Technical and Bibliographic Notes / Notes techniques et bibliographiques

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

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

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

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

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

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

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

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

TWENTY-FIRST YEAR OF PUBLICATION

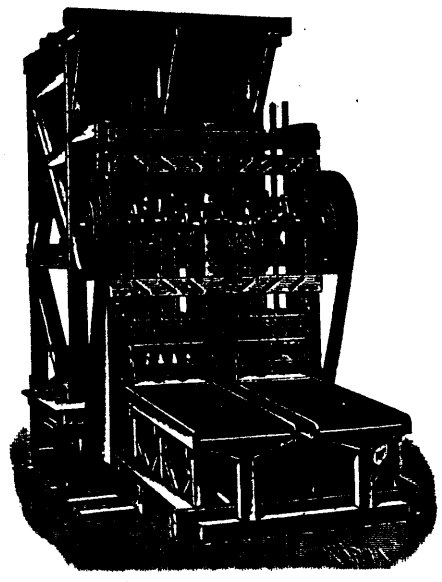
The CANADIAN MINING REVIEW

Established 1882

Vol. XXII—No. IX. OTTAWA, SEPTEMBER 30th, 1903. Vol. XXII—No. IX.

FRIED. KRUPP AKTIENGESELLSCHAFT GRUSONWERK

Magdeburg-Buckau (Germany)



MINING MACHINERY

ORE CRUSHING:

Stone Breakers of specially strong construction, **Roller Mills, Chilian Mills.**

BALL MILLS

for dry and wet crushing, more than 1,800 at work.

STAMP BATTERIES

Shoes and Dies of Krupp's Special Steel.

AMALGAMATION:

Amalgamation Tables and Pans, Larslo's Gold Amalgamators, Settlers, etc.

SEPARATION and CONCENTRATION:

Separators, Exhaustors, Hydraulic Classifiers, Percussion Tables, Jiggers, Rotating Round Tables.

LEACHING PLANT.

Complete Gold Ore Dressing Plant

a. For treating by the Wet Method with Stamp Batteries, Amalgamation and Concentration.
b. For Dry Crushing by Ball Mills Dust Extraction, and Leaching.

COAL WASHING PLANT

Large Testing Station for Crushing and Dressing Ores at the Works.

Agents:

For Canada: JAS. W. PYKE & Co., Merchants Bank Building, MONTREAL.
For the United States: THOS. PROSSER & SON, 15 Gold Street, NEW YORK.
For Mexico: PABLO BERGNER, Apartado 549, MEXICO.
For South Africa: UNITED ENGINEERING CO., Ltd., P.O. Box 1082, JOHANNESBURG, S.A.R.

RAILS

NEW AND SECOND HAND

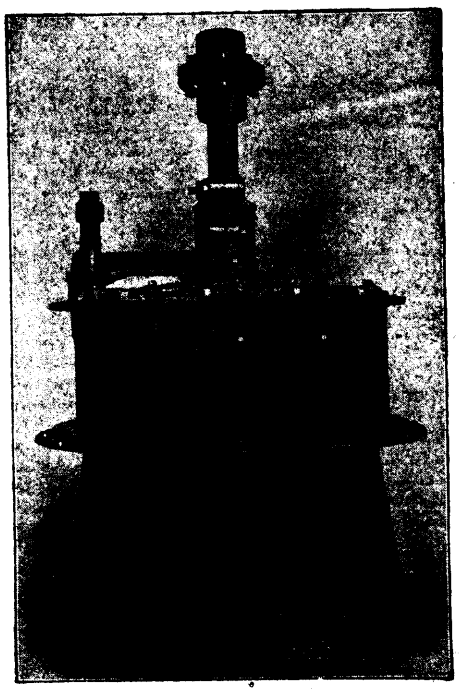
For Railways, Tramways, Etc.

JOHN J. GARTSHORE, 83 Front Street West

Opposite Queen's Hotel TORONTO, ONT.

MINING EQUIPMENT, Etc.

The Wm. Hamilton Mfg. Co. Limited



PETERBOROUGH, ONT.

BUILDERS OF

The Samson Turbine

Upright and horizontal. For all heads.
Especially adapted to driving

MINING and ELECTRIC POWER PLANTS

Unequalled for power, speed, efficiency and regulation.

We also manufacture the **Cascade** wheel, for high heads; and are builders of a complete line of mining machinery.

Write for our Catalogues.

Baldwin Locomotive Works

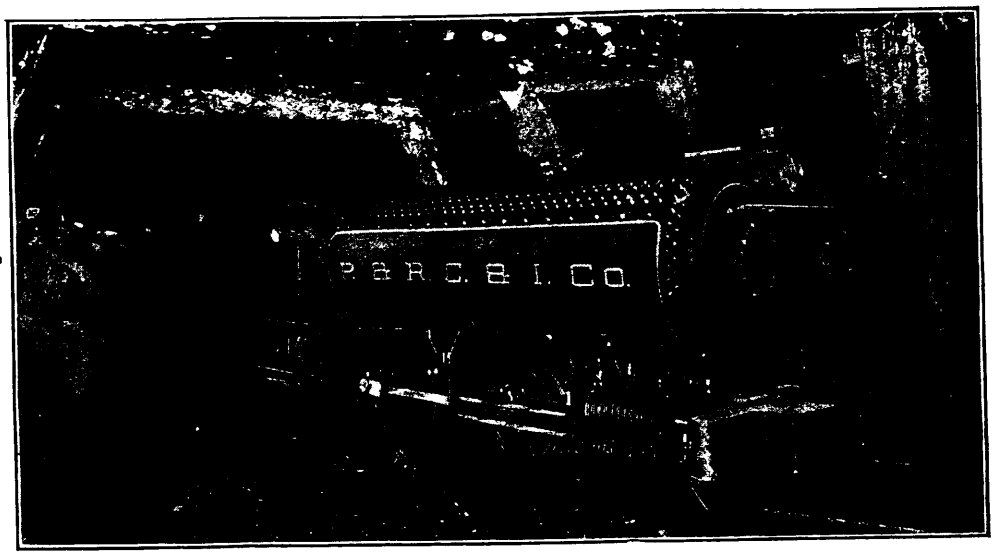
Burnham, Williams & Co., Philadelphia, Pa., U. S. A

Steam

Compressed Air

and

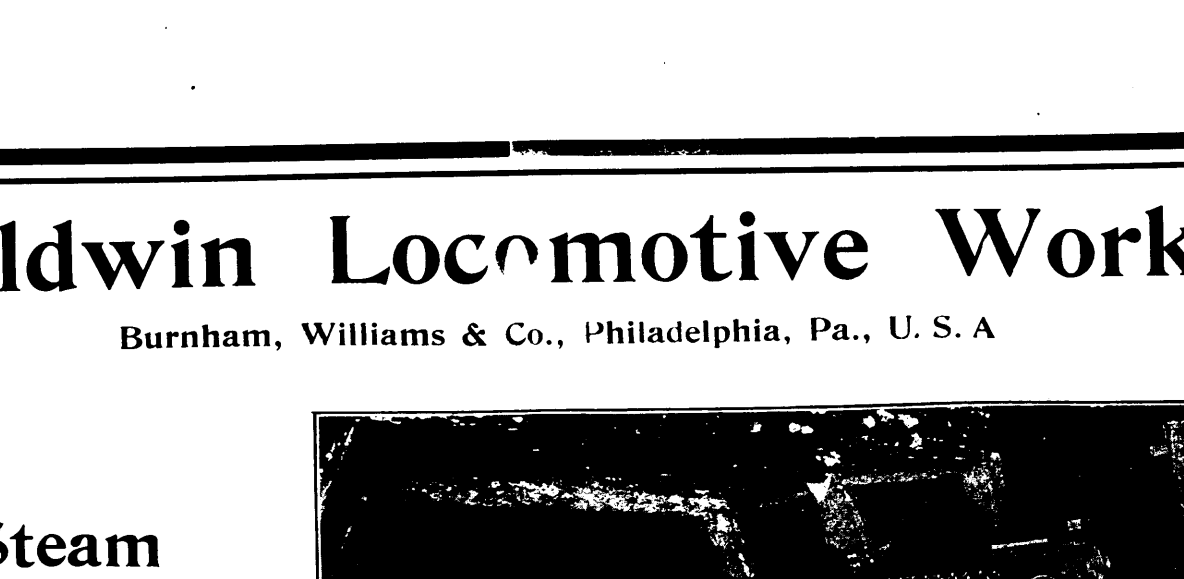
Electric



Baldwin Compressed Air Mine Locomotive

Locomotives FOR Mines and Furnaces

HADFIELD'S PATENT



MANGANESE STEEL

Sole Representative of the Hadfield Steel Foundry Co., Ltd, Sheffield, for Canada **PEACOCK BROTHERS,** Canada Life Building, **MONTREAL.**

THOS. FIRTH & SONS, Ltd., Sheffield,

Tool Steel and Rock Drill Steel

ALWAYS CARRIED IN STOCK.

SHOES AND DIES.

CAMS, TAPPETS, BOSSES, ROLL SHELLS, CRUSHER PLATES.

H. W. DeCOURTENAY & CO.

86 and 88 McGILL STREET

MONTREAL.

Agents for Canada.

DIRECTORY OF MINING ENGINEERS, CHEMISTS, ASSAYERS, ETC.

21st YEAR OF PUBLICATION.

The Canadian Mining Review

Established 1882

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

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

Published Monthly.

OFFICES { Orme's Building, Ottawa; Windsor Hotel, Montreal.

VOL. XXII., No. 9. SEPTEMBER, 1903. VOL. XXII., No. 9.

Dominion Steel Company And Dominion Coal Company.

After three months investigating the affairs of this Company by Mr J. H Plummer, Ex-Assistant General Manager of the Canadian Bank of Commerce, who must be regarded as a financial expert, a scheme has finally been resolved which, whilst not meeting with the entire approbation of all parties concerned is regarded as a via media, and the consummation of which will result in the complete severance of these concerns. Whether the effect of the operation will be the same as in the case of the Siamese Twins, and result in the death of one or the other, remains to be seen. Our own view is that whilst the severance may have been rendered necessary by the development of untoward circumstances it is on every ground unnatural and regrettable. Unnatural, because properly managed the interests of the two concerns dovetail to such an extent that the management could be more economical and more affective under one control than under two. Regrettable, because the severance puts an end to an alliance which had been looked forward to for many years, and which in the opinion of competent experts promised to be productive of prosperity and wealth.

It is not necessary to dilate upon the intrinsic value of the coal Company's property. It is undoubtedly one of the finest properties of the kind on the continent or, indeed, in the world, and nothing but the most incompetent handling could prevent it becoming a commercial success. The one thing which limited its capacity in this direction until a few years ago was the absence of a local market. This combined with the fickleness of the demand from the United States sometimes left the concern so short of trade as seriously to cripple its economical management. The establishment of the Steel Company supplied this local deficiency, and guaranteed such a large consumption as to place the Coal Company beyond the influences above mentioned, and ensured at all times an output which would yield a working profit. Given the two conditions which exist, first a valuable coal property with unlimited supplies of fuel of a suitable character for the manufacture of steel, and added to this a modern steel works properly equipped, and furnished with its own natural ore supply, nothing but competent management was required to bring out from this happy combination a permanent industry which would have been a source of wealth not only to the shareholders but to the country at large. Nothing has occurred to affect the value of the coal or ore deposits. These are just what they were before the Steel Company came into existence. But whilst nature has done so much, man seems to have done his utmost to discount the value and prevent the gathering of the harvest which investors had every right to expect. It is now admitted that whilst the steel plant is modern and in many respects efficient, there has been a reckless squandering of capital, and according to the highest authortty the whole works could be reproduced for two-thirds of what they have cost. In other words, in connection with the institution and development of this industry there has been a waste of at least $7,000,000 to $8,000,000. Just what the position of the Steel Company would be today if they had this amount in cash one can better imagine than describe. It would at least wipe out every cent of their indebtedness, give them sufficient to complete their plant, and still leave a respectable margin for other purposes. It is wonderful to think that after five years work and the expenditure of $25,000,000 to $30,000,000 the plant is still deficient in several important respects; has still to construct mills for wire rods, structural steel, a large battery of coking ovens, and an extensive coal washing plant. It is more difficult to understand how such a disastrous result can have been attained, when one remembers that since the leasing of the Coal Company's property a year ago the whole of the fuel consumed in the Steel Works has been supplied at less than cost. One of the highest authorities in England, if not indeed the highest, who visited Canada in the early part of last year, and went through the Sydney works, stated to the writer that his firm was prepared to enter into negotiations for purchasing outright or securing a controlling interest in the Dominion Steel Company, but that the cost of the plant had been so outrageous that it would be quite impossible for them to come to terms, and on that account the negotiations were dropped at a very early stage. This opinion has been confirmed by other men of high standing, which justifies the verdict that from the time of Mr. Moxham's visionary and crude ideas of cost, when he estimated the production of pig iron at $5 a ton instead of $11, everything has proceeded on a similarly incorrect basis. This is not because the Company has not employed competent experts, but if in face of such a gigantic failure in which the reputations of several of the greatest financiers in Canada have suffered we may be permitted to offer an explanation, we would attribute it to the fact that those experts have worked under the control of a board which did not include one director having a practical acquaintance with the business which he undertook to direct; and when one considers the high character, and even the remarkable achievements of several of these men in the realms of finance and public life, it becomes still more obvious that such experience does not equip men to control and direct a highly technical industrial enterprise. It would have been easy, at the time of Mr. Moxham's original estimates to have submitted them to other tests, for it is well known

that no sooner were his figures published than there was a general condemnation of their optimism on the part of practical men all over the continent. Many of these protests reached the ears of the directors, but were disregarded, and now that disaster and almost disgrace has overtaken one of the most promising concerns ever launched in Canada, one can not altogether acquit the board of directors of responsibility in the matter.

