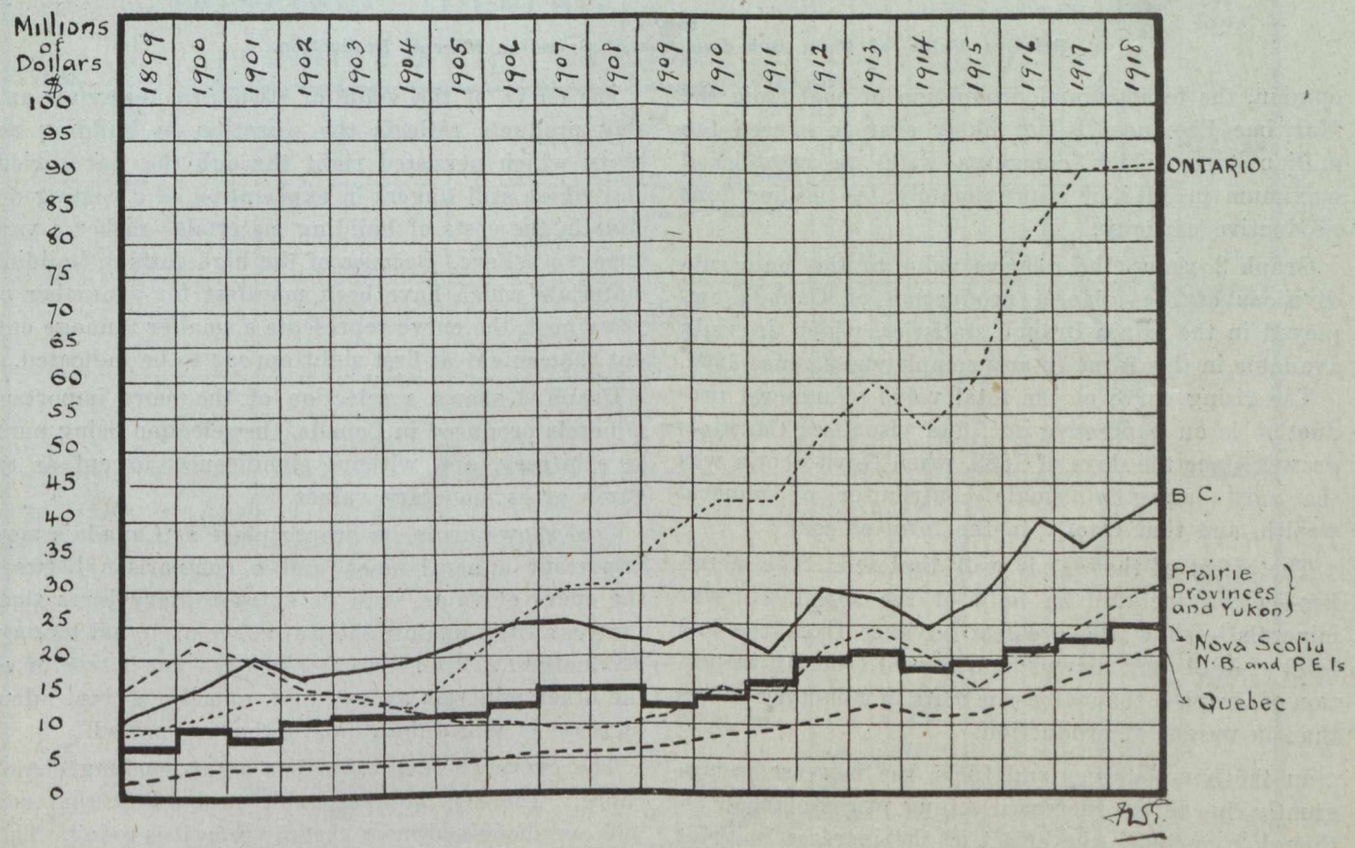


Fig. 1
Value of the Mineral Production of Canada over 20 years, by Provinces.

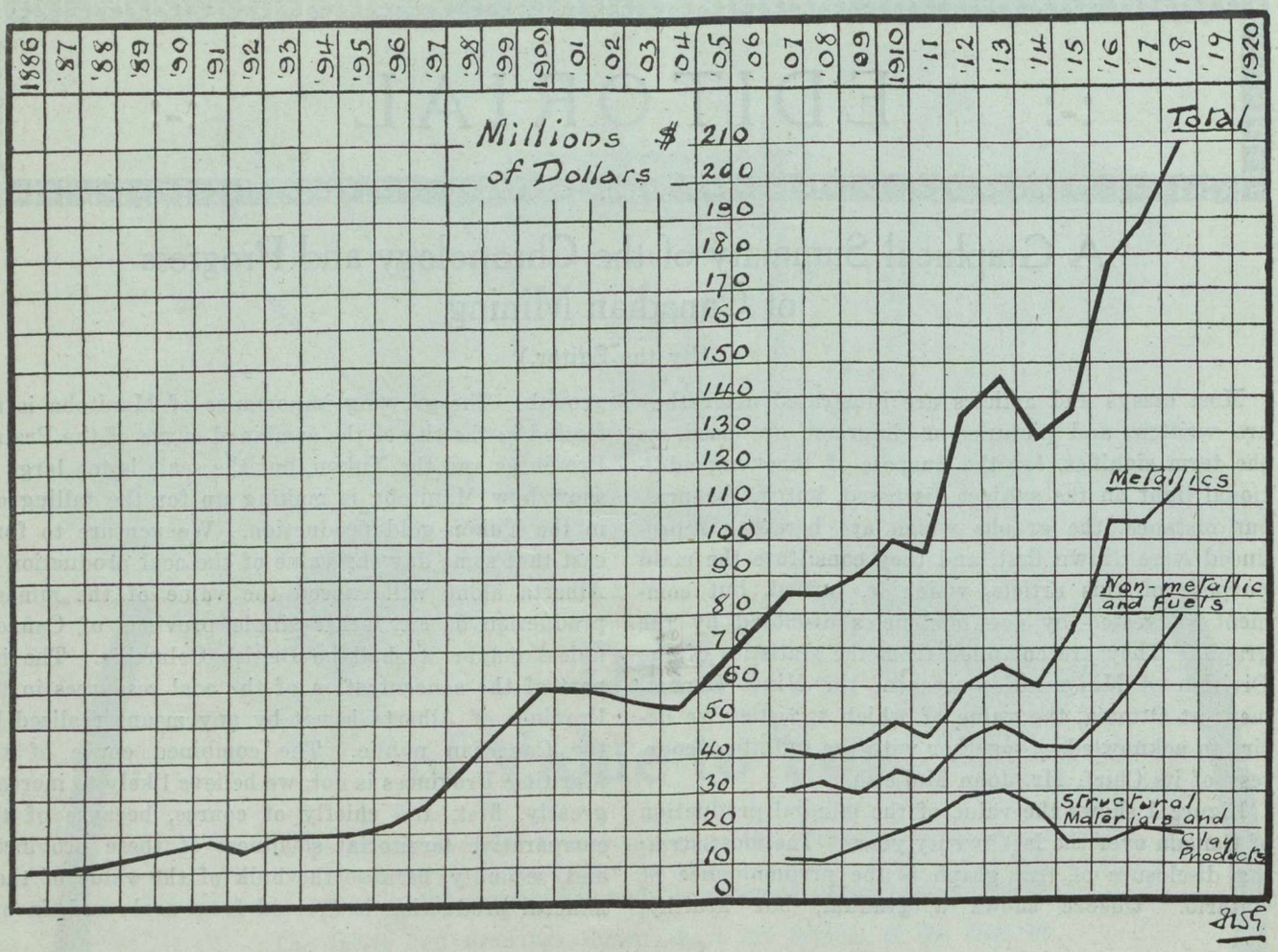


Fig. 2
Relative Value of Main Sub-divisions of Canadian Mineral Production.

opinion, the total annual production of coal from the Maritime Provinces is not likely ever to exceed ten million tons, which compares with an established maximum in 1913 of approximately 7½ million tons productive capacity.

Graph 2, shows the relative value of the main subdivisions of the mineral production of Canada employed in the Mines Branch statistics, which are only available in this form, in any completeness, since 1907.

The rising curve of the total value of mineral production is an impressive one, and visualises Canada's growth since the days of 1886, when Nova Scotia was the most important single contributor of mineral wealth, and that chiefly in the form of coal.

The effect of the war is well disclosed. The metallics—which include the bulk of the so-called "war minerals"—show the greatest advance from the low level of 1914, but, as will be observed from an inspection of Graph 3, the increase is more in monetary values than in weight of production.

In the non-metallics and fuels, the increase is also greatly due to the increased selling prices of coal, although it includes the effect of the increase in price in such war minerals as asbestos, chromite and magnesite.

The curve of the value of structural materials and clay products reflects the cessation in building activity which persisted right through the war period, and which still lingers in expectation of a coming decline in the costs of building materials—rather a vain hope we believe. Because of the high costs of building materials which have been manifest for a number of years past, the curve represents a smaller tonnage output than might at first sight appear to be indicated.

Graph 3 shows a selection of the more important minerals produced in Canada, the selection being purely arbitrary, and without significance, except as regards gross monetary values.

Coal shows up in its proper place as Canada's most important mineral asset, and a comparison between the curve of value, with its extraordinary jump since the year 1915, against the flat curve of actual tonnage production, will serve to emphasise, what is true of all the other minerals except gold, namely, a tremendous increase in unit values during the war period.

The curve of coal value has a far-reaching significance. There is no reasonable probability that coal will ever be mined more cheaply than it is today. That is to say, it may be mined at less apparent monetary cost when, and if, deflation should take place in gen-

eral commodity prices, but the expenditure in effort and the provision of the materials necessary to the extraction of coal, are outlays that must steadily increase, and the instrinsic value of coal will in the future become greater and greater from year to year as the available supply of the raw material is lessened, and as coal obtains a more and more extended use through the spread of the civilized arts to all quarters of the world.

Coal being the material on which all manufacturing costs are based, and a material which is moreover required to provide the power for the extraction of all other minerals, it follows that the curve of costs of most things must follow the curve of the cost, or market value of coal. As every indication forecasts a continuing increase in the selling price of coal, it seems fairly certain that a considerable proportion of the increased unit values of minerals is a permanent increase.

The high place occupied by nickel and copper production, and the declining curve of gold and silver values, will surprise a good many people who hear more of Cobalt and Porcupine than they do of Sudbury and Trail.

The curves display in an interesting way the chronology of Canadian mining. The Klondyke boom shows in the gold curve in the peak of 1900, four years after the discovery in 1896. The result of the discovery of the Cobalt silver veins in 1903 shows in the curve about 1905, rising rapidly to the large and sustained production of the period from 1910 to the outbreak of the war, when adverse influences affected both the market for silver and producing operations. The position of the silver curve in 1918 does not of course reflect the unpredented price of silver today, which in

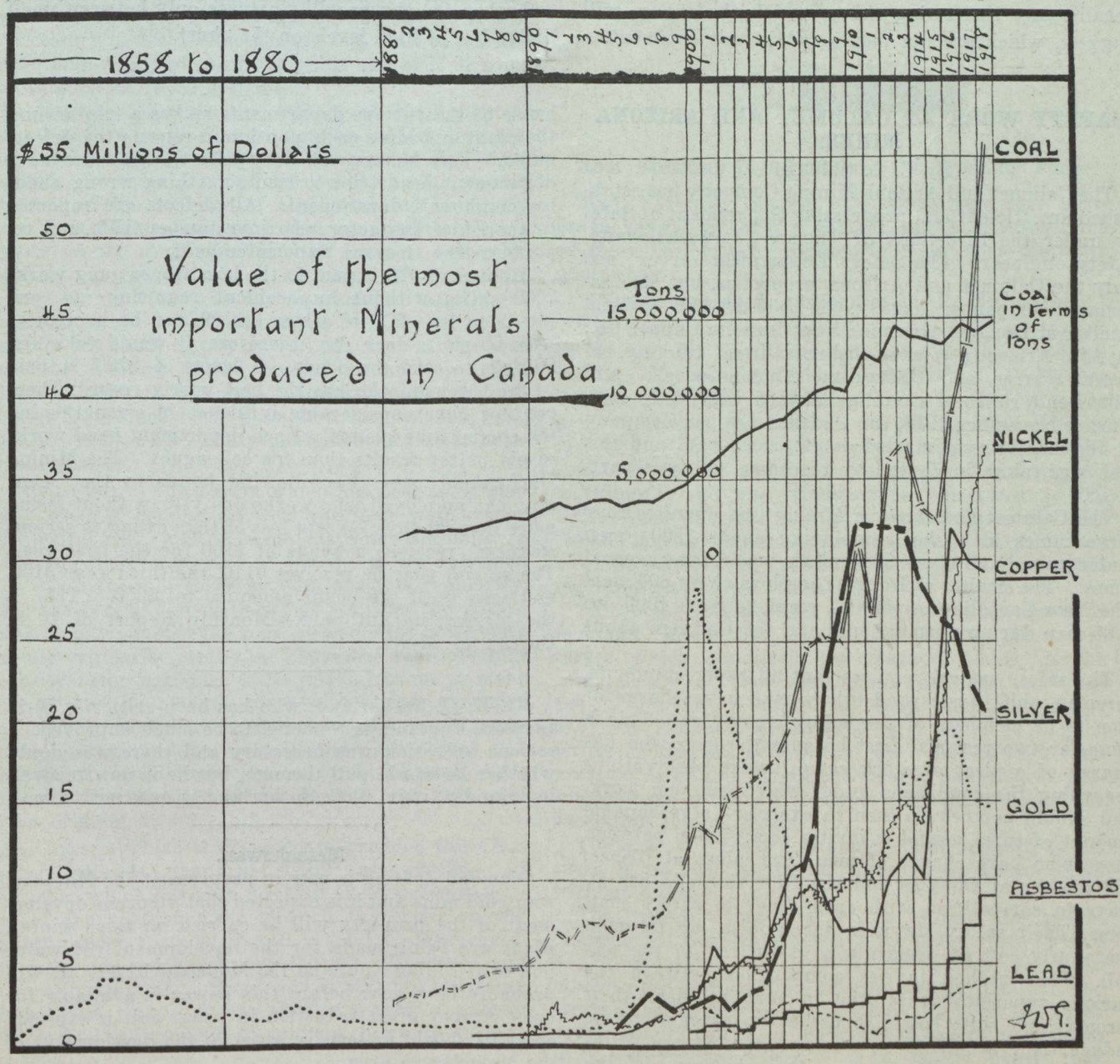


Fig. 3

the course of the year 1919, will to some extent offset the drawbacks to production that took place from various causes.

Copper, lead and asbestos all show the stimulus of war demand, while gold shows the effect of high costs of production and shortage of labor, combined with a fixed selling value for the product.

Iron ore is not shown in Graph 3, as its relative money value is small, and the production is stationary, or declining.

A previous article in the "Journal" (see page 606, issue of 13th August, 1919) contained graphs which showed in some detail the production and consumption in Canada, and the imports and exports into and from Canada, of iron-ore, iron and steel, coal and coke.

Those who are more familiar with the mining history of Canada than it is the writer's privilege to be, may recall many interesting things which the curves will suggest, which are not mentioned in this comment.

The graphs are published because they seem to form a convenient and easily comprehended summary of the chronology and unremitting progress of Canada's premier industry, and because they illustrate the value and wide scope of the work of compilation and recording which has been slowly built up in the Department of Mineral Resources and Statistics at Ottawa, without which the preparation of the accompanying graphs would have been a practical impossibility.

One general impression is conveyed by a study of the graphs, which it is not easy to express. It is perhaps a necessary concomitant of the early development of a highly mineralized continental area, not half prospected, that the curves suggest a certain fortuitousness in mineral discovery, or the chance uncovering of **some** of the mineral treasures of Canada. Possibly, Canada is now entering upon a period when mineral discovery will be of a more systematic and consistent nature, and when the curves will fluctuate only between small limits, but at high levels on the chart.

SAFETY WORK AT CALUMET AND ARIZONA MINES.

(By C. L. Colburn.)

The Calumet and Arizona Mining Company has established an efficient and progressive Department of Safety under the directions of Thomas Cowperthwaite, safety engineer. The Safety Department serves not only the Calumet and Arizona properties, but also associated companies; namely, the Calumet and Arizona smelter at Douglas, Arizona; New Cornelia Copper Co., at Ajo, Arizona; Warren-Bisbee railroad running between Warren and Bisbee; the Tucson-Cornelia and Gila Bend railroad running between Gila and Ajo. During November 1918, the Gadsden Copper Company at Jerome, Arizona, started development work and this also was taken in charge by the same safety department.

The Calumet and Arizona Mining Co., operates four large mines at Bisbee, employing about 1500 men underground and about 500 surface men during normal times. The smelter at Douglas employs about 800 men. The New Cornelia Copper Co., employs from 1000 to 1200 men during normal times and the Gadsden about 50

The safety system requires that all superintendents, foremen, shift bosses and others who have charge of men to be members of the safety committee. This is done for two reasons; first because the man who has charge of a piece of work should make observations regarding the conditions under which his men work, and should compel his men to exercise a reasonable amount of care, second it invites competition between those who have charge of men. The mines at Bisbee, the smelter at Douglas and the New Cornelia are always in competition with each other in safety matters. Their safety status is determined by figuring the yearly cost of accidents as compared to the pay roll. This method invites competition between the various superintendents who in turn require their foremen and shift bosses to use extra precautions to reduce their accidents to a minimum. At the New Cornelia copper mine, a committee composed of the heads of the various departments makes a trip around the plant and mine each month and reports the defects noted. This has proved very effective because each department head tries to find something wrong about his neighbor's department. All defects are reported to the Chief Inspector who investigates them and reports to the General Superintendent.