In addition to the failure of the chief executive body properly to control and direct the expert knowledge which was at their disposal, they incidentally failed to ascertain in the earlier stages of their history just what class of steel could be made from their ore, which accounts for a change of programme, the abandonment of some mills and the purchase of others. It has always been manifest that the Company did not possess a Bessemer ore, and it is well that they are now directing their attention exclusively to the production of a different class of steel.

Whether the severance of the two concerns will enable the Steel Company to rally and make a success, depends upon conditions which will very soon develop. The first is that in addition to the substantial sum of $2,635,000 which they are to receive from the Coal Company, they will be able to raise a sufficient amount of cash to pay off other liabilities, and to complete their plant. For this purpose it is understood that the directors have guaranteed to find the money for $1,500,000 in bonds. In our judgment this amount is totally inadequate, as according to the last published balance sheet the liabilities, after deducting available cash assets, were about equal to the amount now to be received from the Coal Company, which would only leave $1,500,000 for other purposes. According to the best advice we learn that it will take $3,000,000 at least to do what is necessary, and an attempt to do it at less will result either in inefficient plant or an increase in the indebtedness of the Company. The other condition which must obviously be attained without a moment's delay is the securing of efficient and competent control. The Company have evidenced their appreciation of this fact by the recent additions to the board, and in the person of Mr. W. MacMaster it has undoubtedly been strengthened, as he has had many years experience in a branch of the iron trade; but with all respect to the gentlemen who now constitute the board, we consider that it would be of the highest value if they could add one or two others who have been directly interested in the manufacture of steel. We know of no industrial enterprise which is not well represented on its board by men of practical experience in its own line, and in so highly technical and costly an industry as the one under consideration, it is absolutely indispensable.

Turning for a moment to coal, we can not disguise the fact that the future of this enterprise is to some extent under a cloud. Undoubtedly the reason why the lease has been broken and a severance effected is to be found in the difficulty of reconciling conflicting financial interests, and one must agree that whilst Mr. Ross's reputation suffered somewhat in his handling of steel, he has fairly rehabilitated it in the successful manner in which he has enabled the coal interests to emerge from the conflict. No sooner did he find that coal was wedded to a concern which in the present was unprofitable, and the future of which was extremely doubtful than he set about to effect a divorce, and has at last succeeded in doing so by an actual sacrifice of $1,100,000, which may be considered cheap alimony. The bone of contention which made a settlement so difficult and delayed it so long was the contract for fuel by which the Steel Company were to get the whole of their requirements for a practically unlimited time at $1.20 a ton. In every light we consider this contract just as foolish as the one made by the Dominion Coal Company seven years ago with the Everett Gas Company. Both contracts were made at a time when wages were low and the cost of production at its minimum, and the first inflation of trade made the contract a losing one. It is a matter of history that on the failure of the Everett Gas Company the former contract was broken. The present one, however, is of a different character in this respect, that it is more indispensable to the Coal Company, since it furnishes a local demand for a million tons of coal a year, and takes the bulk of the fine or slack which is produced. Mr. Ross has not been able in any way to break this contract, but he has been able to secure such a modification of the terms as will limit the supply of coal at contract prices to something approximating to the present consumption of the Steel Works, and has also secured the option of furnishing fine instead of round coal, in four years hence when the Steel Company will have completed their coking plant. This provision is no disadvantage to the Steel Company, because by that time they will require to coke most of their fuel, and will be in a position to do it, and it is an advantage to the Coal Company in finding a ready market for slack which in bad times of trade becomes a drug. The contract is still, however, a white elephant—or worse; since the present cost of production is $1.35, which makes it extremely doubtful whether such a reduction in cost can be effected as to leave a small margin of profit on the contract, and if not, the liability to supply such an enormous tonnage even at a small loss is a serious one.

Possibly the most regrettable event in connection with these two enterprises is the extent to which the coal property has depreciated during the last two years: not in respect of the coal itself, but of the extravagant expenditure which has been indulged in, and the great increase in the cost of production. The published statement of the directors, issued during the present month, shows that since the agreement between the Coal and Steel Companies, a year and a half ago, "the Steel Company has paid into the Coal department out of its ordinary ressources the sum of $1,480,000, and has given its notes for $655,000 which have now to be paid." The whole of this money has been swallowed up in capital expenditure. Just how it has been spent may be seen from illustration. The total capital expenditure up to date on the New Dominion No. 2 mine has been about $2,500,000, and the output at the present time is in the neighborhood of 2,000 tons per day. This is a larger sum than the total capital expenditure of the Dominion Coal Company in the purchase and equipment of the whole of its mines from 1893 to 1896 when the output had reached 1,200,000 tons per annum or twice the present capacity of Dominion No. 2. Of course this expenditure is destined to yield a very much larger output, but already it is clear that Dominion No. 2 is a gigantic mistake, and the cost sheet demonstrates that coal will never be produced so cheaply in an enormous mine equipped for 5,000 tons per day as in the older mines such as Dominion No. 1, Reserve and Caledonia with a limit of half that amount. The capital account in none of these individual mines stands today at more than $500,000, and Dominion No. 1 had attained an output of 2,000 tons a day long before its capital outlay reached that figure. In 1893, the first year after the Dominion Coal Company acquired and operated the Cape Breton Mines the cost stated was $1.15, according to published prospectus. After equipment the cost fell, in 1896, to 85c. a ton and the management promised that it would be 75c. the following year. Then came a change both in management and policy, and ever since the cost has steadily risen until now, as above stated, it is $1.35. There is not a practical miner in the country who does not know that for mines situated so favorably as these are, this is a ridiculous cost which is not accounted for in any way by the comparatively moderate increases in wages which have been made, but rather by extravagant expenditure and laxity of control. It is extremely fortunate that during the last few years the selling price has been high, and this alone has

saved the Coal Company from disaster. Now that the tide has turned and prices are falling there is not a moment to lose. Competent expert economical control is called for in every department. The cost should be reduced, according to the best judges, at least 25c. a ton, and it is not unlikely that this will have to be done without any considerable reduction in wages as the increases have been much more moderate than elsewhere.

One cannot look at the general state of the coal and iron trades without realizing that 1904 will see the prices back very near where they were three years ago. Already pig iron has fallen in the States from $26 to $17 and mines are being closed in order to restrict production, and if possible maintain prices. This is a general condition both in the States, in Germany, in Belgium and in England, and we are evidently on the eve of one of those cycles of depression which have been persistent and regular in the history of the coal and iron trades. If so, whilst Canada may not suffer, and indeed will not suffer, as much as her larger competitors, prices will of necessity go down to some extent, and it will be with difficulty that even a home market will be retained to the extent to which it is at present controlled by the Canadian product, but if this is done it will only be at lower prices. The average selling price of Nova Scotia coal next year is likely to be $2 a ton, possibly as low as $1.75. This should still leave a respectable margin, but with the diminished tonnage dead charges will naturally raise the cost of production, unless this is offset by the effecting of economies. We consider that the Dominion Steel and the Dominion Coal Companies are at the parting of the ways, in more senses than one. Their experience has been most exceptional and unfortunate, especially in view of the generous protection accorded them by the Canadian Government, and we appeal to the industrial magnates who control them to arise to the importance of the crisis, and by the adoption of an economical policy and the establishment of efficient control to rescue these concerns from the position into which they have drifted, and which cannot long continue without plunging not only the stockholders but the communities which have sprung up around them into ruin.

Ontario's Growing Mineral Industry.

The mineral products of Ontario at the present time show a much greater variety than they did a few years ago. The last five years have seen a great revival in the mining of mica and other substances. Within the same period the mining of other minerals formerly not produced in the Province has been begun and the output has now reached comparatively large dimensions. Ontario can now show as great a variety in mineral products as almost any country of equal extent of territory. These include the ores of gold, silver, copper, nickel, zinc, lead, iron, together with smaller amounts of platinum, molybdenum and other rare metals. Then there are the non-metallic minerals or compounds, a number of which are being produced in increasing quantities, feldspar, graphite, corundum, actinolite, talc, white arsenic, iron pyrites, petroleum, natural gas, salt, peat, marble, and various clays and rocks for use in building and for other purposes, such as cement, calcium carbide and chemicals.

In connection with metal mining the increased interest being taken in the iron ore ranges of the northern and northwestern parts of the Province is especially worthy of notice. Large sums are also being expended on new plants by one of the nickel companies.

It is to the non-metallic minerals, however, that the Province owes her greatest increase in the variety of her productions. The mining of feldspar which was begun less than three years ago is now rapidly growing in importance, and the potters of the United States are drawing on this Province for an increasing amount of their supply of this mineral.

During the last three years Ontario has been the world's chief producer of corundum Both of the two companies operating are now greatly increasing the size of their plants.

During the past year or two petroleum and natural gas wells have been sunk in areas formerly not known to contain these materials in economic quantities. As regards salt, another of the older mineral products of the Province, it may be said that the output can be increased at any time the demand arises for a greater supply.

The production of refined graphite shows a satisfactory growth.

The production of peat briquettes is now assuming the form of a stable industry, and the numerous large deposits of this fuel which are known to exist in the Province gives rise to the belief that it will become an important industry.

The output of actinolite, a mineral which is used as a roofing material, is similar to that of former years. An experimental plant for the production of short fibre asbestos has been erected within the last few months.

The output of iron pyrites is increasing and new deposits are being opened up.

The demand for the different varieties of limestone is constantly growing and serves as an index to the increase in manufacturing in the Province. An important group of industries now use limestone as one of their raw materials. Among these industries are the following,—cement, pulp, beet root sugar, glass, calcium carbide, blast furnace, lime, and chemicals, such as acetate of lime, etc. There are also the uses of the rock as an ornamental, building and structural material. No systematic reports on the limestones of the Province have been published and users of the rock have had trouble in finding material of the desired character, a variety suitable for one use often not being adapted to another. For this reason the Provincial Bureau of Mines has undertaken the preparation of a report on the subject during the present season. The more important outcrops of the rock in various parts of the Province are being visited. The samples taken will be analyzed and users desiring a stone of a particular composition will be able to learn from the report when published where such is to be found. In the manufacture of beet root sugar, cement and certain chemicals a stone carrying a low percentage of magnesia is required. On the other hand in the sulphite pulp process, for example, a rock high in magnesia must be used. On account of the lack of knowledge concerning the occurrence of rock suitable for some of these purposes in the Province material has heretofore been imported. It will be seen from what has been said that limestone plays an important part in the mineral industry and is worthy of much more attention than it has as yet received in this country. At the present time the limestone industry is in a transition state. New uses are being made of the rock and cement is cutting into the field heretofore entirely occupied by stone and lime. The burning of lime in many localities is dying out on account of the increased price of wood for fuel.

Little is also known of the clays of Canada and it is time that a systematic study was made of them. Many of the States of the Union have detailed reports on their clay deposits, and the industry is there being developed on a scientific basis. On this side of the line we have neglected this industry in our chase after the more glittering minerals. The result is that we have no pottery industry of importance and our brick, cement and other industries in which clay is used as a raw material can be greatly enlarged.

Alluvial Mining in Nova Scotia.

The general rule that alluvial mining precedes vein mining applies to Nova Scotia. It is true that here alluvial mining never rose beyond a temporary excitement, as the immediately following discovery of gold-bearing veins distracted attention from it.

In the early history we find references to the Acadians washing gold from the sands of the upper waters of the Avon river. A century after the ground covering the scene of the earliest mining in Tangier yielded notable amounts of gold for the few cubic yards of ground subjected to treatment.

At the Ovens, in Lunenburg County, the Atlantic, wearing into caves the auriferous slates, concentrated small amounts of gold on the beach. The discovery of these washings, limited but rich, caused much excitement. The field, however, yielded but a few ounces, and has since laid dormant. Local men are said still to secure a small wage by washing the sands continually re-assorted by the Atlantic surges. Similar but less rich sands occur on the beaches of Tancook Islands in Chester Bay. The slates yielding the gold at the Ovens contain many veinlets of quartz showing free gold, but hitherto no systematic attempts have been made to see if they could furnish a low grade ore.

At Gays River, in Colchester County, the basal carboniferous conglomerates were formed directly on the auriferous measures. The trouvled boulder making sea of that distant epoch rubbed out gold which was deposited in the slates at the base of the conglomerate. Years ago some little washing was done at the base of the outcrop of this conglomerate now hardened and compacted. An attempt was made to mine and crush the auriferous part of the conglomerate but it was soon abandoned. Later attempts at mining on a similar scheme have failed. It is evident that the gold channel of that period must be found, as in more modern cases, before a maximum of return can be anticipated.