A bonus of $30 is paid to the boss whose gang works 2500 shifts without an accident requiring an employee to lay off. If a boss has 50 men he is credited with 50 shifts each day, therefore, it would take him 50 days to earn the bonus. A bonus of $100 is paid to the foreman who has the best yearly record. These bonuses have considerable influence in strengthening the competitive system. Each department head works to get better results than his colleagues. The Mining Department pays the following bonus to the men: any man employed who works one year without losing more than 30 days (except loss of time owing to serious sickness) receives a bonus of $100 for the first year. The second year he receives $110, the third year $120, and soon until the bonus amounts to $250. This is the largest amount paid.—Monthly Report of U. S. Bureau of Mines.

Mr. H. H. Sutherland, who has been critically ill in London, England, is reported to be much improved. A serious operation was necessary and there was doubt whether he would pull through, but he is now recovering rapidly. Mr. F. C. Sutherland is now with him.

Metachewan.

Diamond drilling is now in progress at the Matachewan gold mine and it is expected that vigorous development of the property will be carried on this winter. Plans are being made for the development of water power at Indian Chute on the Montreal River. It will probably be a year before this power is available for use. A very great reduction in power cost is expected and this should materially assist in the development of the Matachewan area.

Roof Control in Coal Mines

By JAMES ASHWORTH.

This subject is one of the most important of the large number of safety problems which have to be faced and vanquished by every colliery Engineer, Manager and official, and is moreover a most important matter of their daily work. On opening up a new coal mine the operators and engineers have to decide on what, in their opinion, will be the safest and most economical system for operating and extracting the largest per centage of the coal seam or seams. To arrive at this decision many things have to be taken into consideration, for instance, there may be a heavy overburden which means a huge pressure per superficial foot; (2), the overlying strata may be either very hard medium or very friable, particularly as regards the nether roof; (3) the floor also may be either favourable or unfavourable; (4), the seam may be abnormally thick; (5), its gaseous nature may be abnormal; (6), its faultings may require special attention, and lastly, it will be necessary to decide whether the coal shall be worked on the long-wall system or the pillar and stall or some modification of those systems.

In British Columbia the subject of Roof Control has not received as much notice as the subject deserves, and consequently great losses of valuable fuel have resulted. In some parts of the world careful records are kept of the tonnage of coal produced from any given area. Thus, supposing that an operator pays a royalty on the number of tons he extracts and sells, without any restrictions on his mode of extraction, he may through careless mining abandon large areas of pillars, but if on the other hand he is forced by the terms of his lease to pay for all the coal in the area under his holding at the rate of so much per foot thick per acre, then it will manifestly be to his advantage to extract every possible ton of saleable coal, and thus reduce his royalty charge to its lowest practicable amount.

"Roof Control" is a term which has been most generally used in connection with the long wall system of working coal, and in some districts especially in Great Britain has become so precise in its operation as to cause the roof to break with absolute regularity. Thus, the dirt and rock packs or walls in the goaves which mainly support the roof, also squeeze down with absolute regularity, and thus cause the roof pressure on the working coal face to be just sufficient to make the coal work and break down without any excessive crushing. In most of such cases the roadways are maintained by taking down part of the nether roof and using the material thus obtained to build pack walls which in time are crushed and become nearly as solid as the original strata.

Any system which is designed to produce this final result demands that as little as possible of the timber which has been used for the temporary support of the roof shall be allowed to remain in the goaves. Such systems therefore tend to save excessive costs in prop wood and chocks. Wherever any long wall system of working coal is put into operation for the first time, there is always a great tendency to leave timber in goaves to support the roof, whereas the real benefit to be derived from it is obtained by allowing the roof to break down or bend, and get into close contact with the floor in regular sequence. In a gaseous or fiery coal mine the long wall system of working will always give the safest results, because gas given off from the floor finds an easy escape over a large area, and avoids those dangerous localised outbreaks which are too frequently a feature of its escape in the limited area of the rooms of the pillar and stall system. The long wall system also assists in drawing gas out of the coal through the break in the roof which occur in advance of the working face. (see sketch Fig I).

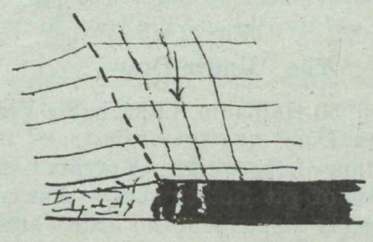


Fig. I

Roof Breaking in Advance of the Working Face.

Many carefully thought out papers have been written on the subject of roof control, and from at least one of these the writer proposes to make some apposite quotations.

"Quotations from authorities on Roof Control.

The author of most of the following quotations is Mr. H. W. G. Halbaum, who is well known through his connection with the Universal Mining School of Cardiff, Wales, and who in 1904 won the prize offered to the Institute of Mining Engineers by Mr. C. H. Claghorne. This paper was entitled "The Action, Influence and Control of the Roof in Longwall workings": and was published in Vol. xxvii. p. 205 1904. This was followed by a second paper on "The Great Planes of Strain in the Absolute Roof of Mines" (Vol. 30 p. 175-201), 1905-1906, from which the following notes have been taken.

"Have the forces which caused the thrust planes of Scotland absolutely ceased to exist? Have the forces which produced the cleavage plains in the coal seams of Northumberland and Durham left the strata in a state of high compression or not? Is resilence a property or not?.....The writer cannot but believe that the relief of high compression in mining strata provides a reservoir of horzontal force sufficient to impart the obliquity of the ascending line of strain.....

The case of "creep" is homely, but suggestive. If there is no real horizontal force, creep is an effect without a cause.....

The "creep" therefore is due to the true lateral extension of the strata beneath the under draw, Fig 2, and this lateral extension is due, evidently not so much to the vertical force transmitted through the coal stratum as to the pre-disposition (induced by super compression in situ), of the strata to extend themselves in the horizontal plane". You cannot break rock with a hammer whose head is formed with coal, neither

*Mining Engineer, Livingstone, Alberta.

can you transmit crushing stresses to rock through a coal medium enjoying lateral freedom..... To recognise a horizontal motive force, therefore is merely to recognise a difference of horizontal resistance.....

The relative draw extends from one eighth to two thirteenths of the depth of the surface.

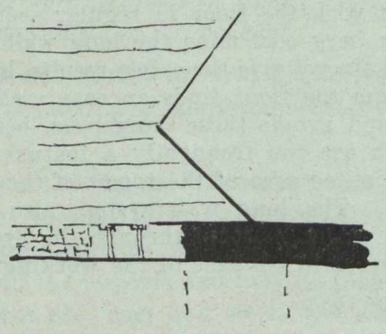


Fig. 2.
The "Under Draw".

Page 108 Vol. 30 Halbaum. Improbable Verticality of the Elementary Line.

"Consideration of the weight of strata overhead and of the strength of pit timber shows that mines must always be largely dependent on side thrust for the main support of the absolute roof, and this efficient side thrust can only be generated when the great lines of strain and principal fracture make an angle with the vertical. No one really believes that any wooden prop or any system of timbering can sustain either the dead or the live load—of the absolute roof. The office of the timber is merely to conserve the comparative integrity of the nether roof, and its efficiency is established when it performs this office successfully. The great lines of strain in the absolute roof are deflected from the vertical by angles which throw the bulk of the weight either back on the packs and dead strata or forward against the face of the prime strata. But if from any abnormal cause, they swing into the vertical line, the results are vertical slips of strata which may either smother the face of work, or superinduce those violent, though happily rare phenomena known as "bumps", outbursts of coal, liberation of large volumes of gas, with possible explosions of firedamp and wholesale destruction of life, limb and property. Such slips are strong presumptive evidence that the normal elementary line is not a vertical line. A vertical elementary line is an abnormal line, and produces abnormal phenomena.

Page 184,—mining engineers commonly say that the roof "arches itself". Fig. 3. An old road used as a return airway will arch itself, whether it runs in the direction of the working or at right angles thereto. Why? Because the roof of the road is a bridge across the road; a beam supported at both ends. Below the neutral surface, all the strains in the strata are tensile, above, all are in compression. When the bridge collapses, the roof arches itself.

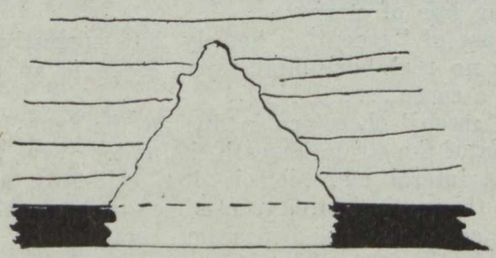


Fig. 3.
Roof Arching.

Page 185,—The arching of the nether roof is a very superficial process. The evidence for the great horizontal motive force which deflects the action of the absolute roof must be sought in the study of more massive phenomena.

Page 187,—And so the repetitive phenomena proceed to the very surface, each succeeding stratum, whether stable or unstable, propagating its strains further toward the solid than did the stratum below, and each, as it gives way, continually enlarging the area of subsidence. Thus the whole volume of subsided material finally assumes the approximate shape of an inverted conic frustrum, Fig. 4.

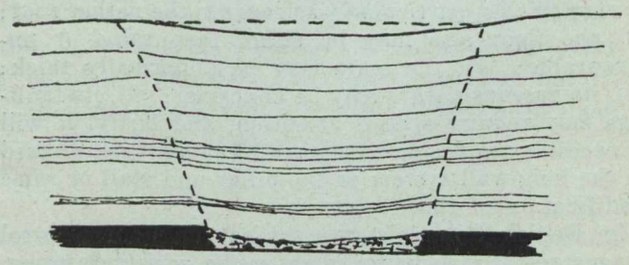


Fig. 4.
Showing upward propagation of subsidence strains.

Page 187,—The Cantilever Idea and its Corollary,—The conception of an ascending line of strain projecting over and towards the solid has been said to be incompatible with the idea of a cantilever action of the roof strata.....A cantilever possesses a neutral surface and above it all the stresses in the beam of strata are of the compressive order. The uppermost tensile stress and the lowermost compressive stress are the maxim of their respective orders; and both orders of stress regularly diminish as the planes on which they act approach nearer the neutral surface, at which plane both kinds of stress are reduced to zero."....When the roof of a road collapses, the roof arches itself and the wider parts of the arch occur where the tensile stresses are greatest.....The greater the stress is any given plane the greater will be the distance through which the resultant strain is propagated towards the solid." Thus in the cantilever of roof-strata, seeing that the maximum compressive stress obtains in the roof line, the strain in the immediate roof stratum must be propagated further towads the solid than the strain in the stratum next above will be propagated.... The compressive stress in the third stratum is again less than in the second, and the strain is propagated to a distance which falls short of that obtaining in the strata below; and so on until we arrive at the neutral surface where stress and strain vanish.

At the terrestrial surface we find the maximum propagation of tensile strain along the line of the draw and that the upper roof arches itself in obedience to the differential tensile stresses in the cantilever, but the arch is now an inverted one." Fig 5..

In all probability, the compressive component with its opposite obliquity is confined to the first few feet of, or above the roof stratum. The fact that it exists at all explains why careful timbering is requisite for

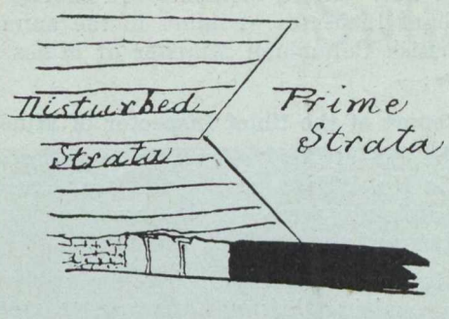


Fig. 5.

safety, and the exceeding superficiality of its extension explains why such timbering is sufficient to ensure safety."

Page 194,—So called good roofs, sandstones more than others perhaps, are peculiarly liable to those instantaneous reversals of stress which accompany any shift of the neutral surface; and this is so by reason of the peculiarly immense disparity of the respective resistances offered to tension and compression by any cantilever associated with an absolute roof the lower layers of which are chiefly furnished with a strong sandstone strata, or by other strata of similar nature.

Mr. Halbaum when writing the paper just referred to said that the first paper he wrote (his prize Paper), on The Action, Influence and Control of the Roof in Longwall Workings, (Inst.of Mining Engineers Vol. XXVII, 1904) would be better if read in the reverse order and therefore the quotations are in this order.

"The roof of a coal mine exerts two pressures. The first is a vertical pressure and due to gravity, and the second is a horizontal line of pressure due to the lateral compression of the rocks.

The influence of the roof on the coal to be gotten is to make the latter easier to be gotten.

In the bored and pillar system the action of the roof is more nearly allied to that of a simple weight,—in longwall it is more nearly allied to the action of a powerful lever,—we may bend the lever or we may snap it at its fulcrum.

Mysterious accidents due to falls of roof stratum sometimes occur under an apparently good roof. If we assume that the examination took place in the interval between the action of two stresses of opposite kinds the mystery disappears. We should therefore trust no roof whatever but carefully timber all.

In working to the dip the lateral thrust of strata beyond the face line is resisted by all the weight of the strata behind; whilst in working to the rise the lateral thrust of the strata beyond the face line is not merely unrestricted but is in a very positive sense facilitated by the weight, which naturally tends to slide down hill and thus accentuates the draw at the surface and exerts a mangling action on the coal head such as cannot be obtained in working to the dip. On the other hand, the roof is more liable to break off at the face line at rise workings, unless the packs be kept well up to the face.

Working to the rise also involves a larger expenditure of timber than does working to the dip.

Coal is more easily worked by the miner when the direction of the workings is at right angles with the direction of the cleavage.

In some cases it is necessary to change the direction of the line of working. The thrust which produces the draw at the surface and "mangles" the coal below is greater in magnitude and richest in power when the direction of working is at right angles to the line of cleavage. The compression of the coal itself is greatest in the line at right angles to the cleavage, and the coal is thus more likely (on its own account), to burst out from the face in such circumstances. The planes of cleavage divide the coal into a number of vertical slices, which run parallel with the face line.

Most long wall men prefer if possible to advance their longwall workings directly across the cleavage.

With a straight face roof action may be unduly violent and then the stepped longwall may be adopted and has often proved effective where a straight face was a practical impossibility.

We may find a weapon of roof control not only in the direction of working but also in the rate of working.

It is necessary to keep pack walls well up to the face of the coal.

The most successful working of longwall demands a roof only moderately strong.

Props tapered or chamfered at the ends ought to be used so that the ends will fuzz up instead of breaking when exposed to roof weight."

"Bumps" in coal mines of Crows Nest Pass District.

This question of roof control has been brought most prominently before the notice of coal mine owners, officials, miners and the public of Western Canada through several disasters at the Coal Creek mines of the Crows Nest Pass Coal Co. Ltd. A short resume of these will serve as an introduction to the subject, and possibly lead to practical solution of the problem of how to work these mines with greater safety, and with the least loss of coal. The frequency of what are locally termed "bumps", have made these mines notorious. Their cause being mainly attributed to movements of the roof strata, caused by insufficiency in the size of the pillars in the workings, but they were not seriously considered until after several fatal accidents had occurred.

The first recorded bump was in June 1906, on the south side of Coal Creek in No. 4 East level of No. 2 mine, when the floor was lifted. The 2nd and 3rd occurred in the month of August 1906, between Nos. 1 and 2 West levels, affecting the roof, and gas was given off. The 4th occurred on the 3rd of January 1907, in a room 18 feet wide, between Nos. 3 and 4 West levels, where the pillars were 25 feet wide. This bump caused an emission of gas, and displaced a piece of timber which fell on the miner and killed him. The 5th, occurred on the 22nd of July 1907, when a miner who was taking a skip off a pillar was killed by a fall of roof and side. Again on the 9th of October, a miner was suffocated by a sudden outburst of gas in a room off No. 4 West level. On the 19th of June, of the following year, three men were killed in a room off No. 6 West level, when the floor lifted to within two feet of the roof, and also gave off much gas.

Dept. of Mines directs new system of panels.

This accident caused in Minister of Mines to take action, and in June 1908, the Coal Co. were asked for a plan of a proposed new panel system of working, in which the rooms were to be 25 feet wide, and the

pillars 45 feet, but before it could be put into operation, another and more extensive bump occurred, viz, on the 31st of July 1908, somewhere between the 3rd and 4th West levels and westwardly of the main haulage road which was driven on a north and south line. At the time of the bump a skip was being taken off the side of the air road on the west side of the haulage road pillar. Three men were killed and one other who was rescued alive also died afterwards from shock. The bodies of one man and two horses were not recovered. It is known that the floor lifted and large volumes of gas were given off. To what extent the roof fell is not known, but some of it did fall. In all previous cases the lifting of the floor was the main feature of the disturbance, with an outburst of gas. In this latter case 24 men were involved, and twenty of them survived through making use of the air in the compressed air pipes which thus kept them alive for seven hours. The 9th and last bump in this area is said to have occurred on the 29th of September 1908 the effect of which was not known.

Provincial Mineralogist detailed to investigate and report.

After the bump of July 31st 1908, the B. C. Minister of Mines sent up his Provincial Mineralogist to make a special investigation and report, which was rendered on the 18th of November 1908. In this report very drastic recommendations were made but were however agreed to by the General Manager of the Company, although it entailed the entire closure of all the workings south of No. 1 West level. This area was outlined on the plan in red ink and comprised an area of over 50 acres. Further it was agreed that if the bumps continued this prescribed area might be enlarged. No roadways were to be driven through it, and it was also agreed to leave a barrier pillar between any new workings in the virgin coal and the prescribed area. It was also clearly explained that these definite conditions were laid down so as to prevent the company's officials changing this policy.

In additions to these restrictions a plan for the future development of the mine (No. 2), by a so called retreating long wall system of panels was agreed to, and development to carry out this plan was commenced, but on a change of management occurring it was found that the scheme was impracticable and later was entirely abandoned.

The new management then commenced to develop the same seam of coal from the main No. 3 slope, on the advancing long wall system, and this plan was followed for some years without any bump or gas outburst troubles, until another change in the management occurred, and it was decided to return to the pillar and stall system with larger pillars than had heretofore been customary. The main reason for this change appears to have been that the management thought that the pillar and stall system would produce cheaper coal than the long-wall system. This larger pillar and stall system has continued until the explosion in No. 3 mine in April 1917 brought the extraction of this coal seam to a temporary standstill.

Bumps were not however confined to No. 2 mine, and in 1916 there were bumps in No. 1 East mine, which are said to have exceeded in extent and destructiveness every other manifestation which had preceded them, though fortunately with a minimum loss of human life. These incidents are shortly reported by the Chief Inspector of mines in the annual report of the British Columbian Minister of Mines for 1916, as follows:—

Report of the Chief Inspector of Mines.

"On the 7th of November 1916, a series of bumps occurrel in No. 1 East mine of the Coal Creek colliery which completely wrecked the inner portion of the mine and caused the death of one man.

These bumps occurred during the early morning when the repairing shift was at work. A rescue party was quickly organised and on entering the mine found that all the men had escaped excepting one. Whilst attempting to reach the place where this man was supposed to be, another bump occurred about 5-30 a. m. Further rescue operations were then suspended for 24 hours, but were resumed and continued until Monday afternoon the 13th when, about 6 o'clock another severe bumps occurred and the rescue party was withdrawn.

It appears that a bump occurred during the afternoon shift of the 7th slightly injuring a miner in No. 9 room off No. 14 East level. The fire boss then removed the men, but owing to a cave in No. 8 room a horse was left inside.

The bumps of the 8th principally affected No. 14 East level though they also affected No. 12 West. The night repair shift of the 7th-8th finding the place "uneasy" retired back along the level, and here ten of them, with two firebosses, were blocked in by caves of roof on either side of them. After three hours work they managed to scramble out leaving one man and one horse unaccounted for.

The effect on the mine was, that all of it, to the south of No. 10 East and West levels was badly caved, in 65 working stalls all the stoppings being blown out, air doors destroyed, and fan air doors were forced open, the ventilation reversed, and the air concussion effects are said to have been felt five miles away.

Less than 25% of the coal had been taken out by the room workings and no pillaring had been done. Another bump on the 13th of November, again destroyed all the ventilating doors, and caused a great upheaval of the floor of the main haulage way for several hundred feet in the region of No. 12 levels. After this bump the Chief Inspector of Mines prohibited any further mining inside of No. 10 West level, i. e. southwards from the west side of the mine to Nos. 16 & 17 room on the East level."

Report of Mr. G. S. Rice of U.S.A. Bureau of Mines

Shortly afterwards the Hon. Lorne Campbell, Minister of Mines, called in Mr. G. S. Rice, of the U. S. A. Bureau of Mines, to report and advise as to the cause of the bumps, and the precautions which were necessary to prevent a recurrence This report has now been issued, and the present Minister of Mines, the Hon. Wm. Sloan, has also issued a pamphlet entitled "Summary of Principal Findings in the Crows Nest Field Investigation".

This summary was issued in December 1919, and has reference to the "bumps" in the workings of No. 1 East Mine on the south side of Coal Creek, Fernie, and is based on Mr. G. S. Rice's report.

(To be continued).

Sulphur in Coal*

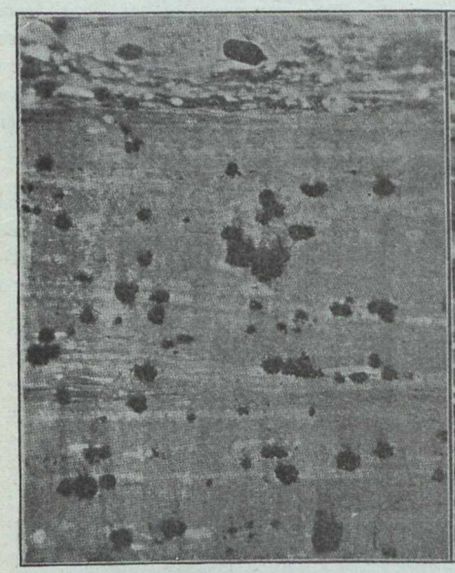


Fig. 1.

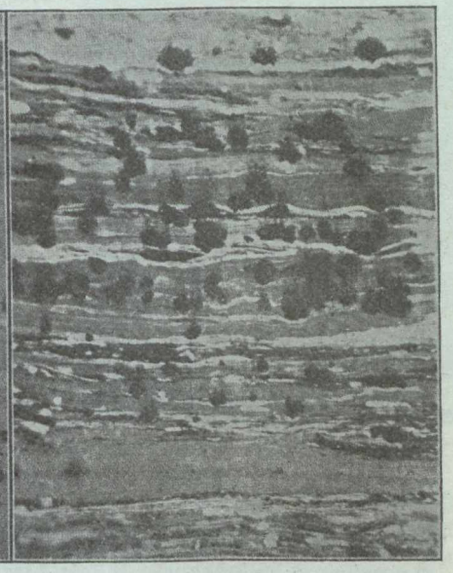


Fig. 2.

Fig. 1,—Thin cross section of coal from Vandalia mine No. 82, near Terre Haute, Ind., No. 5 bed, showing a thin layer of anthraxylous coal with numerous microscopic pyrite globules. Pyrite globules are shown black as irregular roughly rounded areas. Many have been partly broken and fragments, consisting of minute cubes, have been dragged to some distance over the section. Anthraxylon is that part of coal derived from parts of logs, stems, branches, or roots. × 100.

Fig. 2.—Thin cross-section of coal fromVandalia mine No. 82, near Terre Haute, Ind., from No. 5 bed, showing layer of dull coal containing numerous thin strips of anthraxylon embedded in an attritus or debris. Black, roughly round areas represent microscopic pyrite grains; white irregular strips represent cuticles; and short linear patches represent spores. Tendency of pyrite globules is to form rows along thin strips of anthraxylon. Attritus is that part of coal derived from all sorts of macerated plant parts and plant products. × 100.

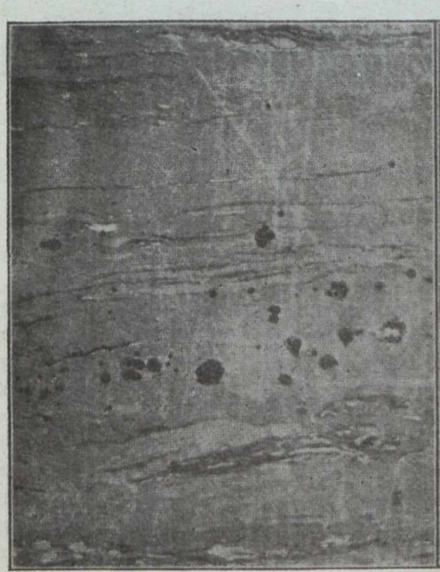


Fig. 3.

Fig. 4.

Fig. 3.—Thin cross-section of coal from La Salle, Ill., showing a layer of anthraxylous coal, including a number of pyrite globules. × 100.

Fig. 4.—Thin cross-section of coal from Sesser, Ill., No. 6 bed, showing pyrite globules in dull coal, which here is composed of thin strips of anthraxylon and attritus; the latter includes spores, shown white. × 100.

Reference was made in our editorial columns in the October issue to the very interesting symposium on sulphur in coal that took place at the Chicago meeting of the A. I. M. & M. E., and while a full reproduction of Dr. Reinhardt Thiessen's paper on this subject would probably not be desirable in a periodical that is prepared for persons who are more concerned in the uses of coal than with its origin or production, a condensation of Dr. Thiessen's treatise, with a reproduction of the microscopic sections on which his conclusions were mainly based, may be not improperly included.

Dr. Thiessen mentioned the better known, and grosser forms of sulphur occurrence in coal, in the form of balls, lenses, nodules, continuous layers, thin sheets and flakes occurring both in the horizontal planes and in the vertical cleavage fissures of coal as it lays in the seam. But pyrites also occur in very fine microscopic particles, disseminated or powdered throughout the compact coal. This form of pyrite occurrence has had little consideration.

All the coals examined by Dr. Thiessen contained a varying amount of sulphur in very small globules, or particles, of pyrite. Their minute size is best appreciated by comparing the illustrations accompanying, in which they are shown at a magnification of 100 diameters, which is equivalent to stating that the entire field covered by the individual slides represents actually a section of coal as large as the ordinary period used in print. The streaked appearance of the globules of pyrite is due to their breaking into innumerable cubical fragments in the process of cutting the section, which distorts the dots of pyrite to some extent.

The amount of pyrite in this form varies econsiderably in different beds from which coals have been examined, and also in different samples from the same bed, or even in different parts of the same microscopic section. No coal section examined has been found did not contain pyrite particles. but no regularity of occurrence has been noticed.

The largest number of the pyrite globules is found in that part of the coal believed to be derived from the woody parts of plants.

Sulphur is an essential element in almost all proteins, which are essential to living organisms, and as coal is derived

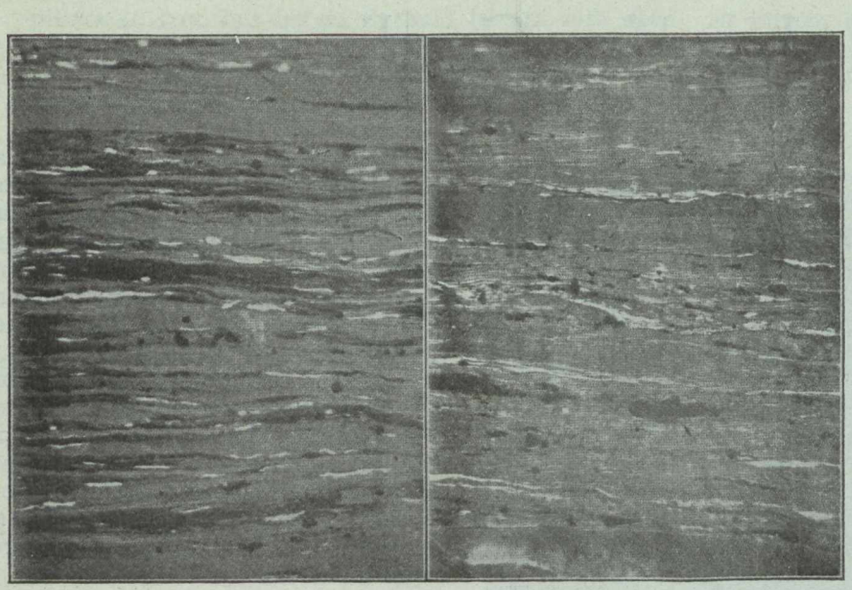


Fig. 5.

Fig 6.

Fig. 5.—Thin cross-section of coal from Shelbyville, Shelby Co., Ill. Pyrite globules are distributed through whole section; here and there, several have joined and others have coalesced. Globules are somewhat smaller than in other sections shown. × 100.

Fig. 6.—Thin cross-section of coal from Sipsey mine of Black Creek bed, Ala. Some of pyrite globules have coalesced into lenticular masses, smaller globules are distributed through whole section. × 100.

Fig. 7.—Thin cross-section of sub-bituminous coal from Stone Canyon, Contra Costa Co., Calif. Coal shown consists of rather finely macerated woody matter, including resinous particles and cuticles, besides pyrite globules, shown in black. × 100.

Fig. 8.—Thin cross-section of lignite from Montana. Section shown consists of macerated woody matter and other plant debris, including some spore and cuticular matter. Only two pyrite globules are shown. × 100.

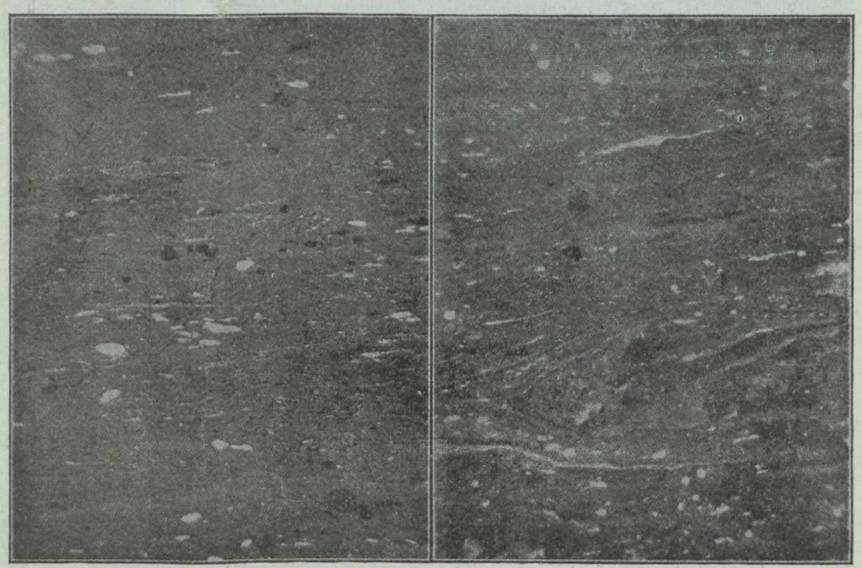


Fig. 7.

Fig. 8.

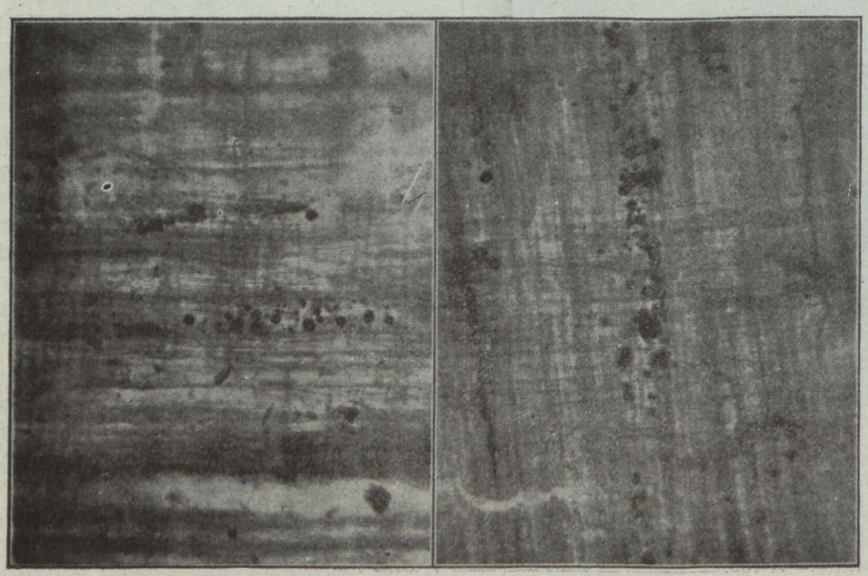


Fig. 9.

Fig. 10.

Fig. 9.—Thin section of woody peat, taken from peat bog near Hayton, Wis. Black dots represent pyrite globules lodged in wood fibers; several have been broken into minute cubical fragments. × 100.

Fig. 10.—Thin section of woody peat taken from peat bog near Hayton, Wis., showing considerable number of pyrite globules lodged in wood fibers. It will be noticed that they are strung out in cavities of wood fibers. × 10.

from vegetation, it must contain at least as much sulphur as the substances from which it has been formed. This form of sulphur is not microscopically distinguishable, and is usually referred to as organically combined sulphur. Regarding this form of sulphur Dr. Thiessen says it has received much scientific attention but has not been sufficiently recognised on the economic side.

Non-protein sulphur exists in plants, and is particularly large in quantity in such odoriferous plants as onion, garlic and mustard, while in some wood ashes it is found up to 3.7 per cent in the case of white pine. Dr. Thiessen notes that the amount of sulphur in plant ashes is not a true index of the quantity present in the plant material, as a certain amount escapes in the burning.

Sulphur is found in all peats, and the process of growth of new and living organisms in the peat bog on top of the residue of plant growth that preceded them, causes a concentration of sulphur in the peat, which is found to contain by actual trial from 0.29 to 4.21 of sulphur. If therefore in the conversion of peat to coal a reduction to one-tenth of the original mass is assumed to have taken place, with no loss of sulphur, then the resultant coal would contain from 2.9 to 42.1 per cent of sulphur. There is therefore more than enough sulphur in peat to account for all the sulphur in coal.

Dr. Thiessen makes more interesting speculations on the part which is played by sulphur bacteria in reducing sulphur to a form in which it can be used by plants, but his remarks are in this respect extremely technical, and moreover the knowledge of the chemical reactions caused by these bacterial organisms is not exactly known today, so that no exact analogy can be drawn with what may have occurred in the age of coal deposition.

Dr. Thiessen's reasoning bears entirely on the form of disseminated sulphur shown in the slides, which he assumes, for the reasons mentioned, to have had a primary origin, and is found in coal today because it is a prime constitutent of the vegetation from which coal is formed.

The grosser forms of sulphur, such as balls, lenses and the large sheets of marcasite that occur in some coals, may have a secondary origin.