To the late Mr. J. Campbell belongs the credit of showing the auriferous character of the soil at several points along the shore west of Halifax and around Halifax Harbor. Two years later it was reported that he and Professor Silliman had washed gold from the sands of Sable Island. Later tests, however, on the Island did not show gold. The fact seems to be that in nearly all the deposits of glacial origin more or less gold is found, but the presence of tenacious clay rendered its working expensive. The appliances of the present day, however, would probably be found equal to the disintegration and washing of this material. Where the glacial drift has been rearranged, and in the less thickly covered localities search should show pay ground. The course of the glacial movement being southerly, and the denudation being on an enormous scale the submarine banks adjoining the Coast must have received vast amounts of gold from the anticlinal domes.

Sherbook, Mine Harbor, Tangier and Gold River in the early days furnished very considerable amounts of soil from the vicinity of the worked veins which was also crushed. As the results were reported together it is now impossible to form any estimate of the amount of soil treated.

At Moose River the alluvium covering the veins has been largely treated. Separate returns are not available beyond the statement that there were crushed in the Moose River ten-stamp mill of Mr. Touquoy from 1888 to 1898, 60,943 tons of slate and surface ground, including a few small lots, say 200 tons, of rich quartz, which yielded 8,640 ounces or an average of about 2 dwts. 20 grains.

Among other localities showing alluvial gold may be mentioned the Nine Mile and Leander rivers, Renfrew, the southern part of Waverly.

In Cape Breton the Middle River of Baddeck has yielded alluvial returns, and the presence of rich lodes is known in the vicinity. At Whycocomah the streams flowing from Lewis Mountain show gold, and in some cases good wages have been made with working tests. In nearly all the streams flowing from the pre-cambrian plateau of Victoria and Inverness counties show gold. The working of a few small rich bars in the Cheticamp River led to prospecting in that vicinity which has shown lead and copper deposits carrying decided gold and silver values, which are now being systematically tested.

It is true, so far as any attention has been paid to the subject, that there may not be in this Province the enormous deposits of auriferous gravel which with the aid of large water powers have attracted extensive investments of capital to wash with water brought for miles millions of tons of alluvium to glean a profit from their scanty contents. It may be stated, however, confidently, that the deposits here are richer, and in many cases capable of development at a small cost.

The extent of ground which has been enriched by the denudation of the anticlinal folds corresponds with that assigned to the gold fields by the geologists. As the gold field is traversed longitudinally by numerous anticlinal folds, and each fold has been subjected to a denudation of from 500 to 2,500 feet it is evident that incalculable amounts of gold have been torn from their matrix and distributed to the south of their original resting place.

Ontario's Minerals.

The twelfth annual report of the Ontario Bureau of Mines has been published since our last issue. The volume is a large one, containing some 354 pages of matter printed in leaded bourgeois type, profusely illustrated by half-tone cuts and zinc etchings, and accompanied by two geologically colored maps. It covers the whole range of the Province's mining industries, and gives much useful and interesting information concerning the mineral resources of Ontario and the progress which is being made in their development.

The statistics presented in the report are for the year 1902 and have already appeared in these columns. As compared with 1901, the advance in value was considerable, the aggregate for 1902 being $13,391,634 as compared with $11,831,086 the previous year.

The mineral products of Ontario make up a long and varied list, but the output of many of the minor substances is insignificant. Of the metallic products, nickel, pig iron, steel, copper and iron ore comprise the bulk. Nickel is the peculiar metal of Canada, and the mines of the Sudbury region are evidently capable of production on a scale equal to any conceivable demand. The nickel contents of the Sudbury mattes made in 1902 amounted to 5,945 tons, much the largest output on record, notwithstanding the slackening of the rate of output during part of the year consequent upon the consolidation of the nickel interests early in 1902. Dr. A. P. Coleman, professor of geology in the University of Toronto, deals with the Sudbury nickel deposits in the report at some length. He describes the governing feature of the nickel region as a great eruptive band of norite enclosing an elongated area of Cambrian rocks about 35 miles long and 8 miles wide, all the chief mines of the district being situated on the basic edge of this band or on dike-like offshoots therefrom. Dr. Coleman suggests that this nickel-bearing band of eruptive rock has in reality a basin shape, and that the separation of sulphides was essentially the result of gravitation, the heavier materials going to the bottom in the process of cooling. He distinguishes two classes of deposits, (1) those

along the southeastern margin of the main range, often crowded into bay-like indentations of the adjoining rock, and (2) those strung out along the narrow offshoots from the main range. A third and rarer type is that of the Vermilion mine, which has no visible association with any gabbro or norite band A brief description is added of the principal mines and mining companies. Since the beginning of operations in the Sudbury region about two million tons of copper-nickel ore have been raised, from which 32,150½ tons of nickel and 31,746¼ tons of copper have been obtained. Plans and sections of a number of the mines are given—the first time we have seen the ore bodies in the nickel mines thus outlined. Most of Dr. Coleman's work last year was done on the southern or main range, where Dr. Barlow of the Dominion Geological Survey has also been at work. We understand that during the present year the former has followed up his studies by an examination of the northern range where some extensive ore bodies exist, on which but little development work has been done owing to lack of railway facilities. Drs. Coleman and Barlow are two of the most capable of our Canadian geologists, and the results of their work ought to be of great scientific interest and practical utility.

A considerable part of the report is devoted to the iron ores and ranges of the Province. Prof. W. G. Miller, the provincial geologist, enumerates the iron ranges of northern Ontario and concisely describes their characteristics; and the new magnetite deposits in and near the township of Hutton which are likely to prove important, are dealt with briefly by Frof. W. K. Leith of the U.S. Geological Survey. A paper on the magnetic concentration of iron ores by J. W. Wells is timely and interesting, in view of the many deposits of low-grade ores in Ontario.

The mines of northwestern and eastern Ontario are described in detail by the mining inspectors, Prof. Miller and Mr. W. E. H. Carter, from notes made during the course of their official visits. Two hitherto little known regions, one on the Mississaga and the other south of lake Abitibi, are respectively described by Mr. L. C. Graton and Mr. L. L. Bolton, geologists attached by the Bureau to surveying parties. The upper stretches of the Mississaga appear to be almost wholly in Laurentian rock, while between Round lake and Abitibi the predominating Huronian formations are for the most part overlaid by large areas of fertile soil. The reports of good agricultural land in this section of new Ontario have been confirmed by further explorations during the present year.

A feature of the Bureau's work from the beginning has been the prominence given to the question of peat fuel, the special interest of Ontario being due to the fact that the Province is without workable seams of coal. Some 44 pages of the report are occupied by a paper on the manufacture and use of peat as fuel, in which a pretty full account is given of the methods of preparing this article in Europe and America. The opinion is expressed that compressed peat is likely soon to take a prominent place in the industrial economy of the nation, and that in efficiency and cost it will compare favorably with coal. This subject of peat fuel has been long before the public, and it is time some practical results were forthcoming. We trust the Bureau of Mines is not pursuing an *ignis fatuis*, and that the test of every-day use will speedily demonstrate the superior qualiteis of peat as fuel. So long as coal is to be had, however, we have our doubts as to the likelihood of this water-retaining material becoming the fuel of the country.

The gold mines of Ontario are proving more or less of a disappointment. The yield of gold was less last year than in 1898, and much less than in 1899. In the Lake of the Woods and Rainy River regions little gold is being won at the present time, notwithstanding that auriferous quartz has been found in very many and widely separated localities. Michipicoton and Hastings County are doing better, and seem to be contributing more largely to the gold output than any other sections.

From the palaeozoic rocks of older Ontario a variety of useful substances is obtained, including petroleum, salt, natural gas, gypsum, and in the eastern portion of the province, mica, talc, graphite, corundum, iron pyrites, feldspar and arsenic. Building stone, brick and other clay products, lime and cement form on important group yearly growing in aggregate output. The Portland cement industry is developing rapidly, the raw materials, bog-lime or marl and clay, being abundant. The production last year was $ 716,221 in value as against $563,255 in 1901, and several new plants are in course of construction.

Altogether the Bureau of Mines is to be complimented on having in its Twelfth Report maintained the high standard of its previous volumes, and Ontario is to be congratulated on the advance which its mineral industries continue to make.

EN PASSANT.

The Royal Commission appointed in England in 1901 to inquire into the coal supply of the United Kingdom, has presented its first report, consisting of the evidence given by the witnesses of whom a large number have been examined. The subjects allotted for investigation by the Commission included the extent and available resources of the coalfields of the United Kingdom, the rate of exhaustion which may be anticipated, the effect of coal exports on the home supply, the possibility of a reduction in cost by cheaper transport, avoidance of unnecessary waste in working, or a change in the usual terms of mining leases, and the probability of Great Britain maintaining its competitive power with the coalfields of other countries. The evidence submitted bears almost entirely upon three points, (1) the limit of depth in mining coal, (2) the minimum thickness of workable seams, and (3) waste in working. As to the first of these points, the Commission has adopted the view that coal seams lying more than 4,000 feet below the surface may for the present be regarded as unworkable. The inquiry not having been completed, no opinion is expressed regarding the available coal supply or its probable duration at the present or any future rate of consumption.

The output of the metalliferous mines and works in Ontario for the first six months of 1903, as returned to the Bureau of Mines, was as follows:—

		Quantity.	Value.
Gold,	ounces.....	5,842	$ 93,233
Silver,	"	23,100	11,550
Iron Ore,	tons	189,055	265,112
Pig Iron,	"	35,373	633,328
Nickel,	"	3,085	1,088,671
Copper,	"	1,860	268,393
Zinc Ore,	"	400	6,000
		Total value,	$2,366,287

The corresponding output for the first six months of 1902 was $2,902,722.

Most wonderful reports are still coming to hand as to the marvelous richness of the discoveries of gold in the Lardeau District, British Columbia, on Poplar Creek. If the one hundredth part of the stories in circulation as to the richness of the quartz in the Lucky Jack and other claims staked on the creek should prove to be founded on fact, then indeed a find has been made which will be of inestimable benefit to the district in particular and the province and

country in general. The gold is said to be found in boulders ranging in weight from fifty to a thousand pounds or more, and fine gold is sticking out all over. In conversation a few days ago with an English gentleman closely identified with large mining interests, who has just visited the creeks as a member of the British Chambers of Commerce party, the Review is informed that the finds appear to be remarkably rich indeed, and that all the members composing the excursion were very much surprised at the showing. He, however, concluded by saying with characteristic British caution, "But then you know all is not gold that glitters, and English capitalists have suffered such heavy losses in the country that they will require considerably more evidence before plunging very heavily in the new ground."

Through the courtesy of Mr. L. Vogelstein, New York representative of Messrs. Aron Hirsch & Sohn of Halberstadt, Germany, we are enabled to give the figures of the German consumption of foreign copper for the months, January-July, 1903, compared with the same period of 1902-1901 :—

	1903.	1902.	1901.
Imports.....	49,263 tons.	47,765 tons.	38,842 tons.
Exports.....	6,283 "	5,517 "	5,449 "
Consumption.	42,980 "	42,248 "	33,393 "

Out of the above, the imports from the U.S.A. were as follows:—

1903.	1902.	1901.
36,549 tons.	35,780 tons.	26,921 tons.

Notes on the History of the Mineral Industry in the Nineteenth Century.

By WILLET G. MILLER, Toronto, Ont.

On reading an interesting review of the progress of the mineral industry in the Nineteenth Century, written a year or two ago by Prof. Treptow of Freiberg, it occurred to me that the subject would be a good one to bring before the members of this Institute ** A knowledge of the wonderful progress which has been made in our industry in the last century should afford us encouragement for the furure.

Prof. Treptow is a member of the staff of the Freiberg School of Mines, an institution which has itself played a very important part in the great advancement which has been made in mining and metallurgical methods during the last hundred years This technical school has also, we might say, had much to do with the immense increase which the last century has witnessed in the volume of mineral products, its graduates having been pioneers in almost every great mining country of the world.

Prof. Treptow's paper gives a handy summary of the statistics of some of the most important mineral substances, together with a sketch of the early utilization of minerals which first came into commerce in the century just closed.

In the following notes I have summarized Prof. Treptow's paper, and have taken the liberty of rearranging some of the material and adding a few notes so as to make it more applicable to this side of the Atlantic.

The history of mining, or in a wider sense the mineral industry, in the 19th century is characterized by a great advancement in technology and a corresponding enormous increase in production over earlier times. There has also been a great widening of geographical boundaries. As a result of the period of great geographical discoveries in the 16th century practically only Mexico and a part of South America were added to the list of mining countries. In the 19th century North America, a great part of Asia, Australia, and finally South Africa become great centres of mining activity and eclipsed in production the older countries.

In the 19th century the industry has done much to promote the cause of civilization, and has opened up many remote and previously little known parts of the earth. In this connection it is only necessary to mention the great effects which have resulted from the rush of gold diggers to California in the late 40's and to Australia in the early 50's.

Mining has been wonderfully influenced by the progress which metallurgy and the chemical industry have made in the century. The development of the science of chemistry, which can hardly be said to have existed at the end of the 18th century, has greatly enlarged the use of previously known economic minerals and has also found uses for many others which, though known, were of no commercial importance.

THE PROGRESS IN TECHNOLOGY OF MINING.