Dr. Thiessen's paper would appear to suggest that the "sink and float" test of the sulphur carrying elements in coal, preliminary to installing washing devices for the reduction of sulphur, might be usefully supplemented by microscopic examination of the coal.

F. W. G.

*Abstracted from a paper by Dr. Reinhardt Thiessen on "Occurrence and Origin of Finely Disseminated Sulphur Compounds in Coal", published by permission of Dirctor, U. S. Bureau of Mines, and read before the A. I. M. & M. E. Chicago, Sept. 1919.

COBALT.

Cobalt minerals are rather uncommon except in the Cobalt district, Ontario, Canada, where they occur in ores that are worked for their silver content, the cobalt produced being a by-product. The smelting and refining of this ore has recently been described by Sydney B. Wright (Mining and Scientific Press, Jan, 25, 1919, p. 125.) As these ores are brought to various smelters, according to changes in smelting contracts, the material comes on the market from different places at different times. In the main it is marketed as cobalt oxide, the metal is produced from the oxide by reduction. The principal use of the metal is in the patented alloy known as stellite (about 80 per cent cobalt) which is used as a high-speed cutting tool in place of steel (Transactions A.I.M.E. Vol. 44, p. 573). It is also used in a high-speed tool steel which contains 4 per cent cobalt and 16 per cent tungsten. It is also claimed that it can be used as a substitute for nickel in plating, the rate of deposition being faster than with nickel and a thinner coating giving equal protection. Other uses of cobalt compounds are in the making of insect poisons and also for coloring pottery and glass, to which it imports the shade known as Delft blue, and also certain purple shades.

Official statistics give the output in Canada in 1916 as 841,859 pounds: of which 215,215 lbs. was in the form of metal. The oxide produced amounted to 670,760 lb., and there were smaller quantities of sulphate, carbonate, and hydroxide of cobalt. Up to the present time the supply of cobalt available from the Canadian ores has been abundant to meet all demands.

There are only two sources of cobalt in the United States that are of any importance. A deposit at Blackbird, Idaho, is owned by the Haynes Stellite Co., which has erected a plant for the production of cobalt concentrates. Cobalt, nickel, and copper sulphides occur in association with lead ores at Fredericktown, Mo., and some cobalt oxide is now being produced by the Missouri Cobalt Co. The price of cobalt metal has averaged about $2.00 per pound in the United States.—From Monthly Report of U. S. Bureau of Mines.

Personals.

Mr. J. B. Tyrrell of Toronto expects to return to the district early in December to complete his examination of the Gold Pan property.

Mr. J. B. Tyrrell and Mr. Jas. McEvoy represented the Toronto branch of the Canadian Mining Institute at a meeting of engineers in Toronto on Nov. 25, to discuss proposed legislation with reference to the engineering profession.

The field geologists of the Ontario Bureau of Mines have all returned to Toronto. Mr. P. E. Hopkins is working on a report on the Shiningtree gold area which will be published soon. A detailed report on the geology of the Kirkland lake area is being prepared by A. G. Burrows and Mr. Hopkins who spent most of the summer in that area.

Mr. J. B. Tyrrell and Mr. R. E. Hore of Toronto will leave shortly to examine gold mines in the Rice Lake district, Manitoba. Mr. Tyrrell will complete his examination of the Gold Pan which he visited just before the freeze up. Mr. Hore will examine the Brooklyn mine.

Ontario's new Minister of Mines, Hon. Frank Mills, will leave Toronto this week to visit the Northern Ontario mining centres. It is probable that Premier Drury and the Minister of Lands and Forests will also make the trip.

Special Correspondence

NORTHERN ONTARIO.

The Silver Camps.

An outstanding feature in connection with the silver mining industry of Northern Ontario, inclusive of Cobalt and Gowganda, is the continued high quotations for silver at a time when the cost of producing is declining. A few of the operators, but not a majority, in spite of the contentions of metal authorities that the price would continue to rise, semed to be of opinion that a decline in the cost of producing would be attended with a more or less corresponding decline in quotations for silver. A few years ago, under normal conditions, it cost, roughly, an average of about 25 cents an ounce to produce silver. At that time 55 cents an ounce was considered to be a fair average price for silver, leaving a net profit of about 30 cents for each ounce produced. Now, with costs more than double, having risen to about 55 cents an ounce, and with silver qouted at upwards of $1.25 an ounce, a net profit of 70 cents is being realized on each ounce produced. The margin of net profit, therefore, is considerably more than double that of a few years ago.

From the foregoing, it would not be well to conclude that the mines are realizing aggregate net profits more than double that of a few years ago. The fact is, that production is recording a natural decline and at the present time is averaging only a little over one million ounces a month as against over two million ounces monthly in the camp's most productive days. Thus, one favorable factor, the high price of silver, and one unfavorable factor, the natural decline in output, serve to about balance one another in such a way as to leave the total net profit as a result of current operations about equal to that obtaining in the camp's most prosperous days.

The negotiations between the controlling interests of the Buffalo Mines and the Mining Corporation of Canada, which has been referred to in these columns as any notable progress was made, has terminated successfully. The deal is a private one insomuch as it was between Charles L. Denison, of New York and the Mining Corporation. For the time being the Buffalo company remains as it is, with the exception that a complete change is being made in the directorate and the management. The writer learns on good authority of the probability of the entire Buffalo company being ultimately taken over, now that control has actually passed to the Mining Corporation.

The Northern Customs Concentrator Company has opened negotiations with the Chambers-Ferland Company with the object in view of purchasing that part of the latter company's property lying adjacent to the La Rose Consolidated. At the time of writing, negotiations have reached an interesting stage and the outcome will probably be learned within the week.

During October the Kerr Lake mine produced approximately 112,000 ounces of silver, thus setting the highest record for some months. The value of the month's output amounted to close to $134,000, and is at the rate of around $1,608,800 a year, as compared with the last fiscal year's output of $1,637,143.

Net profits being realized by the Northern Customs Company as a result of operations being carried on in the old Silver Cliff mine is stated to approximate $25,500 a month, according to official advice to the writer. The property is being worked under lease which includes from surface down to 500 feet in depth. Below that depth, the Silver Cliff is involved in a special arrangement with the adjoining National Mines.

At a depth of 750 feet on the Beaver Consolidated, some exceedingly spectacular ore is being encountered, the richer shoots containing ore carrying from 5000 to 10,000 ounces of silver to the ton.

At a number of the mines, workmen's committees are being formed, along the lines of the agreement between the employes and the mining companies at the time the recent labor strike ended. This leaves the Cobalt Miners' Union without authority, in that the arrangement is one strictly between the various companies and their own employes. The Kerr Lake is among the first to carry out the scheme. A committee has now been formed, composed entirely of Kerr Lake employes. This committee is encouraged to present to the management any grievance which any of the employes may entertain. In this way it is expected that no difficulty will be experienced in relation to matters of welfare for the men. Already the plan is stated to give excellent promise of the desired success.

Arrangements are being made to carry out a diamond drilling programme on the Adanac, in that part of the property lying adjacent to the Gans property of the Temiskaming. It is proposed to drill from a cross-cut at the 310-ft. level. In this part of the property the formation is entirely diabase and the exploration of that area is *not* in accordance with the recommendations of geologists. The reason for adopting this course is due to the success which the Temiskaming Company has met with in exploring the Gans lot. The work will commence as soon as a drilling machine can be procured.

The plan to construct light railways to the outlying mining camps is making satisfactory progress, according to late information. A new company has been incorporated, to be known as the Canadian Light Railway Construction Company, Limited, with a capitalization of $500,000. J. Roebuck, C. J. Corless and W. B. Jones, Toronto, are the incorporators. It is planned to commence actual work next spring.

From the details now available, it is learned that equipment originally purchased by the United States government for use behind the fighting lines in France is being secured. It consists of 30-pound rails, 39-inch gage, the motive power being supplied by 12-ton oil-burning steam engines. The project is one which appears to be quite feasible and may reasonably offer a solution of the transportation problem peculiar to the various outlying districts. In this it is considered probable that the government will offer every reasonable encouragement to those at the head of the new enterprise. Incidentally it seems to open a field in which the various governments may be able to turn much of their transport equipment to continued national good. Also, another factor, and a big one in the North, the success of such a scheme would tend to relieve the government of the burdens of constructing many truck or macadam roads and the attendant costly upkeep.

Regarding the Bailey-Cobalt litigation and the question of whether or not the offer of the Northern Customs Company will be accepted, the case was heard before Mr. Justice Sutherland at Osgoode Hall, on Nov. 19th, decision being reserved.

The winding up of the affairs of the old Majestic-Cobalt is being concluded, according to advice just to hand.

Regarding the question of organizing the Northern part of the province of Ontario so as to gain increased governmental recognition, arrangements are being made to get in touch with all centres in the north. A monster convention is being planned for the next month or so, it being stated among a number of leaders in the movement that the question of secession from Southern Ontario will be considered "a proper subject for discussion."

Gold Mining Districts.

The Hollinger Consolidated dividend payable December 2nd will call for the disbursement of some $246,000. It is expected to be followed by a similar disbursement four weeks later. As to whether or not the New Year will be marked by an increase in the dividend rate, considerable speculation is heard. However, those in more or less close touch with the directorate do not appear to anticipate any increase for a few months longer.

The McIntyre-Porcupine intends to carry out the recently proposed experiments in connection with mechanical muckers. Should this method prove satisfactory it will solve to some extent the present difficulty of securing unskilled labor.

At the Dome Mines considerable attention is being devoted to the development of the Dome Extension. Facilities have been provided whereby it will now be possible to treat a substantial tonnage of ore from the 600-ft. level of the Dome Extension. Apart from this the week appears to have not been marked with anything of more than usual interest at the Dome.

According to official advice, the Porcupine-Keora will be developed to a depth of 250 feet, and a contract for sinking will be let. The management is now engaged in procuring a mining plant, during the installation of which it is proposed to carry on work by hand. The camp buildings are being put in habitable condition. Regarding reports that a mill was to be installed, the deport is decidedly premature to say the least, in that the management plans some actual development work before taking such a step. The Keora is situated in the north part of the township of Whitney, in the Porcupine district.

Satisfactory progress is being made in the development of the Clifton-Porcupine, a considerable tonnage of commercial ore having been opened up. Ore is said to occur on several faces throughout the underground workings.

In connection with the Gold Reef, relative to the recent increase in capital from $1,000,000 to $3,000,000 for the purpose of making possible more aggressive work, nothing of a definite nature appears to have been announced with the exception that the increase in capitalization was ratified. As to the plans of financing and the work proposed, no official statement has been made.

In the Kirkland Lake field satisfactory progress continues, and the result of the first month of operation following the ending of the labor strike is being awaited.

Activity is gradually extending in an easterly direction from the known productive area, and the township of Lebel is coming in for increased attention. The geological conditions in that direction are favorable, and encourages the belief that important developments may be expected. A number of small operations are under way, and the reward so far has been quite promising.

The districts of Boston Creek, Skead township and Larder Lake continue active and the result of work is steadily adding to the potential value of these districts. With the arrival of good sleighing which will make transportation less difficult, work will take on increased proportions. This is also true of the Fort Matachewan gold area. In regard to Fort Matachewan, the diamond drill will be employed again this winter in further exploring the Matachewan Gold Mines (formerly the Otisses) as well as exploring the Robb-Clemens claims which were recently optioned to Smith and Norrington, both of whom are interested in the Allied Gold Mines of Boston Creek. It is stated officially to the writer, however, that the Allied Gold Mines is not involved in the present option on the Robb-Clemens property.

In a general way, interest in gold mining is increasing, and capital, attracted by an opportunity to participate in the development of such a promising mining area, is coming in with increasing volume from the United States and from abroad.

Seven cases are listed for the sittings of Mining Commissioner T. E. Godson, K.C., to be held in Haileybury, on Wednesday, Nov. 26. Following is a summary:—

Thomas Burns vs. John Walsh, being an appeal from the decision of the Mining Recorder in refusing to accept applications for restaked claims L-8065, 8064, formerly L-2515 and 2516.

D. D. Chisholm vs. D. H. Gardner, being a dispute in respect of claims GG. 4144 and GG. 4146.

A. Koury (Thomas Boursk) vs. Robert Fereguson, being a dispute respecting claim L. 7405.

W. H. O'Connell vs. R. R. Campbell which is an application under section 81 of the Mining Act of Ontario in respect of mining claims L-6784 and L-6785 (now L.S. 84 and 85).

Robert Bruce vs. D. D. Chisholm (Donald McDougall), being a dispute in respect of mining claim GG. 4203 situate in Nicol township in the Gowganda Mining Division.

Sandy McIntyre vs. C. E. Pimelle, being a dispute in respect of mining claims L-6872 and L-7295 situate in Lebel township in the Larder Lake Mining Division.

John Y. Cole vs. Donald B. Menzies, being application in respect of mining claim L-3660, L-3663 and L-3664 situate in the Larder Lake Mining Division.

During the week ended Nov. 21st, four Cobalt companies shipped an aggregate of 369,560 pounds of ore. The week's shipments were considerably below normal. Following is a summary:

Ore Shipments.

Shippers.	Cars.	Pounds.
Buffalo	1	109,290
McKinley-Darragh	1	105,659
Mining Corp.	1	92,611
Dominion Reduction	1	62,000
Totals	4	369,560

Bullion Shipments.

While ore shipments were low during the week, the shipments of bullion were comparatively heavy, the Nipissing sending out two consignments and the Mining Corporation one, the whole amounting to close to one-quarter of a million ounces. Following is a summary:

Shipper.	Bars.	Ounces.
Nipissing	132	176,839.58
Mining Corporation	73	72,808.89
Totals.	205	249,648.47

The combined value of the silver at present quotations and the value of the ore amounted to upwards of $350,000.

BRITISH COLUMBIA.

Salmon River, B. C.

On the Forty-Nine Property development is being continued energetically and is expected to be maintained throughout the winter. Mr. H. Howson, who is in charge, states that both the Occidental and the Forty-Nine Tunnels are being driven ahead, the former in shipping ore and the latter in a good concentrating grade. The Forty Nine Tunnel was driven as a cross-cut to tap the vein and when the ore body was reached was continued as a drift. It is heading towards the high grade ore which shows on the outcrop. Mr. Howson says that, if the transportation facilities were available, the property could be shipping now. The camp is as comfortable as circumstances will permit being laid out and built on modern plans, with baths, hot and cold water, oil heaters; the best of food and a good cook also being provided. Besides there is a completely equipped assay office. As the first man went on the ground as late as the first of July last it is thought that a record of accomplishment has been made.

A large motorsled ore truck has arrived at Stewart B. C. for the Premier Gold Mining Company. This is expected to be the forerunner of a battery of the same, it being confidently anticipated that the truck will do the work for which she was purchased, namely, carry the ore over the winter trail from the mine to tide-water. It is likely that the new hauling device will be tried out about the middle of December, as the heavy snow, as a rule, does not come until about that time. It is the intention to install compressor machinery at the Mine and to put in power drills. An electric light plant has been installed and the bunk house, cook house, compressor building, and ore sorting shed are to be lighted by electricity. The wires will be carried to the mine entrance.

Other properties which, according to a definite statement, will be active this winter are the Big Missouri Mineral Hill, and Bush, while it is considered likely that the New Alaska will be developed to some extent. On the property of the Bush Mines, Limited, which is situated just the northeast of the Premier, work is underway under the superintendency of Mr. H. Tanner. The result to date are said to be encouraging. O. B. Bush, of this Company, and head of the Company formerly operating the Premier, has returned to Stewarts and intimates that an extensive programme of development has been decided upon.

On the Mineral Hill development is in charge of Mr. Al. Harris, the work being done on the Joker Claim. The Joker has a good body of ore and promises to become a mine.

A tunnel is being driven on the New Alaska under contract by Angus McKenzie and partner. Mr. Charles F. Caldwell is the head of this Company.

The Hercules and the Indian are two claims which are expected to receive early attention. The Company holding the latter owns four claims on the west side of Cascade Creek, opposite the Bush Claims on the south end of the Missouri ridge, between the Salmon River glacier and the Cascade Creek. The claims are Portland No. 1, Portland No. 2, Big Dick, and Fritz. They are Crown-granted. They are at an elevation of 2400 feet and fourteen miles from Stewart. No work has been done on them since 1913.

Development consists of three open-cuts on the croppings and two tunnels. The open-cuts expose a vein from 12 to 20 ft. in width, which can be followed on the surface to the limit of the claims, about 2,000 feet. The vein is quartz and appears to follow a wide dioritic dyke which intrudes the greenstone-schists. The minerals of the quartz are galena, sphalerite, and pyrites. The first two open-cuts going up the hill show very little galena; the values are about $10 a ton in gold and silver for a width of 12 feet. The upper or main open-cut discloses the vein for a width of 20 feet, of which 5 to 8 feet in the centre is rich in galena, with zinc and galena on the hanging wall, while the balance of the vein on the foot-wall is of quartz and pyrites.

A tunnel has been driven on the vein for a little over 400 feet, showing each of the ore-shoots exposed on the surface. The No. 1 Shoot shows considerable galena at a depth of 150 feet with quartz pyrites predominating. The No. 2 Shoot is entirely of quartz and pyrites and will average about $10 a ton mainly in gold values. The No. 3, or main shoot, from the big cropping on the surface, was struck at about 400 feet in the tunnel and drifted on for 30 feet. The ore started from a seam on the foot-wall and has widened to 14 feet at the face, as exposed by two cross-cuts. Three sectional samples across the face averaged $2.40 in gold, 3.5 oz. siver, 10 per cent lead, and 16 per cent zinc. The hanging wall crosscut at the face is still in heavy zinc ore. Further work in driving this drift is considered important as the foot wall portion of the vein, carrying the galena, is widening and has all the appearance of developing into a good shoot.