Only the chief points in the progress of mining technology can be briefly referred to in the space at our command. The sciences of mineralogy, geology and ore deposits on the one hand and mining on the other have had a closely interwoven history. Even after the former had become distinct sciences they have profited from observations made by miners and from the opportunities which have been provided by mining operations for examining beneath the surface of the earth. Mining has also, it is unnecessary to say, been put under deep obligation for assistance received from these sciences.

Somewhat different is the relationship between mining and the construction of machinery. In the 18th century, and in some places still longer, the miner built his own machines, his whims, water wheels and other structures used in the art of the times. The widening use of steam gradually divorced the work of the miner from that of the machinist until at the present time while the mine manager may have something to say about the design of a machine its construction is left to others.

The advance to be made in the industry in the future, especially in deep mining, will depend not so much on the miner as on the mechanical engineer. This is seen in connection with the deep shafts which have been sunk, *e.g.*, in Michigan and in South Africa.

Steam machines of the earlier part of the century have been naturally largely superseded in deep mining by those using compressed air, in which great advances have been made in late years. Electricity is also beginning to play an important role in the operation of pumps and for other purposes in connection with mining.

Then there were the invention of the diamond drill in 1864 and development of the methods for obtaining oil and gas, the improvement in pumps, introduction of the use of nitro-glycerine as an explosive in 1862, the safety lamp for use in coal mines, 1815, and the improved methods of mine lighting in general. All of these inventions and improvements have made a wonderful change in the industry.

The advancement which has been made in ore-dressing machines since about 1850 is also of great significance.

Further, the perfection of metallurgical processes has made it possible to handle ores of so low a grade at a profit that workers in earlier centuries could not have been convinced of the possibility.

INCREASED PRODUCTION IN OLDER MINING OUTPUT.

Gold is the most widely prized mining product, and then follow iron, steel, and coal. The increase in production of these materials illustrates pretty well the advancement which has taken place in the whole industry. The production of these substances at the present time as compared with that of the last century shows also the great widening of geographical boundaries which has taken place. The three products which form the basis of all commerce show a striking

** Die Geschichte des Bergbaus im 19. Jahrhundert. Vortrag gehalten vor der Naturforschenden Gesellschaft in Danzig von E. Treptow, Professor an der Königl. Sächs. Bergakademie zu Freiberg i.S. Mit 1 karte und 3 Tabellen. Freiberg 1901.

difference in value. While 1 kg. of gold in the world's market has a fixed value of about $700, 1 kg. of iron at the place of production is worth something like 2½ cents, and 1 kg. coal about ¼ cent. The high value of gold permits its mining over all parts of the earth. Gold mining withstands the difficulties of every climate and unfavorable geographical situation. While the production of iron and the winning of coal can only be carried on successfully on a large scale, and they are dependent on trade conditions.

The changes which have taken place in gold production during the last hundred years, as regards quantity and origin, are shown in the accompanying table. It is compiled from the works of the well-known statisticians Soetbeer (1800-1875), Hauchecorne (1880-1890), and Rothwell. Only those time periods are given in the table which indicate a striking change in production, and only the larger producers among the countries. Whole numbers give yearly production in kilogrammes; in the first part of the table the average of ten years, then every five years, and finally in most recent times the individual years are given. The order of the countries in the table is based on amount of production.

TABLE I.

GOLD PRODUCTION IN THE 19TH CENTURY.

(The yearly production is given in kilograms. One kilogram=32·1507 Troy ounces).

—	1801-10	1821-30	1841-50	1851-55	1856-60	1871-75	1885	1890	1895	1898	1899	1900	REMARKS
Transval	.....	.....	.....	.....	.....	.....	.....	15,318	63,589	117,470	109,783	10,300	S. African War, 1899
United States	.....	110	17,600	88,800	77,100	59,500	47,848	49,421	70,470	97,933	105,471	118,362	Cripple Creek, 1891
Australia	.....	.....	.....	67,700	86,700	59,900	41,287	44,851	64,473	93,732	119,186	113,282	West Australia, 1889
Canada	.....	.....	.....	.....	.....	.....	1,679	2,506	2,876	20,614	31,675	39 121	Klondike, 1896
Russia with Siberia	165	3,375	22,515	24,730	26 570	33,380	38,125	38,345	51,161	37,217	36,056	34,744	
British India	.....	.....	.....	.....	.....	.....	203	3,009	6,786	11,685	12,618	14,098	
Mexico	1,763	976	1,994	2,010	1,358	2,020	1,304	1,154	8,427	12 393	13,960	12,589	Note.—The reason for not giving in this table the production of some countries in the earlier part of the century, is due, in some cases, to lack of statistics, and not on account of there being no production. In the case of other countries, e. g. Canada, the statistics have little value for the purpose of the table.
China	.....	.....	.....	.....	.....	.....	6,997	8,020	6,998	9 993	10,000	8,276	
Guiana	.....	.....	.....	.....	.....	.....	.....	3,186	6,530	5,739	6,697	6,112	
Columbia	5,000	3,200	3,400	3,500	3,500	3,500	3,762	5,416	4,890	5,567	5,116	4,213	
Africa, excepting Transval	1,200	1,200	1,500	1,500	1,500	3,000	2,083	2,000	2,232	2,338	2,922	2,428	
Austria-Hungary	960	1,135	1,950	1,775	1,560	1,395	1,774	2,104	2,753	3,136	2,839	3,073	
Germany	.....	.....	.....	.....	.....	.....	1,378	2,000	4,335	2,847	2,605	3,054	
Brazil	3,750	2,200	2,400	2,200	2,120	1,720	204	670	3 359	3,809	2,383	2,408	
Venezuela	.....	.....	.....	.....	.....	.....	7,033	2,372	1,281	1,225	1,450	1,530	
Peru, Bolivia, Chili	4,890	1,920	2,200	1,800	1,650	2,760	835	2,367	1,383	2,928	3,207	3,394	
Other Countries	50	100	1,200	3 500	4,000	3,500	653	2,796	3,482	6,450	7,060	16,904	
Total	17,778	14,216	54,759	197,515	206,058	170 675	155,165	185,675	305,025	435,076	473,028	393,888	

In the first decade of the century Austria-Hungary was the only country in Europe which produced an important amount of gold. This was derived chiefly from the well-known mines of Hungary and Siebenburgen. A little also came from the old gold district of Bohemia and other localities. The production of Austria-Hungary has increased quite gradually in the course of the century.

The production of Africa in the earlier years is estimated. In the first part of the century gold came only from the Niger country and reached Europe by caravans to the Mediterranean. In later times Rhodesia has also produced gold. The centre of production in these early years lay in Central and South America—Mexico, Columbia, Brazil, Peru, Bolivia, Chili, affording about 75 per cent. of the output in the first decade.

In Germany the production in the early part of the century was so small that it is not given separately. Gold ores do not occur in important quantity, the metal that is produced in that country occurring in small amounts in association with copper pyrites and other minerals and being obtained through smelting these ores. Considerable gold is however produced from imported ore and from the refining of what may be called scrap gold.

In the second decade an important decrease took place in the noble metal production of Spanish America, as a result of political disturbance caused by the separation of the individual states from the mother country.

The first large Russian output of over 3 000 kg. yearly is due to the beginning of mining in the Urals, from the year 1820. A decade later the western Siberia gold mines began operations. If we follow the Russian production still further we find that in the fifth decade there is a sudden rise to 22,500 kg., and in the year 1895 the output has gone up to 50,000 kg. These increases were due to the finding of easily worked alluvial deposits. The decrease at the end of the century is due to influences connected with the building of the Siberian railway.

At the end of the first half of the century came in two wholly new gold producers, California and Australia. In the year 1848 alluvial gold in great quantities was found in the former country. A gold fever such as up to that time the world had not known affected not only North America, but made itself felt much more widely, and a rush was made westward to the little known domain. Shortly after, in the year 1851, the first gold discoveries were made in New South Wales and Victoria, Australia, and some years later in Queensland and New Zealand. It was owing to these easily worked alluvial deposits that the world's production in the 50's reached a point which had never before been attained and which was not equalled for many years afterwards. North America and Australia remain from that time for four decades at the top of gold producers.

The discovery of the Comstock lode in Nevada in 1858, the greatest of its kind known, and the celebrated Mount Morgan in Queensland, discovered in 1873, and Bendigo in Victoria gave an impetus to lode mining. Up to 1890 the Comstock lode produced something like $150,000,000 in gold and $200,000,000 in silver, and mining had then reached a depth of 1005 m. or about 3,300 feet.

If we now glance at the year 1885, we see that the table gives the production of Germany, China and Venezuela separately for the first time. British India and Canada are also similarly treated, and it is seen that the production in Central and South America has noticeably shrunken.

In the last ten years of the century the gold production has materially changed. Especially is one struck with the totals, which differ so greatly in this decade from the preceding four decades.

The increased production during this decade was brought about through the discovery of the celebrated South African deposits at Johannesburg in 1888, whose output has grown with such surprising rapidity. The Transvaal is the first country which reached an output of 100,000 kg. Along with this comes the discovery of the West Australian gold fields in 1889, the most important districts being Coolgardie and Kalgoorli, Through these Australia reached a second

maximum of production, the first being about 40 years earlier. Finally are to be noticed the discovery of the Cripple Creek gold field in 1891 and the beginning of the operations in the Yukon in 1896. Canada through this last took her place as a gold producing country of the second order. The United States in 1899 for the first time had an output of over 100,000 kg.

The total gold production of 1899 had a value of $331,000,000, or 1,374,000,000 M., which, however, would occupy a space of only 25 cubic metres.

According to Soetbeer, the total yearly production in the three preceding centuries fluctuated as follows:—

16th century,	between	6,000	and	8,500 kg.
17th "	"	8,300	"	10,600 "
18th "	"	12,800	"	24,600 "

The chief causes contributing to the wonderful increase in production in the 19th century are the discovery of large alluvial deposits together with the developments which have taken place in milling, smelting and chemical processes. While smelting could be earlier applied to refractory ores, modern chemistry has added other methods of treatment. In 1848 Plattner discovered the chlorination process, and in 1888 Forrest added the cyanide process to the treatment of such ores. While in the first half of the century the chief gold produced was obtained from alluvial diggings, the end of the century witnessed the eclipsing of the product of this method of working by the output from lode mining.

It may be added that the second quarter of the century also witnessed the perfecting of the methods of separating gold from other metals, silver, copper and lead. Many old silver and copper coins held so much gold that it paid to separate it.

IRON.

We shall now take up a consideration of the iron production in the century just closed. Table II gives the amount for the beginning, the middle and the end of the century. The numbers for the years 1807 and 1854 are taken from "The History of Iron," by Dr. Ludwig Beck, 4th ed., 1899. The figures for 1900 are taken from Rothwell's "Mineral Industry."

The increase in the production of iron in the course of the century is at least as striking as that of gold. The increase in the output of the latter metal is thirty-fold, while the production of the former is now ninety times as great as it was at the beginning of the century. In the early part of the century the production of Great Britain and France exceeded that of all other countries. Then followed in order Russia, Sweden, and Austria-Hungary. Germany occupied the sixth place and was followed by the United States. In the comparison of the production of France and Germany in 1807 it should be remembered that at that time the latter country embraced a much less extensive territory than in later times, while the former included the output of Holland, Belgium and other territory. Great Britain stood far in advance of all other countries at that time in the production of the metal. The explanation is that the evolution of the steam engine took place in that kingdom, and the smelting of iron by means of coal, which had already begun to replace charcoal, placed this country in the van till after the middle of the century. The development of the railway in Great Britain, after Stephenson had shown his steam waggon in 1829, also increased the country's interest in the production of iron. The birth of these inventions in the island kingdom affords an adequate explanation as to why at the middle of the century she produced two-thirds of the total coal output of the world.

On the continent at the end of the 18th century attempts at smelting iron with coal had been made only in Upper Silesia. In all other districts smelting was confined to charcoal almost to the end of the first quarter of the century and in many places till much later. Then the higher cost of wood and in many places the lack of it, together with the tendency towards the use of coke, brought about a change in the industry, the relative standing of such countries as Sweden and Spain where coal is wanting being greatly altered. A highly developed iron industry is to-day only possible where iron ore and coal occur in large quantities near each other or where, as in the United States, the means of transportation are exceptionally well developed. The production at the present time is also successful only where the material can be turned out in very large quantities and where there is a corresponding large market near at hand.

Brief reference may be made to inventions which have contributed much to the great increase in production of the metal, such as air heating and the evolution of the present type of furnaces; the use of rolling mills and steam hammers in place of hand labour; the Bessemer process, invented in 1856, and that of Gilchrist and Thomas in 1879, through which come the direct production of steel in large quantities and the making possible of the use of iron rich in phosphorus; the use of aluminum in iron castings, and the alloys of manganese, chromium, tugsten, nickel and molybdenum. The iron industry owes in the case of these alloys very much to modern chemistry.

TABLE II

PRODUCTION OF IRON AND STEEL IN 1,000 METRIC TONS.