The lower tunnel, 150 feet below No. 1, has been driven about 60 feet on the vein, in which there is from 1 to 3 feet of good ore on the hanging wall. On the upper end of the claims there is a 6-inch seam of ore on the hanging wall assaying as high as $120 a ton in gold.

Adjoining the Indian Group on the North is the Boundary Group, owned by D. J. McIntominey and under bond to the Granby Consolidated Mining and Smelting Company. East of this Group and adjoining the Indian on the north is the Payroll Group, owned by W. Murphy, on which only assessment work has been done in recent years. This group is situated on the east bank of Silver Creek near its head. The vein has been exposed by three open-cuts showing about 8 inches of galena in a quartz vein which lies on a dip of 45 degrees. A tunnel has been driven forty feet on the vein from Silver Creek, 200 feet below the upper cut.

North and adjoining the Big Missouri Group is the property of the Hercules Mining Company, of Victoria, B. C., on which no work of importance has been done for some time. The Group consists of three claims, Yellowstone, Butte and Old Timer. It is under bond to C. F. Caldwell and associates. The formation is a continuation of the Big Missouri zone and the mineralization identical. Development work consists of seven open-cuts opening up a vein in places is 30 feet in width.

Mr. Bush has announced that a new company, the B. C. Silver Mines, Limited, has taken over the Lake and O'Leary Property between the Premier and the Bush Claims as well as the Mountain Group between the Premier and the International on Salmon River.

Late reports from Stewart and Hyder, the sister mining camps which, situated on the waterfront at the head of Portland Canal, the former on the Canadian side and the latter a few miles to the north and in

American territory, form the gateways to the Salmon River district indicate that both communities are humming. They are described—and this applies particularly to Hyder—as being typical old-time frontier mining towns. Hyder seems to be the centre of entertainment. Prospectors and miners from the mines in the interior to spend a holiday reach this town first and not infrequently return to the hills to earn the wherewithal for more indulgence without getting as far as Stewart. The town's buildings are built on piles. There is one main street, which runs in conformity with the sinuosities of the shore. It has its newspaper, as also has Stewart and both seem to flourish despite the compartive sparcity of population and what must be pretty keen competition.

An amusing phase of the life of Hyder is the activity of a character known as "Jack the Rescuer." A sharp twist in the main street, at a point where the sidewalk is without a protecting railing and where, below, is the cozy mud of the tide flats—sometimes covered with water to the depth of an average person's waist and at others with its slimy surface bared so that the spoutings of the sportive clams may be plainly seen—makes a veritable trap for the unwary. To say that absent minded, or temporarily befogged, pedestrians are frequently precipitated from the walk into the cold water and the mud is no exaggeration. In fact it happens so often that "Jack the Rescuer" earns a comfortable living, and a little over to have an occasional whirl on the roulette wheel, by standing at a post overlooking the critical spot, and, as they fall, pulling them back, wet, mud from head to feet and cussing most blasphemously, at a fee of $2.50 per rescue. Everybody knows the danger; everybody laughs at the other fellow's tumble; and yet; it would appear, Jack's business never grows slack. His rope was just as much in demand at last reports as it was at the beginning of Hyder's recently resuscitated and now hectic life. A few weeks ago the editor of Hyder's newspaper published a humorous story about some unfortunate's fall. The very next day, the writer, who had laughed, tripped and had need of the services of Jack the Rescuer. Never could there have been a more fitting illustration of the wisdom of the adage "he who laughs last laughs best."

But it must not be supposed that Hyder and Stewart are busy only in giving the workers some joy in life. Both look forward to becoming permanent communities of importance. That their future is bright is the opinion of mining men who have been into the Salmon River Country and of businessmen who have opened up in either one or the other of the towns. Not long ago it is reported that $50,000 worth of lots were sold in Hyder in one afternoon. When it is remembered that the town, for the most part has piles for its foundation, it must be admitted that this is "going some."

The High-Cost of Living, too, is an actuality in these camps, although it does not worry the miners much. All have plenty to eat because there are few without adequate funds and, for those who run short, there is work. Transportation of ore from the Premier Mine to the coast costs $121 a ton and the rate is the same for the transport of supplies the other way. The cost of hay is so high that those who have horses are shipping them to Porcher Island, situated at about the mouth of Portland Canal, for the winter. In the few months which must elapse before the spring opens and horses can be used, they would consume more than their value in feed. Hence the general exodus of horses to Porcher Islands. Forty head were brought down by the last outgoing boat.

Barkerville, B. C.

Robt. A. Bryce, a well-known Canadian engineer, who is in charge of the development work now underway at Proserpine Mountain, Cariboo District, visited the Coast recently. He called on Hon. Wm. Sloan, Minister of Mines, Victoria, B. C., to whom he spoke of the work being done by the Mining Corporation of Canada and referred optimistically to the prospects.

That the Armstrong and Dufferin Groups of Claims, which are situated on Grouse Creek, are to be thoroughly tested and that, if the results are what is expected, the exquipment necessary to the working of the properties on a large scale will be installed are statements made by Mr. Bryce. He says that he has assembled a good capable crew of men, that the veins are being systematically stripped, that considerable tunneling is to be done, and that, if progress continues at the present rate, the required definite knowledge of the properties should be obtained by the Spring.

The activity of Mr. Bryce and his associates in this district has attracted the attention of many prospectors. The hills are being thoroughly searched for mineral and many claims are being staked.

Among those who are trying their luck in the Cariboo are J. F. McConnell, a well-known newspaper writer of Vancouver, B. C., who has taken a lay on some promising placer ground. With him are associated "Tommy" Burns, former champion heavyweight pubilist; a sport writer, also of Vancouver, B. C.; and a civil engineer of the same City. Although they are somewhat new to the mining game with the exception of Mr. McConnell, who has had some experience in late years, they are reported to be working energetically. The results of their efforts are said to be satisfactory and it is not improbable that this partnership, odd as it may appears to many of their city friends, will reap a golden reward.

Cowichan, B. C.

The Manganese Property, known as Hill 60, has passed out of the prospect stage. It now is known to be a mine in its potentialities. Work has been suspended temporarily owing to the impassability of the roads, which condition is accounted for by recent heavy rains, and the Company is considering plans for the construction of an aerial tramway. This would materially reduce the cost and expedite transportation of ore from the mountain top. During the past two months eleven cars of the ore of this property have been shipped to the Bilrow Alloys Co., Tacoma, Wn., and the latter report that it is the best manganese ore they have handled. Sufficient development has been done to prove that a very large body of this high-grade manganese ore exists. The success of the enterprise, it is thought, may lead to the development of the manganese deposit of Shaw Creek, near Cowichan Lake, which received some attention during the latter days of the war, when the mineral was much in demand, but which has not as yet been systematically developed.

Nelson, B. C.

The Mountain Chief Copper Property at Renata, B. C., after much development with satisfactory results, is now in a position to commence regular shipments to the Trail Smelter at the rate of from 200 to 500 tons a week. Transportation facilities, however, permit no more at present than 200 tons a week and it is understood that this quantity will be forwarded as long as the Arrow Lakes are sufficiently free from ice

to permit passage of the lake barges. With the installation of a compressor and hoist, which is now taking place, and the provision of a motor truck to convey the ore from the lower terminal of the 3200-foot tram from the workings on Dog Creek to Renata, the mine is equipped for economical operation, and the next step will be in the direction of deep development by sinking.

Writing from the Slocan George Huston, a geologist who makes frequent visits to British Columbia and who now is engaged on examination work, describes impressions received as a result of a recent visit to the Noble Five Mine, in which James Dunsmuir, the wealthy coal operator of Victoria, B.C., is interested as follows:

"I was shown a sample of galena ore from the deep workings of the Noble Five Mine at Cody, near Sandon, which is a strong indication of durability with great depth in the Slocan Mines. This sample was taken from 20 inches of shipping ore out at a depth of 3,000 feet below the apex.

"Being familiar with the Coeur d'Alene mining and geodogical conditions, the point that impresses favorably is the almost entire absence of strong pressure in the sample, together with the unusual features that accompany ores taken at the same or greater depths in the Coeur d'Alene region.

Mining in the Coeur d'Alenes has not reached depths of from 3,000 to 4,000 feet below the apex, and a far different type of ore has been found to occur. There is a notable reduction in the size of the crystals, with a densifying of the structure and a greater intercrystallization between minerals. All this results in making a bad ore to mill, with greater losses in the operation and usually a lower grade of concentrate. Crushing and grinding are also more difficult, due to hardening and greater dissemination. The siderite usually found from the surface down changes to magnetite or coarse grained pyrite, or sometimes straight quartzose gangue. The features mentioned are the result of the enormous rock pressure exerted by great weight on the ore fissures.

"But the sample of the Noble Five, cut at 3,000 feet depth, shows a comparatively coarse crystal, brittle, loose structure, with the same minerals as gangue occurring near the surface. The sample has been but slightly affected by the pressure of rock weight, and is as easy to handle in a milling or sorting and crushing sense as ores near the surface. It is generally admitted that there is a lowering of the silver value to the unit of lead in the Coeur d'Alenes at great depth, but the Noble Five samples holds its usual percentage, and from other Slocan ores studied I found the same rule to prevail.

"A great deal of the silver ore in the United States is being treated by chemical processes, and escapes the smelter's handling.

"With lead ore decreasing in the silver content there now is a sharp demand for galenas carrying good silver values from the smelting plants to the south. This is bound to result in future competition in the effort to fatten up the bullion, and I look to see an influx of mining people to British Columbia during the next year from this feature alone."

C. F. Caldwell, prominent in British Columbia, where he has been engaged for years as a mine operator, has returned from a visit to Eastern Canada and the United States with the report that the East "is awake to the mining wealth of the British Columbia interior, to the riches of the coast mineral region and of the great northland." He says that a knowledge of the possibilities of these sections as an investment field is gaining ground, and there is no doubt that capital may be had for important development enterprises."

He warns the public men of the Province, however, that, if capital is to be secured, it must be reasonably sure of protection. "The richest zinc mines in the world lie in the Slocan," he continues, "and by lack of government protection are worthless because of market conditions and the smelting system. As a consequence of this system the Consolidated Mining & Smelting Co. of Canada is the only one that can buy a zinc mine."

Mr. Caldwell concludes:

"Having worked steadily for over two years for a royal commission on smelting, to consist of one member chosen by the mine owners, one by the smelter management and one by the government—a request I do not think ever will be granted unless the Associated Boards of Trade endorse it—I would ask all owners of zinc properties to urge this body to ask such a Commission of the Government. I would draw attention to the fact that the company is paying only 2 cts. a lb. for zinc, and only for the short time that the Sullivan Mine, by reason of the strike, is not producing. Considering the price in the United States market, recently 7 cents at New York, I believe the shipper ought to receive all excess over four cents."

Hon. J. W. de B. Farris, Attorney General of British Columbia, in an address delivered recently at Nelson, B.C., referred to the extensive development of the mineral resources of the Provinces in recent years and enumerated some of the enterprises either under way or planned. In the latter connection he said: "We are told by the manager of the Consolidated Mining & Smelting Co. of Canada that they are about to erect a $1,000,000 concentrator at Rossland or Trail and an even larger one at the Sullivan Mine, Kimberley. We also are told that the West Kootenay Power & Light Company will have to double its capacity immediately almost to carry on. These are only some of the expansions and developments we are hearing about."

Smithers, B.C.

Work has been resumed on the long tunnel at the Babine Bonanza. This will have to be carried 1,000 feet before the vein is struck. It now is in some 300 feet. James Cronin, the owner has been engaged recently in preparing for the continuance of the work engaging men and forwarding the necessary supplies. When the men reached the camp they found it in a chaotic condition. The cook house had been forced by bears, presumably one or more grizzlies, and about one hundred pounds of butter, a similar quantity of bacon and ham had been consumed. Stoves, tables, dishes, and most of the furniture had been thrown about and much damaged. The destructive visitors, however, had decamped. This is not the first time that the camp has been visited during the absence of the owner and his men with the same results.

Lillooet, B.C.

The purchase of the Pioneer Mine situated on Cadwallader Creek, Lillooet, B.C., near the line of the Pacific Great Eastern Ry., for $100,000 by the Mining

Corporation of Canada is announced by W. R. P. Parker, vice-president of that company. The former owners of the property were Adolphus Williams, K.C., of Vancouver, B.C., and the Ferguson Brothers, the latter being the active members of the partnership. The latter have developed the mine and in the course of their operations in the past three years have taken out considerable gold which has been sent to the Dominion Assay Office, Vancouver. With enlarged equipment and the development of new ore bodies the Mining Corporation expects to substantially increase the output.

Mr. Parker intimates that it is not unlikely that his company will extend its operations in this Province, having a profit and loss account of $2,500,000 set apart for the acquisition and the development of new holdings. It is at present assisting in the development of properties in the Barkerville District, Cariboo, B.C., to which reference already has been made

"We have engineers," states Mr Parker, "in South America, Mexico, Manchuria, and other parts of the world and my only regret is that we did not turn our attention to British Columbia earlier."

Princess Royal Island, B.C.

The Belmont Surf Inlet Mines, Ltd., operating one of the largest gold producing properties in British Columbia is reported to be improving working conditions at their camp. A model little town is being built, homes and public buildings, all being equipped with electric light, steam heating, and running water. There is a fine modern club hotel, as well as churches, post office and school. The mine output is shipped to the Tacoma Smelter. Surf Inlet is one of the most prosperous and wealthy mining camps of the north.

Grand Forks, B.C.

An issue developed recently between the Great Northern Ry. Co. and the Granby Consolidated Mining & Smelting Co., Ltd., when the former commenced the removal of steel rails laid between the Granby Company's smelter at Grand Forks and the railway company's main line. It appears that the mining company maintains that as these sidings were constructed at its expense the steel cannot be taken away without its consent. At any rate the work was stopped when the matter was taken up with the authorities. It is understood that the removal of much of the trackage would not materially affect the Granby Company, the smelter being also served by the C.P.R., but one of the sidings which circled the plant and was the shipping outlet for both transportation lines is of first importance, as over these rails, should the smelter not be operated again, the machinery would be carried for use elsewhere. The Great Northern Company is dismantling its branch line to the former mining town of Phoenix. This work was interrupted by a recent heavy snowfall, and it was after this that workmen turned their attention to the smelter sidings.

The International Diamond Drill Company, Spokane, Wn., has a diamond drill outfit in storage at Grand Forks, B.C., the intention being, it is understood, to start drilling on some properties at Franklin Camp in the spring This plant came from the Snowstorm Group, Highland Valley, where the company has been engaged in drilling for the Mine Department of the Provincial Government.

Trail, B.C.

Ore receipts in gross tons for the week from November 7th to the 14th, inclusive, at the Trail Smelter of the Consolidated Mining & Smelting Company of Canada aggregated 5,596, making the total for the year 285,268 tons. The chief independent shippers were as follows: Blue Bell, Riondell, 92 tons; Echo, Silverton, 206; Iron Mask, Kamloops, 160; Josie (Le Roi) Rossland, 266; Mandy, Le Pas, Manitoba, 153; Mountain Chief, Renata, 145; North Star, Kimberley, 467; Providence, Greenwood, 29; Rambler-Cariboo, Rambler, 194; Ruth, Cedar Creek, 167; Standard, Silverton, 558; and Whitewater, Ratallack, 63. Of the company's properties the largest shippers were the Centre Star, Rossland, with 1,336 tons and the Emma, Eholt, with 1,307 tons. The Sullivan Mine still nis not producing.

Vancouver, B.C.

H. E. Bodine, well known in this province as a mining engineer and prospector, has returned from a trip into Alaska with the United States Geological Survey. He reports that one of the principal members of the party, S. R. Crapps, feel over a cliff and broke both arms and both legs. He was carried out to Anchorage and is recovering. The party were inland on July 23rd and were out for 56 days, on 48 of which it rained.

"The most remarkable feature of the landscape is the magnificent peak of Mount McKinley, said Mr. Bodine. "The story of Dr. Cook, the Arctic explorer, that he had climbed it is undoubtedly a fake, and it is at least 30 miles from the foot of the range to the top of the peak, and it is all more or less like the side of a house.

"From a geological standpoint the extraordinary 'Blue Lead' on the western slope of the Alaska range is the outstanding feature. It is a narrow fissure from three feet to thirty feet wide, extending for over 30 miles. Beneath are a few feet of glacial drift of a character not found anywhere else in the world. It is a conglomerate rock which disintegrates on exposure to the air. This mixture is made up not only of the round pebbles usually found, but of sharp-edged pieces which apparently have never been exposed to the action of water or to contact with each other.

"Along this 'Blue Lead' at various points hydraulic plants have been installed."

Mr. Bodine is leaving shortly for the Lardo District, British Columbia, to undertake the superintendence of the Beatrice, a silver lead mine owned by the New Era Mines, Ltd.

METAL QUOTATIONS.

Fair prices for ingot metals in Montreal 3rd December, 1919.

Electro copper	23½c
Casting copper	23c
Lead	8c
Tin	59c
Zinc	10¼c
Antimony	111c
Aluminum	32c

Steel Bars	3.10
Plate	$3.35

Talc and Soapstone

By Raymond B. Ladoo, U.S. Bureau of Mines, by Permission of the Director.

Word Resources of Talc and Soapstone.