—	1807		1854		1899				1900	
	Iron	Per Cent.	Iron	Per Cent.	Iron	Steel	Iron and Steel	Per Cent.	Iron	Steel
United States ..	24	3·	1,000	17	13,839	10,737	24,576	36·5	14,000	10,382
Great Britain	250	33·	3,000	52·	9,454	4,933	14,387	21·	9,003	5,130
Germany	35	4·6	257	4·5	8,029	6,290	14,319	21·	7,549	6,645
France	225	30·	600	10·	2,567	1,529	4,096	6·	2 714	1,565
Russia	84	11·	200	3·5	2,600	1,400	4,000	6·	2,895	1,830
Austria-Hungary.	50	6 6	225	4·	1,300	660	1,960	3·	1,311	1,145
Belgium	.....	.....	300	5·	1,036	730	1,766	3·	1,161	655
Sweden	75	10·	155	2·7	524	258	782	1·	526	300
Other Countries..	16	1 8	80	1 3	1,052	583	1,635	2·5	625	400
Total ..	759	100·	5,817	100·	40,401	27,120	67,521	100	39,793	28,052

The last space of the table shows the present situation of the iron and steel industry in various countries. The United States stands easily in the first place. In the second class together are Great Britain and Germany. Then follow at a considerable distance France and Russia; then Austria-Hungary and Belgium, and finally Sweden. It is clearly seen that the iron industry reaches large proportions only in North America and Europe. The whole of South America, Africa and Australia possess no modern furnaces; only in Asia has the modern industry begun to take a solid footing. Through the building of the Siberian railway some of the older iron works, *e.g.*, Petrowsk in the Trans-Balkans, which has been established about 100 years, have begun to take on new life. China has had for some years a steel works at Hanyang, and Japan has a similar works which was recently completed in the vicinity of the port of Wakamatsu. There is also a native iron industry in the Himalayas, in Japan, in many parts of Africa, *e.g.*, in German Togo, but the quantity of iron produced in these districts is insignificant.

COAL.

The coal industry is in a similar position to that of iron, since it depends not only on the occurrence of the material, but also on the market for it. Table III gives the situation at a glance. It may be stated that brown coal is produced in important quantities only in Germany and Austria-Hungary.

The development of the coal industry in the 19th century can be briefly described as follows:—At the beginning of the century it had

the standing of a great industry only in Great Britain, in the districts of Durham and Northumberland, which are at the present day important centres of the industry in the island kingdom. The yearly output at that time was from two to three million English tons (1 Eng. ton = 1016 kg.) On the continent there was in many places a coal mining industry, but the consumption was very small and was confined to the areas immediately surrounding the workings since the means of transportation was limited. In Germany the industry first became prominent about 1840, and in the United States about 1850. Great Britain in the middle of the century was even a greater leader in coal production than in that of iron. The result was due not only to the demand for coal in the industries of that country but was owing to the situation of the coal fields, either near the sea or on navigable rivers which favored the export of large quantities of the material.

TABLE III.*

COAL PRODUCTION IN 1,000 METRIC TONS.

—	1850		1898		1899	1900
	1,000 tons	Per Cent.	1,000 tons	Per Cent.		
United States....	5,776	9·	198,071	32·3	230,000	243,414
United Kingdom.	45,328	67·	205,287	34·	223,616	228,772
Germany.....	5,184	8·	96,310	16·	101,640	149,551
France.....	4,437	7·	32,356	5·	32,331	33,404
Belgium.....	5,820	9·	22,088	4·	22,072	23,462
Russia.....	52	.....	13,000	2·	13,100	15,000
Austria-Hungary.	584	.....	12,786	2·	12,694	39,027
Australasia.....	.....	.....	6,414	1·	6,470	7,477
Japan	.....	.....	6,000	1·	6,721	7,429
India.....	.....	.....	4,679	0·8	5,016	6,216
Canada.....	164	.....	3,785	0·6	4,467	5,088
Africa.....	.....	.....	2,550	0·4	239	405
Spain.....	.....	.....	2,467	0·4	2,600	2,582
Other Countries..	63	.....	3,077	0·5	2,500	2,500
Total.....	67,405	100.	608,870	100.	663,466	764,427

*The statistics for 1850, 1898 and 1899 include only the production of "steinkohle," anthracite and true bituminous coal, of Germany and Austria-Hungary. The production of "brown" coal for the years mentioned was in Germany respectively as follows in thousand tons, 1522, 31649 and 34000. In Austria-Hungary the production of this coal in the three periods was 360, 25000 and 26045 thousand tons respectively. Coal mining in Japan according to modern methods dates from 1873. In the Transvaal the mining of this substance dates from about 1890.

It will be seen from the table that the relative output of the various countries has changed greatly during the century. In the last two years the output of Great Britain has, in spite of the fact that it had always been on the increase, been surpassed by that of the United States. After the former country comes Germany; then at a considerable distance France and Belgium, and finally Russia and Austria-Hungary. The coal industry flourishes in many other countries than those mentioned. Japan, India, Siberia, Canada, Transvaal and Australia produce important quantities.

The most important coal fields of Japan are on the southernmost part of the large island of Kiuschiu, the most imporant workings being at Miike. Other mines are on the northern part of the island in the vicinity of Tschikussen, whose shipping harbor is Wakamatsu, in the neighborhood of which are the recently erected steel works. There is also an important coal industry on the north island Jesso.

In Siberia coal mining has been carried on for some forty years, for supplying the Russian fleet in the Pacific Ocean. The new railway has given an impetus to coal mining in other parts of Siberia.

The districts in China in which there is an important industry lie near Kaiping, northeast of Tientsin with which they are connected by a railway. Other large coal fields are known in this empire.

The total of the year's production of coal on the earth in 1900 amounted to more than 700,000,000 tons. Since it is extremely difficult to get a clear conception of this mighty mass we may state that this quantity of coal would form a cube which would have a length on its edges of something like 1 km. (=0.62 English mile).

If this mass of coal were placed on railway carriages, each of 10 tons capacity, a single train formed of them would have a length of 630,000 km. Since the earth's equator has a length of 40,000 km., a railway track long enough to accommodate these cars, all at one time, loaded with the yearly output, would girdle the earth nearly 16 times, one car occupying a space of 9 m.

The most important use of coal is in the production of steam for power; then there is the demand for fuel for household purposes. While, as already stated, coke was in use in Great Britain for smelting in the 18th century, it was so used on the continent and in North America first in the 19th. The production of gas for lighting originated in our own century. Both the last-named industries, the production of coke and gas, are of great importance on account of their by-products, tar and ammonia, which are obtained in large quantities.

Coal tar is at the basis of a highly developed branch of the chemical industry. From it a great variety of antiseptic and medicinal materials are obtained—creosote, used in the preservation of wood, napthalene, phenol, salicylic acid, antipyrin, phenacetine and saccharine, which in many cases takes the place of sugar. Benzol must also be mentioned, being used in the chemical industry as a solvent for fats, etc. It also serves for the improvement of illuminating gas. From the tar industry are derived the analine dye materials which were made known through the work of the chemists A. W. Hoffman and W. H. Perkin, 1856. Two other important dye materials, alizarin and indigo, which have long been known, but which were formerly obtained from plants, have in recent years been artificially produced from distillates of tar.

The residue, or hard pitch, from tar distillation, which remains after a temperature of 400°C is reached, now plays an important role in a wider branch of the coal industry, viz., in the briquetting of fine or dust-like coal. It forms the binding material for the briquettes. The briquetting of coal and peat is becoming an important industry. In Germany in 1900 some 1,700,000 tons of the ordinary varieties of coal and 5,000,000 tons of brown coal briquettes were produced.

Paraffin and mineral oil have since 1855, in important quantities, been derived from brown coal. At the present time more than one million tons of this coal are consumed annually for this purpose.

OTHER METALS.

In the production of silver, the United States takes the lead; then follow Mexico and Bolivia, then Australia, and in the fifth place Germany. A considerable part of the silver produced in the last named country comes, however, from foreign ores. The celebrated silver mining districts in the United States are the Comstock lode in Nevada, discovered in 1858, which has already been referred to, since in addition to silver it has produced much gold, and the deposits of Leadville, in Colorado, where operations were begun in 1876. In Mexico and Bolivia the mines are for the greater part short lived, but they have produced an important amount of silver. The mining here usually ceases at shallow depths since these countries have often been the scene of revolutions which deter capitalists from investing in machinery. Thereto has been added the lack of good coal and transportation facilities. In Australia the celebrated Broken Hill mines are large producers of silver.

The United States at the present time turns out three-fifths of the world's production of copper. This comes chiefly from two districts, the south shore of Lake Superior, in operation since 1855, although worked to some extent in pre-historic times, and Butte in Montana. The latter district has been known since 1877 as a producer of silver and gold. In 1883 its copper deposits attracted attention.

Next to the United States, Spain produces the greatest amount of copper, chiefly from the famed Rio Tinto mines, which were known to the Romans. Then follow Chili and Japan. In the former country copper mining has been active since 1855, at least "Chili bars" have since this year been quoted on the London Exchange. In Japan active metal mining dates from the end of the 60's.

In Germany the old Mansfield mines produce by far the most copper. In June, 1899, His Majesty the Emperor took part in the celebtation of the 700th year of the working of these mines.

In Australia, whence comes an important quantity of copper to the world's markets, mining began in this metal with the discovery of the celebrated deposits of Burra-Burra in South Australia in 1845.

The demand for copper for use in electrical apparatus has given an extraordinary impetus to production, which in 1890 was 274,000 kg. and in 1899, 477,000. The price has also changed. At the beginning of the 90's it fluctuated between 90 Pf and 1 M. per 1 kg., and has since risen to 1.50 M. The result is that everywhere copper mining has taken on new life. How great the use of this metal is in Germany can be seen from the statement that in 1899 this country consumed 98,000 kg., a larger amount than that used by any other European country.

Other metals will now be referred to briefly. The great lead deposits of Leadville and Broken Hill have already been mentioned in connection with silver. The new tin workings on the island of Billiton are important, discovered in 1852. The metal has been known in the neighboring island of Banka since the 18th century. The deposits of Mt Bischof in Tasmania, 1873, should also be mentioned. During the last hundred years a group of quicksilver localities have been found in New Alameda, New Idria and Sulphur Bank in California and Nikitowka in the South of Russia, since 1888. The celebrated quick silver deposits in Huancavelica in Peru, which produced a large quantity of material for the amalgamation of South American silver ore was, however, abandoned in 1830. This furnishes us with an example of the effects which the working of new deposits often has on the existence of older industries.

Among the most important mining industries of our century cannot be left out that of the celebrated Kimberly in South Africa. In 1867 diamonds were here found in rock in place, while these gem stones in all other districts occur in loose deposits or in detrital matter. The DeBeers Company, which now operates these deposits, absolutely controls the diamond market.

NEWER METALS.

To the group of seven metals of ancient times, the noble metals —gold and silver—mercury and the useful metals copper, iron and steel, tin and lead, with the alloys bronze and brass, have been added in our century an important number of new ones. The surprising fact is that during the first eighteen hundred years of the Christian era, only a single metal, antimony, which, alloyed with lead and other metals, came into use in the 15th century, was discovered.

The new useful metals of the 19th century are: zinc, platinum, nickel and aluminum, together with manganese, chromium and tungsten, bismuth and magnesium. There are thus added to the seven earlier known metals nine new ones, which are not mere chemical curiosities or parts of compounds, but metals which take a prominent place in industry and are used on a large scale.

In adding zinc to the group of the new useful metals of the 19th century, an explanation is necessary. The oxidized zinc ores—zinc carbonate and zinc silicate, commonly called calamine—were from very early times into the 18th century smelted with copper to form brass. In our century, however, zinc has been used by itself as a distinct metal, as well as in alloys. Dr. Helm has, it is true, described as a curiosity a zinc object dating from prehistoric times, but not generally till about 1800 was zinc in use as a simple metal. The great quantity of zinc which, before the beginning of our centruy, was produced in England, and about 1800 in Silesia, Belgium and elsewhere, found application exclusively in alloys. The discovery, about 1820, that zinc could be vaporized if heated to 100° C, caused an important advance in its metallurgy. After this zinc began to be used in castings and in the plating of iron. In this way zinc has become an industrial metal of the 19th century.

The important zinc-producing countries at the present time are Rhineland, with the neighboring parts of Belgium and Holland, Upper Silesia and the United States. In the last named country the first zinc smelters were built, in 1850, shortly after the zinc deposits of Franklin in New Jersey, and Bethlehem in Pennsylvania, had begun to be worked. Especially important are also the Sardinian deposits, from which most of the ore is taken to Belgium to be smelted.

It is noteworthy that up to about 1850 all the zinc produced came from calamine. After this zinc blende came into use. Through this has resulted the re-opening of some very old mines in Rhineland which had formerly been worked for lead.

Platinum and nickel were known in the 18th century. The former metal was discovered in association with gold in Columbian sands in 1750, Nickel was recognized as a simple metal in 1779; but the industrial application of both of these metals belongs to the 19th century.

Attention was next directed to platinum through the discovery of it in the Ural mountains in 1819. In 1824 a considerable amount of it was produced. The desire of the Russian government to find some use for the metal which had accumulated in the treasury, resulted in 1828–30 in the coinage of it, there being something like 14,000 kg. coined But the coin enjoyed no popularity, and soon came back into the treasury. First, about 1860, a demand arose for platinum through its growing use in connection with chemical manufacture, especially for laboratory utensils, and for vessels used in the production of sulphuric acid. Further applications have been found for the metal since 1880 in electric apparatus. The largest amount of crude platinum has always come from Russia, a little also being supplied by Borneo. The production of refined platinum is carried on in Germany and England; the yearly production amounts to between 4,000 and 5,000 kg. The price has been increasing for many years. In 1875, 1 kg. was worth about 1,000 M, while at the present time it is 2,300 M, or close to the value of gold. Platinum has, at one or two periods during late years, been higher in price than gold.