Talc and soapstone together with pyrophyllite (usually sold as talc) are very widely distributed over the earth. Deposits are known in nearly every country but the production on a commercial scale has largely been confined to the countries of highest industrial development. Thus the United States produces about 65 per cent, France, 13.4 per cent; Italy, 7.4 per cent; Germany and Austria, 5.4 per cent, and Canada 4.7 per cent. Since soapstone, used in slabs and fabricated articles, such as sinks and tubs, is produced in important quantities only in this country, this discussion will be largely confined to various grades of ground and massive talc. It should be noted, however, that the aborigines in this country and the natives of many other countries, such as India, and Brazil, made use of, and still make use of massive soapstone in the manufacture of pots and kettles.

While the most valuable grade of ground talc is that used for toilet purposes, by far the largest production is of the lower grades, used in the manufacture of paper, rubber, paint, prepared roofing, and other industrial uses. Since the lower grades of talc will not stand high transportation charges, it follows that the greatest production will come from the countries and districts which have best developed the industrial uses. In the United States, Germany, and Austria, many uses have been found for the lower grades of talc. In France and Italy the principal product shipped is high grade talc for toilet purposes and massive tale for the manufacture of lava, but some use is made of the lower grades. In most of the other producing countries there is little or no market for anything but the highest grades. Thus India, Brazil, Japan and Spain, with many known deposits, produce only small quantities. The accompanying table indicates the approximate distribution of production:

World's Production of Talc and Soapstone.

(In 2000 lb. tons.)

Country	1911	1912	1913	1916	1917	Per cent of total
U.S. (a)	143,551	159,270	175,883	212,961	218,848	65.0
France (b) ...	44,092	60,629	66,332	.....	45,000*	13.4
Italy (c)	15,600	15,800	23,530	28,586	25,000*	7.4
Canada (c) ..	7,300	8,270	12,250	13,104	15,803	4.7
Austria (c) ..	15,212	.....	.....	.....	15,000*	4.4
Norway (c) ..	.....	885	1,653	6,063	6,000*	1.8
Spain (d) ...	6,226	.....	.....	1,062	5,000*	1.5
Germany (Bavaria) (d)...	3,728	3,551	.....	.....	3,500*	1.0
India (c)	689	882	1,350	1,010	1,900	0.6
British So. Africa (c) ...	.....	.....	.....	132	785	0.2
Totals					336,836	100.0

* Statistics unavailable. Figures represent producing capacity estimated for obtaining approximate world production.

(a) Talc and soapstone.

(b) Talc, soapstone and asbestos.

(c) Talc.

(d) Soapstone.

The United States.

The production of talc in the United States in 1917 was divided as follows:*

State.	Short tons.	Value.	Average price per ton.
Vermont	93,960	$625,150	$6.65
New York	74,671	881,462	11.80
Virginia	6,432	85,856	13.35
California	4,152	74,000	17.82
Georgia	3,819	94,314	24.70
North Carolina	2,175	41,766	19.20
Maryland, Mass., New Jersey, and Pa.....	13,404	87,124	6.50
Totals	198,613	1,889,672	$9.51

The entire production of soapstone in 1917, 20,235 tons, came from Virginia.

Detailed descriptions of the deposits in the different States have been given by J. S. Diller in Mineral Resources, U.S. Geological Survey, 1917, and previous years and need not be repeated here. It is of interest to note, however, that the greatest production is centered in New York and Vermont, and that California is becoming an important producer of high grade talc. Vermont has the largest reserves, clearly blocked out, of all producing States.

France.

The most important producing properties in France are in the Department of Ariège. Important deposits are at Montferrier, in the Pyrénées, about 12 miles from the Spanish line, and at Luzech. Another producing district is at Luzenac, near the port of Cette. Eighty-five per cent of the production comes from the Department of Ariège. French or tailors' chalk is produced principally in the Dept. of Gard. Other districts in which talc and soapstone are mined are in the following departments, named in order of importance: Pyrénées-Orientales, Isère, Ande, Savoie, Loire (Haute), and the Island of Corsica. Immediately before the war the production of talc was rapidly increasing, but the scarcity of labor during the war made the production almost negligible. It is probable that the mining will soon be resumed on its former scale.

Italy.

The highest grade talcs in the world are mined in Italy. Their superior color, freedom from grit and impurities and fineness of grain make them especially suited for toilet and medicinal uses and for lava blanks. The main producing district is in the Italian Alps in the neighborhood of Perosa, south of Turin, in the Vallee di Chisone. It is also mined near Pinerolo and in the valleys of San Murtino, Susa and Lanzo.

Canada.

Canadian talcs generally command a slightly higher price than those of the eastern United States, some being suitable for certain grades of toilet powder, but most are used in the industries which demand a medium high grade talc. The principal production comes from a group of mines near Madoc, Hastings Co., Ontario. Several small mines have been operated in

* U.S. Geological Survey, Mineral Resources, 1917.

Brome, Megantic, Montmorency, and Wolfe Counties, Quebec, and in Cariboo Co., and a few other localities in British Columbia. The production of the Madoc district has been rapidly increasing and probably will be an increasingly important factor.

Austria-Hungary.

Austria before the war produced a tonnage equivalent to about 4.4 per cent of the present world production of talc and soapstone. The principal deposits of talc in Austria are in the Province of Styria in the communes of Mautern, Aflenz, Anger, Pollau, St. Kathrein, and Floing. Other producing districts are in Salzburg, Grusserhof and Rohoncz, Hungary. The talc is of a high grade but not equal to that from Italy. Much of the Austrian talc was used in Germany for paper making. Austrian producers before the war were keenly alive to the possibilities of utilization of talc and formed an association which published results of research and notes on many new uses.

Spain.

Talc production of Spain is small and comes principally from the Province of Gerona in the Pyrénées, but one mine is reported in the Province of Malaga.

Germany.

Important talc deposits are reported at Gopfersgrun, near Wunsiedel, in the Fichtelgebirge, Bavaria, from which most of the German production came before the war.

India.

Massive talc of excellent quality has been mined in India for years, the natives making use of it for pots and kettles, but export trade has become of importance due to the particular suitability of Indian talc for lava manufacture. The largest production at present comes from the Jabalpur district in the Central Provinces. Other producing districts are in the Provinces of Madras, Rajputna, Mysore, Bengal, Burma, Bombay, and Central India. Veins are usually thin but of high grade. Resources are said to be large.

British South Africa.

Talc is found in Natal and Rhodesia, but the most important production comes from the Barberton district in the Transvaal. Large bodies of more or less pure talc occur both in Rhodesia and Transvaal. In the Barberton district pencils, tailors' chalk, billiard chalk, and ground talc are produced. An important industry sprung up during the war and practically all local needs were supplied. It is stated that a large export trade is looked for when shipping becomes normal.

Brazil.

While no export trade in talc or soapstone is reported, Brazil promises to be a future source of importance. A very pure white talc is reported at Rezende, State of Rio de Janeiro. Deposits at Lorena and Santo Amaro, both in the State of Sao Paulo are also being worked. Good grades of massive talc, at present worked only by natives for local uses, occur near Itaberaba, Bahia; Municipio de Ouro Preto; Varzea near Dores de Boa Esperanca; near Jacuhy in western Minas Geraes; and in the State of Ceara, and Goyaz.

China.

Massive talc or high grade soapstone has been mined for years in China, for the manufacture of carved utensils, images and ornaments. Much of the material, while ideal for carving, is too highly colored for ground talc. The principal district has been the Tsintien region, Chekiang province, about 42 miles from Wenchow. It is also found in the Provinces of Chihli and Fukien.

Norway.

Talc and soapstone both occur in Norway. Soapstone from Gudbrandsdal is used in the Cathedral of Trondhjems. Mills for the grinding of local talcs have been erected at the Songefjord, north of Bergen and in Cistesto, Vikor, south of Bergen. In 1912-14 the entire production came from Froastad, Isteso, and Hardanger in the S. Bergenhus province, and in 1916 from N. Bergenhus.

Japan.

Both talc and pyrophyllite are found in Japan in the Provinces of Hitachi, Kozuke, Musachi, Omi, Bizen, Suo, Hizen, Higo, Harima, Bingo and Aki. Small imports of Japanese talc have been received in this country, and it is probable that Japan is a potential source of some importance.

British Isles.

While the mining of talc and soapstone is not of importance today in the British Isles, several deposits are known and have been worked. Among these may be mentioned the Lizard district in Cornwall; Crohy Head and Gartan near Letterkenny in County Donegal, Ireland; the Shetland Isles, the Hebridges (Harris), and Shiness in Sutherland.

Philippines.

Several deposits of high grade fibrous talc are known in Illocos Norte. From tests and analyses this talc seems to be of excellent quality for paper filling and may become an important source in the future.

Talc of a grade suitable for paper, etc., is reported as occuring near Heathcote, Australia. Deposits of talc of various grades occur in French South Africa, Jamaica, Sweden, the Netherlands, and Belgium from which countries small imports into the United States have been received. Talc of excellent quality but in small quantities comes from Syria, Mexico, New Zealand, and in fact almost every country possesses some resources of talc or soapstone.

Accurate data upon reserves is very difficult to obtain, but it is probable, from the wide distribution of known, but at present unworked deposits, that there are ample supplies for years to come. Probably the United States will continue to lead in production, but the western States will doubtless become of increasing importance. Deposits are now being worked in California and Washington and many other occurences have been noted in the Coast Range, the Sierra Nevadas and in the Rockies. Our position in this field thus seems secure.

A Summer Road to Rice Lake.

It is said that the Manitoba government is favorably disposed towards the proposals to build a summer road to Rice Lake and that surveyors will soon be at work looking over the various routes. There is considerable difference of opinion as to the most suitable route. The present winter road from Fort Alexander crosses much muskeg and would not be suitable in summer. Alternative routes are up the river from Black River settlement or along the sand ridges from Manigotogan. Another route would be from Lac du Bonnet to Long Lake and thence to Rice Lake.

MANITOBA CORRESPONDENCE.

Pan Extension.

Plans for the development of the Pan Extension property, which adjoins the Gold Pan mine, call for the erection this winter of bunk house, boiler house, cook house and smaller buildings. There will be purchased a small hoist, a 3 drill air compressor, boiler engines and pumps.

In 1917 some work was done on property under the superintendence of Mr. Reahill. A shaft was sunk to a depth of 50 feet. The vein is 4½ to 5 feet wide and Mr. Reahill says that good ore was encountered to the bottom of the shaft. This shaft is about 300 feet from the 260 ft. shaft on the Gold Pan. The company owns two claims, one adjoining Gold Pan on the west is known as the Gold Pan Fraction. The second claim, known as the Sunlight, is a short distance east of the Gold Pan. Mr. John Beckman is secretary of the company.

Prospectors' Classes at University of Manitoba.

Instruction in mineralogy is now being given two evenings each week at the University of Manitoba by Professor J. S. DeLury. These classes are open to anyone who wishes to obtain an elementary knowledge of the science of ore deposits.

Bruce Consolidated.

The Bruce Consolidated mining company, which will develop properties in the Rice Lake district this winter, owns the September Morn, Bruce, Brucehor, Bruce Fraction, Mina and Canada claims. These were located by J. J. Papineau, who located the Moose claim. The properties have been reported upon favorably by Professor J. S. DeLury.

Steel Map of Rice Lake Gold Districts.

The accompanying sketch map shows the location of a number of gold properties in the vicinity of Gold Lake and Long Lake. Chief activity during the past summer has been at the Brooklyn mine at Gold Lake. Other properties in the immediate vicinity of the Brooklyn will be developed this winter.

The map shows the routes to the camp from Lake Winnipeg. The summer route is up the Manigotogan river and across Clearwater lake to the Gold Pan property. The winter road from Fort Alexander is shown in dotted line. At the 23 mile post where it crosses Black River, there is a claim used as a stopping place. The winter road from Manigotogan is also shown. This is shorter, but to use it necessitates the crossing of Lake Winnipeg. Fort Alexander can be reached by a 14 mile winter road from the Canadian National railroad. The all land route is however not yet in good shape for travel, as there is little frost in the ground and the snow is already deep. Those who have travelled from the mine during the past few weeks have used dog teams. One party came down the Fort Alexander road to the Black river, then down the river to Lake Winnipeg and crossed on the ice to mile 69—near Victoria Beach on the C. N. R. Another party from the Brooklyn followed the Hole river down to the lake and then walked down the shore of lake Winnipeg. It is expected that the winter road will be soon in condition for travelling by horses from the railway via Fort Alexander.

Eastern Mining and Milling Co.

Good results are being obtained at the copper mine of the Eastern Mining and Milling Co., at Eastman, Quebec. Preparations are being made to mine the ore at the 80, 130, and 260 feet. levels. The new plant for the mill is now on the property and two of the three Hardinge mills are now installed. When the three mills are in operation the capacity of the plant will be about 250 tons per day.

The company uses the oil flotation process and ships the concentrate to the United States. Investigations are under way which it is hoped will result in the refining of the concentrates on the property. The preliminary experiments indicate that an economical process of refining will be found and it is not unlikely that an electrolytic copper refinery will be built at the mine. Mr. F. M. Connell of Toronto is president and general manager of the company which is operating the mine at Eastman, Quebec.

FORWARD TENDENCY IN ENGINEERING.

General Mitchell addresses first meeting of season of American Society of Mechanical Engineers, Ontario Section, at Toronto.

The American Society of Mechanical Engineers, Ontario Section, held their first meeting for the season on the evening of Nov. 14th in Toronto. The gathering took the form of a dinner at the Engineers' Club, following which General C. H. Mitchell, C.B., C.M.G., D.S.O., spoke on some phases of mechanical engineering in the war, which had come under his observation in France and Italy. General Mitchell, who went over with the First Contingent in 1914 as Intelligence Officer, served with great distinction, first in France and then as Intelligence Officer on the general staff of the British expedition sent to the aid of the Italians on the Piave. His address covered transportation matters and mobile shops and other engineering features of the advanced areas in France. He made some very interesting observations on the Italian Hydro Electric developments as he found them at the end of the war in comparison with their condition and size at the time of a previous trip in 1906. He gave a vivid description of the Italian engineering feats in the construction of the "Teleferrica", or wire cable-ways, which transported men and munitions in hanging carriers over mountain peaks and across great chasms, even when subject to a great hazard due to shell fire.

General Mitchell, who is the new Dean of Engineering, as well as an old graduate of the Faculty of Applied Science, University of Toronto, closed with a description of after-the-war conditions at the University and drew some deductions as to the trend of engineering opportunities in different channels, as indicated by the tendency of certain branches, notably mechanical engineering and engineering chemistry, to push ahead at the present time.

After the General's address the meeting proceeded to discuss plans for the season's work and the program of one meeting per month, alternately with a dinner with an address and a technical session, was decided upon. A large number of prospective members were present and all mechanical engineers of the district are invited to participate in these meetings, with the hope that they will ultimately join. It is felt that when members come from as far away as Chatham, London and Belleville to attend, there is little excuse for local engineers failing to identify themselves with the parent organization of this branch of engineering.

Mr. James McEvoy who recently returned from a trip to the Belcher Islands, where he examined iron ore deposits, has taken office quarters in Yonge Street Arcade, Toronto.

WANTED—A competent man with experience covering the principal departments of electrolytic copper refining. Must be prepared to go to Europe if necessary. State terms in application, also experience in design construction and operation, giving references. Mark envelope "Application" and address to W. J. Forrester, Imperial Bank Chambers, Leader Lane, Toronto.

WANTED.

CHEMIST, American, desires position. Several years experience in blast-furnace work, besides steel, ores, electrolytical processes, food products, etc. Best of references. Box 3, Canadian Mining Journal, Garden City Press, Ste. Anne de Bellevue, P.Q.

MINING OPPORTUNITIES IN NORTHERN MANITOBA

Mineral Areas

Approximately three-fifths of the total area of Manitoba is Pre-Cambrian, and all but a small part lies in Northern Manitoba. In the Pre-Cambrian in Ontario, the well-known camps of Sudbury, Cobalt and Porcupine have been developed. In Northern Manitoba there was practically no prospecting until the Hudson Bay Railway gave access to the mineral districts. There are three fields in particular to which attention is now directed—The Pas Mineral Belt, the Cross and Pipestone Lakes area, and the Oxford Lake, Knee Lake, God's Lake and Island Lake area.

Development

Since 1915, development has been rapid in The Pas Mineral Belt. Twenty million tons of low-grade copper ore have been explored by diamond drilling at Flin-Flon Lake. High-grade copper is exported from Schist Lake to the smelter at Trail, B.C.; three and three-quarter million pounds of copper have already been realized. Copper prospects are under development on Athapapuskow Lake, Copper Lake and Brunne Lake. The building of a smelter will give impetus to the development of a large copper industry. Gold is now produced at Weskuko Lake, and important discoveries have been made on Copper Lake, and on Knee Lake on the Hayes River route.

Transportation

Transportation is available by the Hudson Bay Railway, by the Ross Navigation Co. Steamboats on the Saskatchewan River, and by wagon roads built into the producing areas by the Manitoba Government. Wekusko Lake may be reached in less than one day from The Pas. The Hudson Bay Railway gives easy access to several promising districts where little prospecting has yet been done.

Mining Regulations

The mineral resources are under Federal control, and the Dominion Mining Laws apply to Northern Manitoba. No mining license is required. Work to the value of $100 per year must be performed for a period of five years on claims filed under the quartz mining regulations. The office of the Mining Recorder for Northern Manitoba is at The Pas.

Opportunities for Capital

The district is comparatively new, and there are several very promising properties which may be acquired at reasonable prices. Financial and mining companies would be well advised to have their engineers inspect these properties at an early date.

For maps, reports and general information, apply to—

THE COMMISSIONER OF NORTHERN MANITOBA

THE PAS, MANITOBA.

The Canadian Miners' Buying Directory.

Acetylene Gas:
Canada Carbide Company, Ltd.
Canadian Fairbanks-Morse.

A.C. Units:
MacGovern & Co.

Agitators:
The Dorr Co.

Air Hoists:
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.

Alloy and Carbon Tool Steel:
International High Speed Steel Co., Rockaway, N.J.

Alternators:
MacGovern & Co.

Amalgamators:
Northern Canada Supply Co.
Mine and Smelter Supply Co.
Wabi Iron Works.

Antimony:
Canada Metal Co.

Antimonial Lead:
Pennsylvania Smelting Co.

Arrester, Locomotive Spark:
Hendrick Manufacturing Co.

Arsenic White Lead:
Coniagas Reduction Co.

Assayers' and Chemists' Supplies:
Dominion Engineering & Inspection Co.
Lymans, Limited
Mine & Smelter Supply Co.
Pennsylvania Smelting Co.
Stanley, W. F. & Co., Ltd.

Assayers and Chemists:
Milton L. Hersey Co., Ltd.
Campbell & Deyell
Ledoux & Co.
Thos. Heys & Son
C. L. Constant Co.

Asbestos:
Everitt & Co.

Balls:
Canadian Foundries and Forgings, Ltd.
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works.
The Hardinge Conical Mill Co.

Ball Mills:
Hardinge Conical Mill Co.
Hull Iron & Steel Foundries, Ltd.
Mine and Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works.

Balances—Heusser:
Canadian Fairbanks-Morse Co., Ltd.
Mine and Smelter Supply Co.

Babbit Metals:
Canada Metal Co.
Canadian Fairbanks-Morse Co., Ltd.
Hoyt Metal Co.

Ball Mill Feeders:
Fraser & Chalmers of Canada, Ltd.
Hardinge Conical Mill Co.

Ball Mill Linings:
Hardinge Conical Mill Co.
Hull Iron & Steel Foundries, Ltd.

Belting—Leather, Rubber and Cotton:
Canadian Fairbanks-Morse Co., Ltd.
Link Belt Co.
The Mine & Smelter Supply Co.
Northern Canada Supply Co.
Jones & Glasco.

Belting:
R. T. Gilman & Co.

Belting (Transmission):
Goodyear Tire & Rubber Co.

Belting (Elevator):
Goodyear Tire & Rubber Co.

Belting (Conveyor):
Goodyear Tire & Rubber Co.

Blasting Batteries and Supplies:
Canadian Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Ltd.

Bluestone:
The Consolidated Mining & Smelting Co

Blowers:
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Co., Inc.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.

Boilers:
Northern Canada Supply Co.
Canadian Ingersoll-Rand Co., Ltd.
Marsh Engineering Works
MacGovern & Co., Inc.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
The John Inglis Company
Wabi Iron Works.

Blue Vitriol (Coniagas Red):
Canadian Fairbanks-Morse Co., Ltd.

Bortz and Carbons:
Diamond Drill Carbon Co.

Boxes, Cable Junction:
Standard Underground Cable Co. of Canada, Ltd.
Northern Electric Co., Ltd.

Brazilian Rough Diamonds:
Diamond Drill Carbon Co.

Brazilian Mica:
Diamond Drill Carbon Co.

Buggies, Mine Car (Steel)
Hendrick Manufacturing Co.

Brazilian Ballas:
Diamond Drill Carbon Co.

Brazilian Rock Crystal:
Diamond Drill Carbon Co.

Brazilian Tourmalines:
Diamond Drill Carbon Co.

Brazilian Aquamarines:
Diamond Drill Carbon Co.

Bronze, Manganese, Perforated and Plain:
Hendrick Manufacturing Co.

Buckets:
Canadian Ingersoll-Rand Co., Ltd.
The Electric Steel & Metals Co.
R. T. Gilman & Co.
Hendrick Manufacturing Co.
Link-Belt Co.
M. Beatty & Sons, Ltd.
Marsh Engineering Works
Mussens, Ltd.
MacKinnon Steel Co., Ltd.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Buckets, Elevator:
Hendrick Mfg. Co.

Cable—Aerial and Underground:
Northern Canada Supply Co.
Standard Underground Cable Co. of Canada, Ltd.

Cableways:
M. Beatty & Sons, Ltd.
Fraser & Chalmers of Canada, Ltd.
Mussens, Ltd.
The Wabi Iron Works
R. T. Gilman & Co.

Cages:
Canadian Ingersoll-Rand Co., Ltd., Montreal, Que
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Mussens, Ltd.
The Wabi Iron Works

Canadian Miners' Buying Directory.—(Continued)

Cables—Wire:
Standard Underground Cable Co. of Canada, Ltd.
Canada Wire & Cable Co.
Fraser & Chalmers of Canada, Ltd.
Northern Electric Co., Ltd.
R. T. Gilman & Co.

Cam Shafts:
Canada Foundries & Forgings, Ltd.

Car Dumps:
Sullivan Machinery Co.
R. T Gilman & Co.
Canadian Fairbanks-Morse Co., Ltd.

Carbide of Calcium:
Canada Carbide Company, Ltd.

Cars:
Canadian Foundries and Forgings, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
John J. Gartshore
MacKinnon Steel Co., Ltd.
The Electric Steel & Metals Co.
Northern Canada Supply Co.
Marsh Engineering Works
Mine and Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Car Wheels and Axles:
Canadian Car Foundry Co., Ltd.
Burnett & Crampton
John J. Gartshore
Marsh Engineering Works, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works

Carriers (Gravity):
Jones & Glassco

Castings—Brass
The Canada Metal Co., Ltd.

Castings (Iron and Steel)
Burnett & Crampton
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works

Cement Machinery:
Northern Canada Supply Co.
Hadfields, Limited
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
The Electric Steel & Metals Co.
R. T Gilman & Co.
Burnett & Crampton

Chains:
Jones & Gltssco
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
Link-Belt Co.
Greening, B., Wire Co., Ltd.

Chain Drives:
Jones & Glassco

Chemical Apparatus:
Mine and Smelter Supply Co.

Chemists:
Canadian Laboratories
Campbell & Deyell
Thos. Heyes & Sons
Milton Hersey Co.
Ledoux & Co.
Constant, C. L. Company

Chrome Ore:
The Electric Steel & Metals Co.
Everett & Co.

Classifiers:
Mine and Smelter Supply Co.
Mussens, Limited
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
R. T. Gilman & Co.
The Dorr Company

Coal:
Dominoion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters:
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.

Coal Mining Explosives:
Canadian Explosives, Ltd.

Coal Mining Machinery:
Canadian Ingersoll-Rand Co., Ltd.
Sullivan Machinery Co.
March Engineering Works
Hadfields, Ltd.
Hendrick Mfg. Co.
Fraser & Chalmers of Canada, Limited
Mussens, Limited
R. T. Gilman & Co.

Coal and Coke Handling Machinery
Link-Belt Co.

Coal Pick Machines:
Sullivan Machinery Co.

Cobalt Oxide:
Coniagas Reduction Co.
Everitt & Co.

Compressors—Air:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
MacGovern & Co., Inc.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
The Mine & Smelter Supply Co.

Concrete Mixers:
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.
Gould, Shapley & Muir Co., Ltd.
MacGovern & Co., Inc
Mussens, Limited
R. T. Gilman & Co.

Condensers:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Northern Canada Supply Co.
MacGovern & Co., Inc.

Concentrating Tables:.
Mine & Smelter Co.
Deister Concentrator Co.
The Wabi Iron Works

Converters:
Northern Canada Supply Co.
MacGovern & Co,, Inc.

Contractors' Supplies:
Canadian Fairbanks-Morse Co., Ltd.

Consulters and Engineers:
Hersey Milton Co., Ltd.

Conveyor Flights:
Hendrick Mfg. Co., Ltd.

Conveyor—Trough—Belt:
Canadian Fairbanks-Morse Co., Ltd.
Link-Belt Co.
Hendrick Mfg. Co.
Mussens, Limited
Jones & Glassco (Roller, Belt and Chain)
Hendrick Mfg. Co.
The Wabi Iron Works

Conical Mills:
Hardinge Conical Mill Co.

Copper:
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

Cranes:
Canadian Fairbanks-Morse Co., Ltd.
Link-Belt Co.
R. T. Gilman & Co.
Smart-Turner Machine Co.
M. Beatty & Sons, Ltd.

Crane Ropes:
Allan Whyte & Co.
Greening, B., Wire Co., Ltd.

Crucibles:
Canadian Fairbanks-Morse Co., L d.
Mine and Smelter Supply Co.

Crusher Balls:
Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Limited, Hull, Que

Crushers:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Hardinge Conical Mill Co.
The Electric Steel & Metals Co., Ltd.
R. T. Gilman & Co.
Lymans, Ltd.
Mussens, Limited
Mine and Smelter Supply Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Canadian Miners' Buying Directory.—(Continued)

Cyanide Plant Equipment:
The Dorr Co.

D. C. Units:
MacGovern Co.

Derricks:
Smart-Turner Machine Co.
M. Beatty & Sons, Ltd.
Marsh Engineering Works
R. T. Gilman & Co.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited

Diamond Drill Contractors:
Diamond Drill Contracting Co.
E. J. Longyear Company
Smith & Travers
Sullivan Machinery Co.

Diamond Tools:
Diamond Drill Carbon Co.

Diamond Importers:
Diamond Drill Carbon Co.

Digesters:
Canadian Chicago Bridge and Iron Works

Dies:
Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.

Dredger Pins:
Canadian Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited

Dredging Machinery:
Canadian Steel Foundries, Ltd.
M. Beatty & Sons
Hadfields, Limited
Hull Iron & Steel Foundries, Ltd.
R. T. Gilman & Co.

Dredging Ropes:
Allan, Whyte & Co.
Greening, B., Wire Co., Ltd.
R. T. Gilman & Co.

Drills, Air and Hammer:
Canadian Ingersoll-Rand Co., Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Canadian Rock Drill Co.
The Mine & Smelter Supply Co.
Mussens, Limited

Drills—Core:
Canadian Ingersoll-Rand Co., Ltd.
E. J. Longyear Company
Standard Diamond Drill Co.
Sullivan Machinery Co.

Drills—Diamond:
Sullivan Machinery Co.
Northern Canada Supply Co.
E. J. Longyear Company

Drill Steel—Mining:
Hadfields, Limited
International High Speed Steel Co., Rockawaw, N.J.
Mussens, Limited

Drill Steel Sharpeners:
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
Sullivan Machinery Co.
Canadian Rock Drill Co.
The Wabi Iron Works

Drills—Electric:
Canadian Fairbanks-Morse Co., Ltd.
Sullivan Machinery Co.
Northern Electric Co., Ltd.

Drills—High Speed and Carbon:
Canadian Fairbanks-Morse Co., Ltd.
Hadfields, Limited

Dynamite:
Canadian Explosives
Northern Canada Supply Co.

Dynamos:
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Company

Ejectors:
Canadian Fairbanks-Morse Co. Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Elevators:
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
The Wabi Iron Works

Engineering Instruments:
C. L. Berger & Sons

Engines—Automatic:
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.

Engines—Gas and Gasoline:
Canadian Fairbanks-Morse Co., Ltd.
Alex. Fleck
Fraser & Chalmers of Canada, Ltd.
Sullivan Machinery Co.
Gould, Shapley & Muir Co., Ltd.
MacGovern & Co., Inc.
The Mine & Smelter Supply Co

Engines—Haulage:
Canadian Ingersoll-Rand Co., Ltd., Montreal, Que
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.

Engines—Marine:
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Co., Inc.

Engines—Steam:
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons
R. T. Gilman & Co.
MacGovern & Co., Inc.
Fraser & Chalmers of Canada, Ltd.

Engineers:
The Dorr Co.

Ferro-Alloys (all Classes):
Everitt & Co.

Feed Water Heaters:
MacGovern & Co.

Flood Lamps:
Northern Electric Co., Ltd.

Flourspar:
The Consolidated Mining & Smelting Co.
Everitt & Co.

Forges:
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.

Forging:
M. Beatty & Sons
Canadian Foundries and Forgings, Ltd.
Smart-Turner Machine Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.

Frogs:
Canadian Steel Foundries, Ltd.
John J. Gartshore

Frequency Changers:
MacGovern & Co., Inc.

Furnaces—Assay:
Canadian Fairbanks-Morse Co., Ltd.
Lymans, Limited
Mine & Smelter Supply Co.

Fuse:
Canalian Explosives
Northern Canada Supply Co.

Gears (Cast):
Hull Iron & Steel Foundries, Ltd.
The Link-Belt Co.

Gears, Machine Cut:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Hamilton Gear & Machine Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Granulators:
Hardinge Conical Mill Co.

Grinding Wheels:
Canadian Fairbanks-Morse Co., Ltd.

Gold Refiners
Goldsmith Bros.

Canadian Miners' Buying Directory.—(Continued)

Gold Trays:
Canada Chicago Bridge & Iron Works

Hose (Air Drill):
Goodyear Tire & Rubber Co.

Hose (Fire):
Goodyear Tire & Rubber Co.

Hose (Packings)
Goodyear Tire & Rubber Co.

Hose (Suction):
Goodyear Tire & Rubber Co.

Hose (Steam):
Goodyear Tire & Rubber Co.

Hose (Water):
Goodyear Tire & Rubber Co.

Hammer Rock Drills:
Mussens, Limited
The Mine & Smelter Supply Co.

Hangers and Cable:
Standard Underground Cable Co. of Canada, Ltd.

High Speed Steel:
Canadian Fairbanks-Morse Co. Ltd.
Hadfields, Limited
International High Speed Steel Co., Rockaway, N.J.

High Speed Steel Twist Drills:
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam:
Canadian Ingersoll-Rand Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Jones & Glassco
M. Beatty & Sons
Marsh Engineering Works
Northern Canada Supply Co.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works
R. T. Gilman & Co.
Mussens, Limited
Link-Belt Co.

Hoisting Engines:
Canadian Fairbanks-Morse Co., Ltd.
The Electric Steel & Metals Co.
Mussens, Limited
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.
M. Beatty & Sons
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.
The Mine & Smelter Supply Co.

Hose:
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co

Hydraulic Machinery:
Canadian Fairbanks-Morse Co., Ltd.
Hadfields, Limited
MacGovern & Co., Inc.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Industrial Chemists:
Hersey, M. & Co., Ltd.

Ingot Copper:
Canada Metal Co., Ltd.
Hoyt Metal Co.

Insulating Compounds:
Standard Underground Cable Co. of Canada, Ltd.

Inspection and Testing:
Dominion Engineering & Inspection Co.

Inspectors:
Hersey, M. & Co., Ltd.

Jacks:
Canadian Fairbanks-Morse Co., Ltd.
Can. Brakeshoe Co., Ltd.
Northern Canada Supply Co.
R. T. Gilman & Co.
Mussens, Limited

Jack Screws:
Canadian Foundries and Forgings, Ltd.

Laboratory Machinery:
Mine & Smelter Supply Co.

Lamps—Acetylene:
Dewar Manufacturing Co., Inc.

Lamps—Carbide:
Dewar Manufacturing Co., Inc.

Lamps—Miners:
Canada Carbide Company, Limited
Canadian Fairbanks-Morse Co., Ltd.
Dewar Manufacturing Co., Inc.
Northern Electric Co., Ltd.
Mussens, Limited

Lamps:
Dewar Manufacturing Co., Inc.

Lead (Pig):
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

Levels:
C. L. Berger & Sons

Locomotives (Steam, Compressed Air and Storage Steam:
Canadian Fairbanks-Morse Co., Ltd.
H. K. Porter Company
R T. Gilman & Co
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited

Link Belt
Canadian Fairbanks-Morse Co. Ltd.
Northern Canada Supply Co.
Jones & Glassco

Machinists:
Burnett & Crampton

Machinery—Repair Shop:
Canadian Fairbanks-Morse Co., Ltd.

Machine Shop Supplies:
Canadian Fairbanks-Morse Co., Ltd.

Magnesium Metal:
Everitt & Co.
Hull Iron & Steel Foundries, Ltd.

Manganese Steel:
Canadian Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Metal Marking Machinery:
Canadian Fairbanks-Morse Co., Ltd.

Metal Merchants:
Henry Bath & Son
Geo. G. Blackwell, Sons & Co.
Coniagas Reduction Co.
Consolidated Mining & Smelting Co. of Canada
Canada Metal Co.
C. L. Constant Co.
Everitt & Co

Metallurgical Engineers:
The Dorr Co.

Metallurgical Machinery:
The Dorr Co.

Metal Work, Heavy Plates:
Canada Chicago Bridge & Iron Works

Mica:
Everitt & Co.
Diamond Drill Carbon Co.

Mining Engineers:
Hersey, M. Co., Ltd.

Mining Drill Steel:
International High Speed Steel Co., Rockaway, N.J.

Mining Requisites:
Canadian Steel Foundries, Ltd.
Dominion Wire Rope Co., Ltd.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works

Mining Ropes:
Dominion Wire Rope Co., Ltd.

Mine Surveying Instruments:
C. L. Berger & Sons

Molybdenite:
Everitt & Co.

Monel Metal:
International Nickel Co.