The closely related metals, palladium, iridium, rhodium, ruthenium and osmium, which occur associated with platinum, are obtained as by-products in refining this metal. Iridium is, on account of its extreme hardness, made use of in forming the points of pens. Osmium, which has the highest melting point of all known metals, and has up till recently been produced only in the form of powder or a spongy mass, is now used as a fine wire in electric lamps.

The production of nickel on a commercial scale dates from 1823. It was then, and for some time afterwards, used solely in alloys, namely, in nickel (German) silver. The customary composition of this alloy is 50–66 per cent. copper, 18·5-13 per cent. nickel, and 31–19 per cent. zinc or tin. Utensils, known as white copper and having a similar composition, come from China. Another important alloy of nickel, of the composition 25 per cent. nickel and 75 per cent. copper, is used in coinage. The Swiss used this first in coinage in 1850, later the United States, then Belgium and Germany in 1871. France has recently introduced her first nickel coin; it has a value of about 5 American cents. Through the endeavour to find new appli-

cations for the metal, it was learned how to roll and press it. This made it possible to use the metal in the manufacture of many useful articles, such as table and kitchen utensils, and to turn the metal into coins. The Austrian 10 and 20 half-penny pieces are composed of the pure metal.

Galvanic plating with nickel has risen to an important industry. Finally, since 1890, an alloy of approximately 5 per cent. nickel and steel—nickel steel—has been largely used for armour plate. This use gives rise to the largest demand for the metal.

Of similar interest to the wide application of the metal, is the change which has taken place as regards its productive territories. Outside of Schneeberg in Saxony, Scandinavia was one of the earliest producers of the metal. The chief and about the only producers of the ores of this metal are, at the present time, New Caledonia and Sudbury, the ore of the former country being a magnesian silicate and of the latter pyrrhotite. It may be added that small amounts of the closely related metal, cobalt, are practically always associated with nickel. The workings in New Caledonia were begun in 1874, and there was an important output in 1880. Development at Sudbury began in the later 80's. Inversely as the production of the metal has increased, the prices have fallen. The annual production is now about 7,000 tons, and the price per kilogram has fluctuated, during the 25 years of extraordinary expansion in production, from 10 to at times 30 M, according to changing demands, and has now sunken to about 2½ M.

The fourth of our modern industrial metals is aluminum. It was first produced as a metal in 1855, yet it was up to about 1890 so high priced—the price being something like 50 M per kg.—as to prohibit its becoming widely used. Cryolite served as the first raw material for this metal. This mineral is found in large quantities only at Ivigtut, on the southwest coast of Greenland, and has been mined in large quantities by the Danish government since 1857. The natural aluminum hydrate, bauxite, which occurs in large quantities in France and the United States, is now used as a source of the metal, and the use of the electric furnace in 1891 first made possible the production of the metal on the large scale. At the present time the price is only about 2 M per kg. In 1899 about 6,000 tons were produced.

The hope that aluminum, the specific gravity of which is only 2.6, would serve as a light metal, has not yet been fulfilled, since its use brings up many difficulties Considerable amounts of the metal find use in the chemical industry, it being used as a strong reducing agent in the production of metals, *e. g.*, chromium, which are reducible with difficulty. In foundry work a little aluminum is sometimes added to molten iron in order to prevent the formation of blow holes in castings. It is also used quite widely for cooking and other utensils. Recently aluminum wire has begun to be used in the place of copper wire for the transmission of electricity.

Another important light weight metal is magnesium, its specific gravity being only 1.7, which is considerably less than that of aluminum. For more than 200 years magnesium sulphate, or bitter salt, has been known as a constituent of mineral water and medicinal springs. The metal was first produced by Davy in 1808. At the present time it is obtained in large quantities through the electrolysis of molten carnallite, a double compound of magnesium and potassium chloride, which comes in large quantities from the potash salts of north Germany. The metal finds use as powder, wire or strips, solely in the production of strong light in fireworks and photography. In spite of this restricted use, the yearly production is 5,000 kg. The tests which have recently been made of magnalium, an alloy composed of about 80 per cent. aluminum and 20 per cent. magnesium, are of interest. This alloy is a light metal, and is said to be superior in many respects to pure aluminum. More important than the production of the metal is that of the artificial magnesium sulphate, which is used in great quantity in the cotton industry.

The metal bismuth was first produced in quantity about 1830, although it had been earlier known. It serves, in combination with lead and tin, for the production of an alloy which melts at a low temperature, and is used in safety apparatus for steam boilers and for other purposes. The salts of the metal are used in medicine. Bismuth ores are obtained in large quantities at Schneeberg, Germany, and a further supply of rich ores comes from Tasmania and Bolivia.

Finally, we may now consider the applications which the ores of manganese, chromium and tungsten have found in the second half of the 19th century, both in the chemical and iron industries.

In early times manganese ore, pyrolusite, was used as a source of oxygen. The metal itself is now largely used in alloy with iron, manganese steel possessing properties which make it extremely valuable for certain purposes. There are yearly about 1,000,000 tons of manganese ore produced, Russia supplying the greater part, followed by the Unites States and Spain, then come India and Germany.

About 45,000 tons of chrome ore are marketed yearly, the chief producers being New Caledonia, Russia, and Asia Minor. Like manganese, chromium finds use in the chemical industry in the preparation of various salts, and also in the production of chrome steel.

Only a small quantity of tungsten ore, some hundred tons, is consumed annually. It comes from the United States, Australia, and Zinnwald, Germany. Tungsten steel is a highly prized alloy for certain uses.

Molybdenum is another metal which is now beginning to be used in alloy with steel. For the manufacture of tools, such as chisels and planes, molybdenum steel is said to be especially valuable. There are only two known minerals which occur in quantity and contain molybdenum in large amounts. They are wulfenite and molybdenite. The former is found in quantity at Bleiberg in Carinthia and the latter is mined in Norway.

MINERALS IN CHEMICAL INDUSTRY.

We shall now pass from the metal industry to that of chemical manufacture While the former was of importance at the commencement of the 19th century, the latter had scarcely made a beginning and was confined chiefly to the production of sulphuric acid, potash, sal-ammoniac, and saltpetre. Compared with the demands of to-day, the output was very small. We shall refer to those raw materials only which were first made use of in our century.

Since about 1850 an important and numerous series of experiments have thrown light on the value of mineral manures, after the agricultural chemists had set right the older views on fertilizers and shown that plants for their growth require certain elements, namely nitrogen, phosphorus and potassium. The raw materials for these are Chili saltpetre, guano, the natural phosphates, and potash salts. The slags produced in the working of phosphorus-holding iron ores by certain processes, which have already been referred to, are another source of this valuable element for use in agriculture.

Saltpetre, the potash variety, is formed widely where the remains of plants and animals, or the excreta of the latter, decay under favorable conditions. In the Province of Bengal, for example, this material is produced in large quantities by mixing earth with animal excreta, turning the mixture over from time to time, and after, it may be some years, washing out the salt with water. The saltpetre thus produced is largely used as a manure in the East Indies.

About 1821 large deposits of soda nitre, known as Chili saltpetre, were found on the rainless west coast of South America. This district is the chief source of the raw material for the saltpetre industry. The

nitre is found on the Rio Loa, the former great river between Bolivia and Peru, at Caracoles and Taltal. The raw material is there called caliche. The pure saltpetre is obtained by dissolving out the salt with water and allowing it to crystallize. An industry has been established since about 1830. In 1899, 1,360,000 tons of saltpetre were produced, about one-third of which went to Germany, the price being about 160 M. per ton at Hamburg. A large part of the Chili nitre is transformed to potash nitre by the use of the potash salts of North Germany, the potash variety then being known as conversion saltpetre. It is used as a fertilizer, and forms one of the chief constituents of gun powder. Nitric acid, which plays a great part in the chemical industry, is also produced from saltpetre. The greatest part of the iodine of commerce is obtained from the residues of the saltpetre crystallization.

The high value of guano depends on the fact that it contains a high percentage of ammonia salts and nitrogenous organic substances, as well as calcium phosphate. As the last mentioned compound is not soluble in water, the guano must, in case it is to be used as a manure, be treated like the naturally occurring phosphate, apatite, by the process invented by Liebig in 1840. In this process the phosphates, after treatment with sulphuric acid, give soluble compounds. Since the nitrogen-holding constituents of gnano are soluable in water, it is evident that this material is only to be found in arid climates, such as that of Peru and Bolivia. This guano is known to be composed of the excreta and the remains of the food of sea birds. While the guano of South America has been used as a manure for over a century, it was shipped to Europe first in 1840, and the production has greatly increased since 1850. The most valuable guano deposits of South America are now exhausted.

The mineral, calcium phosphate, also serves as a raw material for the superphosphate industry. It is found in two forms, crystallized as apatite and rock-forming phosphate. The first occurs, *e. g.*, in South Norway and in Central Canada, and in the Spanish province of Estremadura, in large quantities; the rock phosphate, phosphorite, is found on the peninsula of Florida. These natural phosphates are insoluble in water, and must therefore be changed into the soluble form by the process already mentioned.

The rich store of potash salts, and associated magnesium salts, in north Germany, which at present monopolizes the world's trade in these materials, was first worked in 1861. At that time the industry was started at Stassfurt and Leopoldshall and later at numerous other points. Both production and demand increased remarkably quickly. 2,500,000 tons represented the total output up to 1899. A large number of works are engaged in treating this raw material, and the export trade is large, the trade being entirely in the control of the Kali Syndicate.

It may be stated that the valuable material bromine is produced from the residues of the potash salts. It, and the closely related element iodine, find wide application.

Boracic acid is also derived from a mineral found with the potash salts. Another compound of this acid, the natural borax, occurs in large quantities in the so-called borax lakes, *e.g.*, in California and Tibet.

Another industry, the winning of rock oil—international naptha—has reached great importance during the last 40 years. Its beginning dates from 1859. In that year the first well was bored at Titusville in Pennsylvania. Raw oil and its products now represent not only a mighty home industry in North America, but an enormous export trade has also been built up. A second important rock oil locality is that of Baku on the Caspian Sea. This has been developed since 1870. The importance of the rock oil industry is seen from the fact that 16,000,000 tons of the material are produced annually. About half of this comes from the United States and half from Baku, while Canada, Austria, India, and Roumania produce comparatively small quantities. Oil has been discovered in many other places, *e.g.*, in the East Indian islands. German native production, which is very little, comes from the vicinity of Hanover and from some parts of Alsace. Thus nearly the whole German consumption depends on imports, which amounted, in 1899, to nearly 1,000,000 tons, valued at 65,000,000 M. The winning of oil and its transportation are somewhat unique industries.

We shall now refer briefly to some mineral products which are of comparatively small importance commercially, but which are of considerable scientific interest.

The compounds of thorium, cerium, and yttrium have had a commercial interest since Auer von Welsbach utilized them in the mantle of his gas lamp. His first patent was taken out in 1885. Previous to this, these compounds were known only as the constituents of certain rare Scandinavian minerals. The increase in price and demand for these materials gave rise to a diligent search for them. They were found in North America, and later in Brazil in the pea yellow mineral, monazite, which is the source of these earth's to-day. The last named country is by far the most important producer.

While 1 kg. of thorium nitrate in 1894-5 cost 2,000 M., the price now is about 30 M. Auer's mantle, the manufacture of which has produced a use for these rare materials, is now composed of 99 per cent. thorium oxide and 1 per cent. cerium oxide; the mantle holds about one-half gram of this mixture, and gives a nearly pure white light. The original greenish color of the light was due to the impurity of the thorium salts. From forty to fifty thousand of these mantles are now in use daily in Germany.

Lithia mica, lepidolite, which contains about 3 per cent. of the rare element, lithium, serves as the chief source of the lithia salts, which are used in medicine in connection with many complaints caused by urinary secretions. The yearly consumption of these salts is from 2,000 to 3,000 kg. Lithia mica occurs in large quantities at Zinnwald, in Germany.

Barium compounds are also used in important quantities at the present time. They include barium sulphate, known as barite or heavy spar, and the carbonate, witherite. The consumption is between 20,000 and 30,000 tons annually. The greatest quantity of heavy spar, after the material is ground and cleaned, serves as a valuable paint, known as permanent white, being for some purposes preferred to white lead. Barium salts, especially the chloride, find many applications in the chemical industry. Barite occurs in many places in Germany and elsewhere. Witherite is mined in large quantities, chiefly in the north of England.

Near these barium compounds stand the closely related compounds of strontium. The chief of these are strontianite, the carbonate, and celestite, the sulphate. Strontium salts give a red color to a flame, and are hence used in fireworks. Since 1871 strontium hydroxide has had an important use in the refining of sugar, as have also the hydroxides of barium and calcium.

Celestite is mined chiefly in Sicily, where it occurs in association with native sulphur.

Strontianite is mined in Westphalia. Germany imported in 1899 over 8,000 tons of strontium compounds.