Motors:
Canadian Fairbanks-Morse Co., Ltd.
R. T. Gilman & Co.
MacGovern & Co.
The Wabi Iron Works

Canadian Miners' Buying Directory.—(Continued)

Motor Generator Sets—A.C. and D.C.
MacGovern & Co.

Nails:
Canada Metal Co.

Nickel:
International Nickel Co.
Coniagas Reduction Co.
The Mond Nickel Co., Ltd.

Nickel Anodes:
The Mond Nickel Co., Ltd.

Nickel Salts:
The Mond Nickel Co., Ltd.

Nickel Sheets:
The Mond Nickel Co., Ltd.

Nickel Wire:
The Mond Nickel Co., Ltd.

Oil Analysts:
Constant, C. L. Co.

Ore Sacks:
Northern Canada Supply Co.

Ore Testing Works:
Ledoux & Co.
Can. Laboratories
Milton Hersey Co.
Campbell & Deyell
Hoyt Metal Co.

Ores and Metals—Buyers and Sellers of:
C. L. Constant Co.
Geo. G. Blackwell
Consolidated Mining and Smelting Co. of Canada
Oxford Copper Co.
Canada Metal Co.
Hoyt Metal Co.
Everitt & Co.
Pennsylvania Smelting Co.

Packing:
Canadian Fairbanks-Morse Co., Ltd.

Perforated Metals:
Northern Canada Supply Co.
Hendrick Mfg. Co.
Greening, B., Wire Co.

Pig Tin:
Canada Metal Co., Ltd.
Hoyt Metal Co.

Pig Lead:
Canada Metal Co., Ltd.
Hoyt Metal Co.
Pennsylvania Manufacturing Co.

Pipes:
Canadian Fairbanks-Morse Co., Ltd.
Canada Metal Co., Ltd.
Consolidated M. & S. Co.
Northern Canada Supply Co.
R. T. Gilman & Co.

Pipe Fittings:
Canadian Fairbanks-Morse Co., Ltd.

Pipe—Wood Stave:
Pacific Coast Pipe Co.
Mine & Smelter Supply Co.

Piston Rock Drills:
Mussens, Limited
Mine & Smelter Supply Co.

Plate Works:
John Inglis Co., Ltd.
Hendrick Mfg. Co.
The Wabi Iron Works
MacKinnon Steel Co., Ltd.

Platinum Refiners:
Goldsmith Bros.

Pneumatic Tools:
Canadian Ingersoll-Rand Co., Ltd.
Jones & Glassco
R. T. Gilman & Co.

Prospecting Mills and Machinery:
The Electric Steel & Metals Co.
E. J. Longyear Company
Standard Diamond Drill Co.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Pneumatic:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Sullivan Machinery Co.

Pumps—Steam:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
The Electric Steel & Metals Co.
Mussens, Limited
Northern Canada Supply Co.
Smart-Turner Machine Co.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Turbine:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Vacuum:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
The Wabi Iron Works

Pumps—Valves:
Canadian Fairbanks-Morse Co., Ltd.

Pulleys, Shaftings and Hangings:
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
The Wabi Iron Works

Pulverizers—Laboratory:
Mine & Smelter Supply Co.
The Wabi Iron Works
Hardinge Conical Mill Co.

Pumps—Boiler Feed:
Smart-Turner Machine Co.
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
Mine & Smelter Supply Co.

Pumps—Centrifugal:
Canadian Fairbanks-Morse Co., Ltd.
The Electric Steel & Metals Co.
Smart-Turner Machine Co.
M. Beatty & Sons
Canadian Ingersoll-Rand Co., Ltd.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Diaphragm
The Dorr Company

Pumps—Electric
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
Smart-Turner Machine Co.

Pumps—Sand and Slime:
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mine & Smelter Supply Co.
The Electric Steel & Metals Co.
The Wabi Iron Works
Smart-Turner Machine Co.

Quarrying Machinery:
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.
Hadfields, Limited
Mussens, Limited
R. T. Gilman Co.

Rails:
Hadfields, Limited
John J. Gartshore
R. T. Gilman & Co.
Mussens, Limited

Railway Supplies:
Canadian Fairbanks-Morse Co., Ltd.

Refiners:
Goldsmith Bros.

Riddles:
Hendrick Mfg. Co.

Roofing:
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.

Rope—Manilla:
Mussens, Limited

Rope—Manilla and Jute:
Jones & Glassco
Northern Canada Supply Co.
Allan, Whyte & Co.

Canadian Miners' Buying Directory.—(Continued)

Rope—Wire:
Allan, Whyte & Co.
Dominion Wire Rope Co., Ltd.
Greening, B. Wire Co.
Northern Canada Supply Co.
Mussens, Limited

Rolls—Crushing
Canadian Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
Hadfields, Limited
The Electric Steel & Metals Co.
Mussens, Limited
The Wabi Iron Works

Samplers:
Fraser & Chalmers of Canada, Ltd.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heyes & Son
Mine & Smelter Supply Co.
Mussens, Limited

Scales—(all kinds):
Canadian Fairbanks-Morse Co., Ltd.

Screens:
Greening, B. Wire Co.
Hendrick Mfg. Co.
Mine & Smelter Supply Co.
Link-Belt Co.

Screens—Cross Patent Flanged Lip:
Hendrick Mfg. Co.

Screens—Perforated Metal:
Hendrick Mfg. Co.

Screens—Shaking:
Hendrick Mfg. Co.

Screens—Revolving:
Hendrick Mfg. Co.

Scheelite:
Everitt & Co.

Separators:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Mine & Smelter Supply Co.

Shaft Contractors:
Hendrick Mfg. Co.

Sheet Metal Work:
Hendrick Mfg. Co.

Sheets—Genuine Manganese Bronze:
Hendrick Mfg. Co.

Shoes and Dies:
Canadian Foundries and Forgings, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works

Shovels—Steam:
Canadian Foundries and Forgings, Ltd.
M. Beatty & Sons
R. T. Gilman & Co.

Siline:
Coniagas Reduction Co.

Saline Refiners:
Goldsmith Bros.

Smelters:
Goldsmith Bros.

Sledges:
Canada Foundries & Forgings, Ltd.

Smoke Stacks:
Hendrick Mfg. Co.
MacKinnon Steel Co., Ltd.
Marsh Engineering Works
The Wabi Iron Works

Special Machinery:
John Inglis Co., Ltd.

Spelter:
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

Sprockets:
Ltnk-Belt Co.

Spring Coil and Clips Electric:
Canadian Steel Foundries, Ltd.

Steel Barrels:
Smart-Turner Machine Co.
Fraser & Chalmers of Canada, Ltd.

Stamp Forgings:
Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.

Steel Castings:
Canadian Brakeshoe Co., Ltd.
Canadian Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
The Wabi Iron Works

Steel Drills:
Canadian Fairbanks-Morse Co., Ltd.
Sullivan Machinery Co.
Northen Canada Supply Co.
The Electric Steel & Metals Co.
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited

Steel Drums:
Smart-Turner Machine Co.

Steel—Tool:
Canadian Fairbanks-Morse Co., Ltd.
N. S. Steel & Coal Co.
Hadfields, Limited
Swedish Steel & Importing Co., Ltd.

Structural Steel Work (Light):
Hendrick Mfg. Co.

Stone Breakers:
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Sulphate of Copper:
The Mond Nickel Co., Ltd.
Coniagas Reduction Co.

Sulphate of Nickel:
The Mond Nickel Co., Ltd.

Surveying Instruments:
C. L. Berger

Switches and Switch Stand:
Canadian Steel Foundries, Ltd.
Mussens, Limited.

Switches and Turntables:
John J. Gartshore

Tables—Concentrating:
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.

Tanks:
R. T. Gilman & Co.

Tanks—Acid:
Canadian Chicago Bridge & Iron Works

Tanks (Wooden):
Canadian Fairbanks-Morse Co., Ltd.
Gould, Shapley & Muir Co., Ltd.
Pacific Coast Pipe Co., Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works

Tanks—Cyanide, Etc.:
Hendrick Mfg. Co.
Pacific Coast Pipe Co.
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works

Tanks—Steel:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Chicago Bridge & Iron Works
Marsh Engineering Works
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Hendrick Mfg. Co.
The Wabi Iron Works

Tanks—Oil Storage:
Canadian Chicago Bridge & Iron Works

Tanks (water) and Steel Towers:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Chicago Bdidge & Iron Works
Gould, Shapley & Muir Co., Ltd.
MacKinnon Steel Co.
Mine & Smelter Supply Co.
The Wabi Iron Works

Canadian Miners' Buying Directory.—(Continued)

Tramway Points and Crossings:
Canadian Steel Foundries, Ltd.
Hadfields, Limited

Transits:
C. L. Berger & Sons

Transformers:
Canadian Fairbanks-Morse Co., Ltd.
R. T. Gilman & Co.
Northern Electric Co., Ltd.

Transmission Appuiances:
Jones & Glassco

Troughs (Conveyer):
Hendrick Manufacturing Co.

Trucks—Electric:
Canadian Fairbanks-Morse Co., Ltd.

Trucks—Hand:
Canadian Fairbanks-Morse Co., Ltd.

TTrucks:
Canadian Fairbanks-Morse Co., Ltd.

Tubs:
Hadfields, Limited

Tube Mills:
The Electric Steel & Metals Co.
Fraser & Chalmers of Canada, Ltd.
Hardinge Conical Mill Co.

Tube Mill Balls:
Canada Foundries & Forgings, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.

Tube Mill Liners:
Burnett & Crampton
Fraser & Chalmers of Canada, Ltd.

Turbines—Water Wheel:
MacGovern & Co.

Turbines—Steam:
Fraser & Chalmers of Canada, Ltd.
MacGovern & Co.

Twincones:
Canada Foundries & Forgings, Ltd.

Uranium:
Everitt & Co.

Welding—Rod and Flux:
Prest-O-Lite Co. of Canada, Ltd.
Imperial Brass Mfg. Co.

Welding and Cutting—Oxy-Acetylene:
Prest-O-Lite Co. of Canada, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Imperial Brass Mfg. Co.

Wheels and Axles:
Canadian Steel Foundries, Ltd.
Hadfields, Limited
The Electric Steel & Metals Co.
The Wabi Iron Works

Winding Engines—Steam and Electric:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Wire:
Canada Wire & Cable Co., Ltd.
Greening, B. Wire Co.

Wire Rope:
R. T. Gilman & Co.
Dominion Wire Rope Co., Ltd.

Wire Cloth:
Northern Canada Supply Co.
Greening, B. Wire Co.

Wire (Bars and Insulated):
Standard Underground Cable Co. of Canada, Ltd.
Northern Electric Co., Ltd.

Wolfram Ore:
Everitt & Co.

Woodworking Machinery:
Canadian Fairbanks-Morse Co., Ltd.

Xineenium:
Everitt & Co.

Zinc:
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

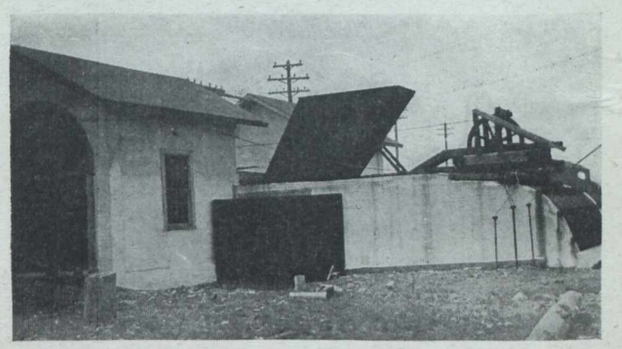
Zinc Spelter:
Canada Metal Co., Ltd.
Hoyt Metal Co., Ltd.

ALPHABETICAL INDEX TO ADVERTISERS

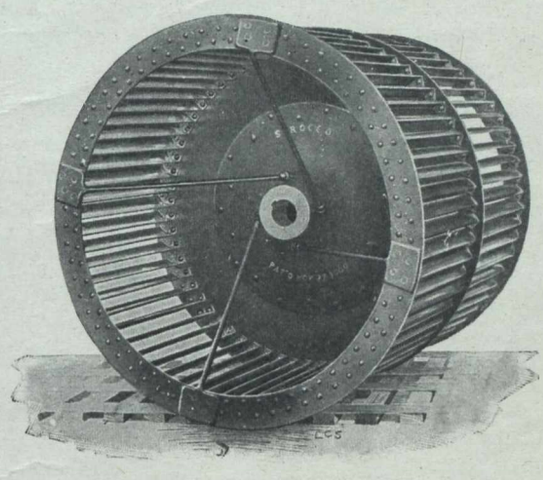
"Sirocco"

TRADE MARK

MINE FANS



Equipment in use at the Nova Scotia Steel & Coal Company's Mine.



DELIVER
MORE AIR WITH LESS POWER

Ordinary mine fans use a lot of power, and did you ever figure out how much that power is costing a year?

Suppose you are using 200 h.p., an average of 7000 hours a year. If that power delivered to the fan costs less than 5 cts. per horsepower hour you are doing better than the average.

$$\text{Now figure:} \quad \frac{200 \times 7000 \times 5}{100} = \$70{,}000$$

In many mines the figure is greater—we know of one mine where the yearly cost of power to operate the fans is figured at nearly $125,000.

So when we say that Sirocco Mine Fans deliver more air with less power, we are talking money—getting right down to brass tacks.

The limited space at our disposal here prevents going into the reasons for Sirocco superiority, but they are explained thoroughly in our 66-page illustrated booklet on mine ventilation.

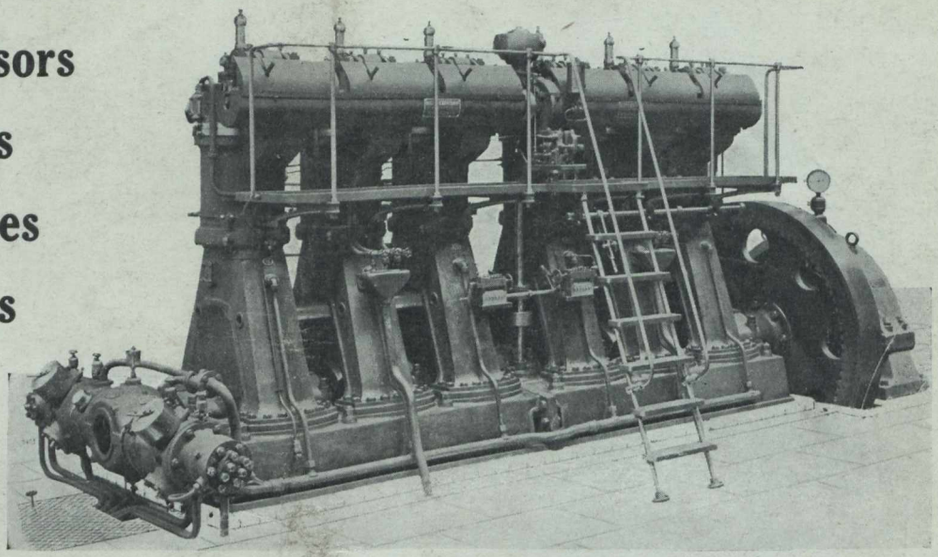
CANADIAN SIROCCO CO., Limited
WINDSOR, ONTARIO

BRANCH OFFICES:—

CALGARY, Alberta
TORONTO, Ontario
WINNIPEG, Manitoba
MONTREAL, Quebec

BELLISS & MORCOM

Air Compressors
Diesel Engines
Steam Turbines
Steam Engines
Condensers



BELLISS & MORCOM DIESEL CRUDE OIL ENGINE.

LAURIE & LAMB

211 Board of Trade Building - - - - MONTREAL

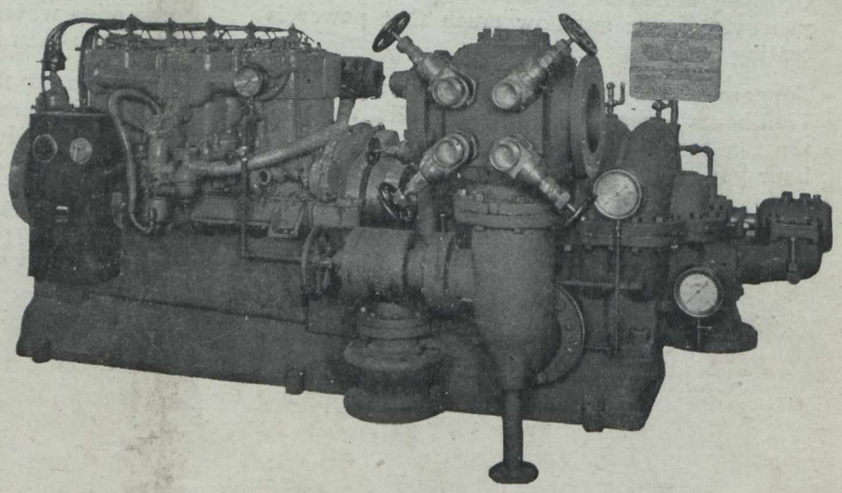
Lea-Courtenay self-contained fire pump unit for the protection of the isolated plant

The first successful self-contained fire pump equipment was a

LEA-COURTENAY CENTRIFUGAL PUMP

coupled to a gasoline engine. There are no stand-by charges for electrical current. Its operation does not rely on your Power Plant or the Central Station.

Lea-Courtenay Centrifugal Pumps are built on insurance standards; in capacities of 500, 750, 1,000 and 1,500 GPM., to be operated by gasoline engine, steam turbine or electric motor; singly or in combination for emergency. Ask for bulletin giving details.



FRASER & CHALMERS OF CANADA, Limited

GUARANTEE BUILDING :: :: MONTREAL, QUE.