Compounds of uranium, another somewhat rare metal, came first into commerce in 1830. The largest quantity of its ore, pitch blende, is produced in the silver mines of Joachimsthal, in Bohemia. Uranium is used in the glass industry to produce a yellowish green fluorescent glass. It is also used to produce black and yellow colors for painting porcelain.

We mav now, in concluding this survey of the economic minerals of the 19th century, refer to the wide applications which have been made of mica and asbestos during the last 20 years. Both of these minerals have been known since ancient times, and various uses have been found for them in different ages. Each of the two is non-combustible, and in a high measure proof against the action of acids. They both conduct heat and electricity badly. The structural characteristics of both are striking. Mica is easily recognized by its thin, flexible and transparent cleavage plates. This makes the mineral valuable for certain purposes. For other purposes powdered mica is used. Asbestos, when of good quality, can be separated into fine fibres, which can be spun like cotton. The less valuable varieties serve for the production of paste board. In the powdered form it makes up an integral part of fire-proof paint. Both asbestos and mica find a wide use as refractory materials, and are used extensively in various forms as insulators. Quebec is by far the greatest producer of asbestos, which is the serpentinous variety. Mica, suitable for commercial purposes, is found as a constituent of coarsely crystallized granites and syenites, the so-called pegmatites in India, the United States and elsewhere. The mica found under these conditions is the potash variety, muscovite. In Ontario and Quebec, which, with the countries just mentioned comprise the chief mica producers, the variety mined is phlogopite, magnesian mica. Sheets of phlogopite from one mine in Ontario, at times, have a diameter of 6 or 7 feet. Phlogopite occurs in deposits which evidently are of secondary origin, the constituents frequently including large crystals of apatite, pyroxene and calcite.

Other minerals, *e.g.* graphite and magnesite, are also used extensively as refractory materials. The wide use of certain minerals and artificial compounds for abrasive purposes may also be mentioned.

If we look at the testimony of mining in our century, we find that the technology of more than 20 mineral groups has been worked out. Uses have been found for some long known minerals, and the applications of others have been widely extended. Other minerals have been discovered during the century, and commercial uses have been found for them. Mining has thus, through the turning into wealth of such a vast variety of materials, added much to the prosperity of the peoples of the earth.

To complete our account of the progress during the century it may be well to glance at the wide geographical distribution of industries which mining now exhibits. Mining is carried on the farthest north on the European continent; a copper mine at Alten, south of Hammerfest, is in about 70° north latitude; there is important copper mining at Sulitjelma in Norway, about 67° north latitude; on the Swedish side there are iron mines as far north.

On the new Siberian islands in the Arctic Ocean, which reach to 75° north latitude, a peculiar kind of mining is carried on. The buried remains, some of which are in an almost perfect state of preservation, of mammoth are excavated from the everlasting ice. This mining is not so insignificant as one might think, since about 20,000 of these remains have been found in Siberia. As the remains are those of extinct animals, and are used not as specimens, but for what may be called true commercial purposes, the industry has a right to be called mining.

The cryolite mine, at 61° north at tude, in Greenland, has already been mentioned; then on the west side of the American continent are the Yukon gold fields, in 64° north latitude.

In the southern hemisphere mining can naturally not be carried on so far distant from the equator. The division of sea and land is there different from what it is in the far north. The most southern point where mining is carried on is Punta Arenas, in the straits of Magellan. Here, at times, a supply of coal is secured. The nearest workings to this lie much farther north; they are the coal mines of Coronel. Near by are the copper works, in 37° south latitude. South Africa reaches only to about 34°, her most southern mines of importance being the diamond workings of Kimberly and the gold deposits of Johannesburg. On the island of Tasmania, which lies south of Australia, mining is carried on actively at various points. In the most southern part of New Zealand, Otago, profitable gold mines are in operation.

MINING NOTES.

Boundary District.—To Sept. 5th the shipment made from the several mines is as follows:—

Granby Mines, to Granby smelter	1,231
Snowshoe mine, to Sunset smelter	2,400
Mother Lode, to Greenwood smelter	3,520
Sunset, to Sunset smelter	736
Emma, to Trail smelter	330
Oro Denoro, to Sunset smelter	759
Athelstan, to Sunset smelter	225
Total for week	9,201

Total for year to date, 402,308 tons.

The Ivanhoe Mine.—The present staff at the Ivanhoe will be increased to about sixty miners, and the concentrator will work day and night for an indefinite period. The mill has been given an overhauling for an extensive run, and vast improvements in the machinery are under consideration for perfecting zinc milling. The present equipment it good, but the best is wanted to save all values. During the period of depression Manager Hickey took time by the forelock, and exploited the ground to a large extent. Ore was met everywhere a tunnel was driven, the whole mountain top appeared to be a network of mineral veins, the smaller ones containing solid ore and the larger concentrating. Besides these there are large zinc fissures which carry high values in silver, and from test shipments made and the returns received, which will be given attention once the profitable marketing of the Slocan zinc is assured.

The Kootenay Mine.—The Kootenay mine at Rossland has been closed down indefinitely. The crew of forty men is reduced to a single watchman, although a few men will be engaged at the property for a short time. The suspension is complete to all intents and purposes, however, and the announcement will be received with regret, moreover, it is intimated that a similar course may be followed at the Jumbo mine unless certain conditions are altered. A substantial increase in the treatment charges extended to the Kootenay mine was the direct cause of the suspension.

The Granby Smelter.—The Granby company, which had been closed down for a week to permit of the blowers being connected with the new furnaces, resumed operations on Sept. 9th when two furnaces were blown in. Two additional furnaces were to be blown in next day. On October 1st six furnaces with a treatment capacity of 2,200 tons daily, will be in blast.

The Athelstan Mine.—The Athelstan mine, Wellington camp, is shipping steadily and is gradually increasing the daily rate, although the ore must be hauled on wagons about a mile, and up hill at that. The ore is so easily mined however, that power drills are hardly necessary, picks and shovels being the chief tools needed. Excellent returns are said to be received from the shipments, which all go to the Sunset smelter at Boundary Falls.

The Winnipeg Mine.—Cars have been delivered to the Winnipeg mine, Wellington camp, for the purpose of making the first of the ore shipments since work was resumed at the mine. For the present, until the machinery is in full working order, the shipments from this mine will be on a small scale. Lumber has been delivered at the property, and work on the new gallows frame and compressor building is progressing, the shaft, in the meantime having been pumped out to the 100 feet level.

Scarcity of Miners.—A despatch to a western exchange dated the 11th inst. says:—The scarcity of men to work in the mines of the Boundary is being felt in no small degree of late. This is due to the fact that nearly all of the larger properties have been gradually increasing their forces, with the intention, now that a steady coke supply seems assured at the three smelters in this section, of keeping the present forces at work, and probably of increasing them. Efforts have been made to secure men from Victoria, Vancouver, Nelson, and Rossland, and there is work for a large number of such at good wages steadily. A number have come in this week to this camp, who immediately found work. As a result of the labor shortage and the absorption of idle men by the mines, it is almost impossible to secure a man for ordinary labor here at this time. The indications are that there will be plenty of work for all those who wish to labor in the Boundary all this fall and winter.

Sydney Dry Dock.—It is announced that a company in which H. M. Whitney, of Boston, a director of the Dominion Iron and Steel Company and Dominion Coal Company, is the prime mover, has been formed to establish a dry dock at Sydney. Advantage is to be taken of the recent legislation of the Dominion Parliament, guaranteeing 3 per cent. on a dock costing $1,000,000 or upwards. The cost of the proposed Sydney dock is $1,250,000. Work is to be resumed at once at the Dominion Iron and Steel Co.'s quarters at Georges river, which were closed down some time ago, throwing 300 men out of employment. About 200 men will be employed. The Dominion Iron and Steel Company is rushing work on their steel rail mill.

Le Roi No. 2.—The report of Le Roi No. 2 for the month of July shows that while the ore shipments were practically the same as during the preceding month, the ore values exhibit an improvement of $4 a ton gross value, showing a gain in the net proceeds of nearly $3. The freight, treatment, and smelter deductions show an increase of about 5s per ton. The report of development is not altogather satisfactory; in referring to the No 1 mine we are told "it is rapidly becoming difficult, and the sooner we can concentrate or get cheaper smelting rates the better." The oil concentrating plant will apparently soon be completely installed.

Hastings (B.C.) Exploration Syndicate.—At a meeting of the directors of this company which was recently held in London, the chairman referred to the valuable work done by their engineer, Mr Leslie Hill, and stated that under his management and by exercising the strictest economy ore had been won which brought a gross return of $44,000 after paying smelter charges, and a further sum had been received from the property which had been let on tribute. It is hoped that fresh discoveries may be made in the Arlington mine, and the company possesses coal lands at Blairmore which they regard as valuable.

Dominion Coal Co.—The ouput of the mines of the Dominion Coal Co. for August shows quite a decrease from the output of the preceding month. This is largely attributed to the scarcity of labor and its irregularity during the month. The miners are strong on picnics, preferring a day's picnicking to a day's pay at any time, and this year the month of August was prolific in picnics. This is the cause blamed for the falling off. Dominion No. 1 mine, which was the scene of a fire a few months ago, and the subsequent flooding, shows the gratifying output of 55,546 tons. Next month the Hub colliery will be a contributor to the output.—Coal Trade Journal.

Nova Scotia Steel & Coal Co.—The output of coal from the mines of the Nova Scotia Steel & Coal Co., Sydney Mines, for August, shows an increase of 3,022 tons as compared with the output of the previous month. The output of the respective mines was as follows:—Sydney No. 1, 21,275; Sydney No. 2, 11,961; Sydney No. 3, 8,540; total, 41,776 tons. The company will begin the installation of its electric plant this week in order to supply the machine shop, the general offices and blast furnaces with electric lights. The machinery has arrived, and it will be installed as quickly as possible.

Cape Breton Coal Output.—The output from the collieries owned and operated by the Dominion Iron and Steel Co., lessees of the Dominion Coal Co., for the month of August: Dominion No. 1, 5,546; Dominion No. 2, 57,283; Dominion No. 3, 37,661; Caledonia, 52,642; Reserve, 72,221; International, 18,785. Total, 244,138.

N. S. Coal and Steel Co.—The directors of the Nova Scotia Coal & Steel Company have declared a quarterly dividend of 2 per cent. on the preferred stock of the company for the quarter ended Sept. 30, payable on Oct. 15, to shareholders of record Sept. 20. They also declared an interim dividend of 3 per cent. on common stock, payable Oct. 15, to shareholders of record Sept. 30. Books to close Oct. 1 to 5.

President Gold Mining Co.—The Wabigoon Star, Ontario, says:—Among the mining propositions of the Manitou district which are attracting considerable attention is that of the President Gold Mining Co., of Cincinnati, of which Mr. Oberst Burbank, of Cincinnati, is the managing director. This company has an efficient management which is directing its efforts towards legitimate development and is not expending its resources in extravagant outlays on appurtenances which can very well wait until occasion requires their construction. So far the surface work on the President has been sufficiently advanced to warrant working on a larger scale, comfortable camps having been erected, roads built and the surface generally put in good condition. The shaft is now some 25 feet deep, a collar has been put in, and a contract for 100 feet of sinking will be let Already there are ten tons of ore on the dump, all good rock and panning quite freely.

NEW COMPANIES.

ONTARIO.

The Vera Mining Company, Limited.—Incorporated under the statutes of Ontario, August 28th, 1903. Authorized capital $1,000,000, in 1,000,000 shares of $1 each. Directors—P. J Finlan, D. B. MacDonald, P. Robinson, T. Robinson, L. McTavish, I. Rubenstein, C. A. Anderson, J. O'Boyle, J. A. Russey. Head Office—Sault Ste. Marie, Ont. Formed to acquire the properties known as "The Vera Mining Company, Limited."

The Iron and Steel Company of Canada, Limited.—Incorporated under the statutes of Ontario, August 21st, 1903. Authorized capital $300,000, in 60,000 shares of $5 each. Directors—C. E. Carbonneau, H. T. Wills. J. F. Wills Head Office—Belleville, Ont. Formed to acquire the properties known as "The Iron and Steel Company of Canada, Limited."

The Lucinda Gold Mining Company, Limited—Incorporated under the statutes of Ontario, August 31st, 1903. Authorized capital $100,000, in 20,000 shares of $5 each. Directors—F. M. Dole, C. M. Dysinger, M. Gates, F. D. Root, A. E. Sharpe, P. R. Carter. Head Office—Sault Ste. Marie, Ont. Formed to acquire the properties known as "The Lucinda Gold Mining Company, Limited."

The Manitoulin Portland Cement Company, Limited.—Incorporated under the statutes of Ontario, August 28th, 1903. Authorized capital $1,000,000 in 10,000 shares of $100 each. Directors H. G. Field, J. Carter, T G. Ellis, R. F. Sutherland, W. Sherwood. Head Office—Windsor, Ont. Formed to acquire the properties known as "The Manitoulin Portland Cement Company, Limited."

Northern Developing Company.—Incorporated under the laws of the Territory of Arizona, and licensed under the statutes of Ontario, August 28th, 1903. Authorized capital for use in Ontario, $30,000. John Joy, Gold Rock, Ont., Attorney. Formed to acquire the properties known as "Northern Developing Company."

Provident Mining Company.—Incorporated under the laws of the Territory of Arizona, and licensed under the statutes of Ontario, August 31st, 1903 Authorized capital for use in Ontario, $1,000,000. James B. O'Brian, Toronto, Ont., Attorney. Formed to acquire the properties known as "Provident Mining Company."

The Transcontinental Exploration Syndicate, Limited.—Incorporated under the statutes of the Dominion of Canada. Capital stock, $100,000. Directors—Sir Adolphe Caron, Sir Frederick Borden, R. J. Devlin, M. P. Davis, Ottawa; H. A. Ward, M.P., Port Hope; W. M. German, M.P., Welland; W. H. Harris, Tunbridge Wells, England. Formed to engage in locating, procuring, purchasing, working and disposing of gold, coal and other mineral lands, and timber and other lands in the Province of British Columbia or in the North-West Territories or elsewhere in the Dominion of Canada.

BRITISH COLUMBIA.

Luke Creek Gold-Copper Mining Company, Limited.—Incorporated under the statutes of British Columbia, 10th August, 1903. Authorized capital $1,000,000, in 1,000,000 shares of one dollar each. Formed to acquire the properties known as the "Luke Creek Gold-Copper Mining Company, Limited."

The King Edward Mines, Limited —Incorporated under the statutes of British Columbia, 17th August, 1903. Authorized capital $500,000 in 500,000 shares of one dollar each. Formed to acquire the properties known as "The King Edward Mines, Limited."

Texada Mining Company.—Incorporated under the statutes of British Columbia, 5th August, 1903, as an Extra Provincial Company. Authorized capital $10,000, in 10,000 shares of $1 each. Head Office—Tacoma State of Washington, U.S.A. Head Office in this Provnice, Vancouver, B.C., W. E. Burns, Vancouver, B.C. Attorney. Formed to acquire the properties known as the "Texada Mining Company."

The Cassiar Coal Development Company, Limited.—Licensed under the statutes of British Columbia, 12th August, 1903. Authorized capital, $300,000, in 3,000 shares of $100.00 each. Head Office—Toronto, Ont. Head Office in this Province, Vancouver, A. J. Kappelle, Vancouver, Attorney for the Company. Formed to acquire the properties known as "The Cassiar Coal Development Company, Limited."

PERSONAL MENTION.

Mr. D. R Young of Vancouver, managing director of the Similkameen Valley Coal Company, has resigned his position with the Company owing to a disagreement with the directors over some questions of internal policy.

Messrs. Robert Jaffray, G. G. S. Lindsay, K.C., and Lieut. Col. Mason, of Toronto, who are a directors of the Crow's Nest Pass Coal Company, have returned to Toronto after spending some time at the collieries of the company in East Kootenay inspecting the various plants and mines.

Mr. W. A. Carlyle, M.E., general manager of the Rio Tinto copper mines in Spain, was lately on a visit to the capital, stopping with Mr. J. A. Gemmill, barrister Mr. Carlyle was at one time a distinguished science student of McGill university, and afterwards professor in that institution. He was also first head and organizer of the provincial bureau of mines in British Columbia, and then became general manager of the Le Roi mine at Rossland. He is now chief executive officer of works employing over eleven thousand hands.

Mr. C. C. Ray, of Ottawa, who has been spending a couple of months in Dawson city in looking over his interests has just returned to the capital. He states that shortness of water has been the means of closing down many of the placer workings much earlier than was expected. The Royal Commission on the Treadgold concession had only just opened when Mr. Ray was leaving the country, so he could not speak of its present progress or future results.

Professor Moses, who fills the chair of Mineralogy at the Columbia University of New York, is on a visit to British Columbia. While in the west he intends examining the great rock slide at Frank, N. W. T., and to look into the present condition of the mountain. Being a high authority on seismic and other disturbances, his opinion as to the stability of Turtle Mountain will be of considerable interest, not only to the residents of the district but to the scientific world at large.

Mr C. Fernau, consulting engineer of London and Newcastle-on-Tyee is on a visit to the Kaslo district. He is mainly interested in the Monitor group at Three Forks. Mr. Fernau is quite an expert in the concentrating and reduction of lead and zinc ores, being connected with the Vieille Montagne Zinc Company, which is the largest in the world.

Mr F E. Woodside, of Vancouver, has been appointed Secretary of the Local Branch of the B.C. Mining Association, vice Mr. Sangster resigned. Mr. Woodside will commence his duties almost immediately.

Lieut. F. N. Gibbs, of Port Arthur, consulting engineer for the J. C. A. Henderson Mining Company, of Johannesburg, South Africa, and late of the 3rd Canadian Regiment, is now on a visit to America looking up the latest developments in mining machinery. He will spend sometime in Canada, and is very enthusiastic over the mineral wealth of the Transvaal.

Sir J. Beaven Edwards, chairman of the board of directors of the Slough Creek, Limited, in the Cariboo district, B.C., is now on a vitit to the west looking over the Company's mines at Slough Creek and Lightning Creek, and expects to spend about a month examining the extent of the seasons operations. Referring to a meeting which was recently called in London by some dissatisfied shareholders, to consider the election of a new directorate. Sir John states that 75,000 shares were represented, which voted confidence in himself and his associates, and only 15,000 were looking for a change.

Mr. Clermont Livingston, general manager of the Tyee Copper Company, Limited, who has been on a visit to England, accompanied by his family, has returned to the west. He brings back with him on a trip, Messrs. E. B. Livingston, and J. Lancaster, of Coventry, England.

Mr. J. C. Drewry, of Rossland, director of the St. Eugene mine, a large lead producer of East Kootenay, is on a visit to Toronto. He states that the inability to secure satisfactory rates for freight and treatment from the Canadian smelters is the principal reason for the closing down of the mine.

Mr. W. Blakemore, C. & M. E., who has been spending the summer in British Columbia, has returned to Montreal where he will remain through the winter.

Mr. J. Hicks of Rat Portage, Ont., has gone to Prescott, Arizona, to take charge of the underground work of the Home Run Mine on Groom Creek, which has lately been purchased by Messrs. Douglas, Lacey & Co., the great mining brokers of New York city.

Mr. John L. Retallack, who spent the last five or six months in the capital, where he was looking after the securing of a bounty on lead ores, has since his return to British Columbia been selected as the Liberal candidate for the electoral district of Kaslo. The friends of Mr. Retallack feel confident of his success in the approaching election, as the excellent work done while in Ottawa in the securing of the lead bounty has made him many friends in the district.

Mr. Herman French, an English mining engineer of large experience, is now in the Newcastle district, Vancouver Island, examining and inspecting some mineral properties owed by a Victoria syndicate. Mr. French is a mining engineer with a distinguished record, and was before coming to this country superintendent of the Nina Cuatro Amigos mine, in Spain. While in the west he will be the special representative of a large London syndicate, which is deeply interested in British Columbia as a mining field, and now awaits Mr. French's reports as a result of which they may possibly make heavy investments.

Mr. Henry Mahun, managing director of the Société Minière de la Colombie Britannique, of Atlin, has been appointed attorney for the company in place of Mr. Emile Janne de Lamare.

Mr. Allan MacLean, of London, England, a director in the Kootenay and Velvet mining companies, is now on a visit to the Rossland district. During his visit to the country he also made a trip to Mexico, to look over the silver mining industry in that republic accompanied by Mr. Wm. Thompson, general manager of the Rossland-Kootenay Company.

Mr. Roscoe R. Leslie, superintendent of the Le Roi mine, has severed his connection with the company. Before leaving Mr. Leslie was presented with a magnificent solitaire diamond ring and a Brunton compass by the employees at the mine.

Mr. Ralph L. Broadbent of the Geological Survey, has been appointed to take charge of the Canadian Mineral exhibit at the great exhibition in St. Louis next year. The intention is to have a large mineral display from each of the Canadian Provinces.

Mr. Justice Britton, one of the commissioners on the Treadgold investigation which has been going on for some time at Dawson city, left for Ottawa immediately after the closing of the session on the 10th inst. Mr. B. T. A. Bell, the other commissioner, and editor of the Canadian Mining Review, will spend a week or two in the Yukon before leaving for Ottawa.

A recent issue of the Mining World, Chicago, says. Many shady mining brokers are fooling investors by issuing their weekly or monthly circulars, clothed in all the garb of legitimate mining newspapers. Subscription rates, advertising rates, publishing company's name, etc., occupy the usual space at the top of the editorial pages. Advertisements are circulated throughout the big city dailies, requesting those interested in mining to send for sample copies None of those schemes are other than prospectuses, issued solely and exclusively in the interests of the broker or promoter, and about nine out of every ten of them are boosting the rankest "wildcat" schemes on the market. It is a mystery how the public can be fooled or misled by them, but they do thrive. None of the half dozen or more mining papers would publish the stuff these brokers use, and consequently they work it off on the public through these mediums

Canadian Mining Institute

INCORPORATED BY ACT OF PARLIAMENT 1898

AIMS AND OBJECTS.

(A) To promote the Arts and Sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications.

(B) The establishment of a central reference library and a headquarters for the purpose of this organisation.

(C) To take concerted action upon such matters as effect the mining and metallurgical industries of the Dominion of Canada.

(D) To encourage and promote these industries by all lawful and honourable means.

MEMBERSHIP.

MEMBERS shall be persons engaged in the direction and operation of mines and metallurgical works mining engineers, geologists, metallurgists, or chemists, and such other persons as the Council may see fit to elect.

STUDENT MEMBERS shall include persons who are qualifying themselves for the profession of mining or metallurgical engineering, students in pure and applied science in any technical school in the Dominion, and such other persons, up to the age of 25 years, who shall be engaged as apprentices or assistants in mining, metallurgical or geological work, or who may desire to participate in the benefits of the meetings, library and publications of the Institute. Student Members shall be eligible for election as Members after the age of 25 years.

SUBSCRIPTION.

Members yearly subscription	$10 00
Student Members do	2 00

PUBLICATIONS.

Vol. I, 1898, 66 pp., out of print.
Vol. II, 1899, 285 pp., bound red cloth.
Vol. III, 1900, 270 pp., " "
Vol. IV, 1901, 333 pp., " "
Vol. V, 1902, 700 pp., " "
Vol. VI, 1903, 600 pp., now in press.

Membership in the Canadian Mining Institute is open to everyone interested in promoting the profession and industry of mining without qualification or restrictions.

Forms of application for membership, and copies of the Journal of the Institute, etc., may be obtained upon application to

B. T. A. BELL, Secretary,
Orme's Hall, Ottawa

PROVINCE of QUEBEC

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

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

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

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

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

Mining concessions are divided into three classes :—

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

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

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

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

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

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

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

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

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

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

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

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P. Q.

PROVINCE OF NOVA SCOTIA.

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

—AND—

PRECIOUS STONES.

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

GOLD AND SILVER.

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

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

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

MINES OTHER THAN GOLD AND SILVER.

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

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

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

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

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

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

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

THE HON. A. DRYSDALE,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

DOMINION OF CANADA

SYNOPSIS OF REGULATIONS

For Disposal of Minerals on Dominion Lands in Manitoba, the North-West Territories, and the Yukon Territory.

COAL.

Coal lands may be purchased at $10.00 per acre for soft coal, and $20.00 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at such rate as may from time to time be specified by Order-in-Council shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding Free Miner's certificates may obtain entry for a mining location.

A Free Miner's Certificate is granted for one or more years, not exceeding five, upon payment in advance of $10.00 per annum for an individual, and from $50.00 to $100.00 per annum for a company, according to capital.

A Free Miner having discovered mineral in place may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end of the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a Mining Recorder's Office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.00.

At least $100.00 must be expended on the claim each year or paid to the Mining Recorder in lieu thereof. When $500.00 has been expended or paid the locator may, upon having a survey made and upon complying with other requirements, purchase the land at $1.00 per acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of royalty on the sales not exceeding five per cent.

PLACER MINING, MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

Placer mining claims generally are 100 feet square; entry fee, $5.00, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

DREDGING IN THE RIVERS OF MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

A Free Miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental $10.00 per annum for each mile of river leased. Royalty at the rate of two and a half per cent., collected on the output after it exceeds $10,000.00.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the rivers below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100.00 per mile for first year, and $10.00 per mile for each subsequent year. Royalty ten per cent on the output in excess of $15,000.00.

PLACER MINING IN THE YUKON TERRITORY.

Creek, Gulch, River, and Hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other Placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end bearing notices. Entry must be obtained within ten days if the claim is within ten miles of Mining Recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a Free Miner's certificate.

The discoverer of a new mine is entitled to a claim 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee $15.00. Royalty at the rate of 2½ per cent. on the value of the gold shipped from the Territory to be paid to the Comptroller.

No Free Miner shall receive a grant of more than one mining claim on each separate river, creek, or gulch, but the same miner may hold any number of claims by purchase, and Free Miners may work their claims in partnership, by filing notice and paying fee of $2.00. A claim may be abandoned and another obtained on the same creek, gulch, or river, by giving notice, and paying a fee.

Work must be done on a claim each year to the value of at least $200.00, or in lieu of work payment may be made to the Mining Recorder each year for the first three years of $200.00, and after that $400.00 for each year.

A certificate that work has been done or fee paid must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a Free Miner.

The boundaries of a claim may be defined absolutely by having a survey made, and publishing notices in the *Yukon Official Gazette*.

HYDRAULIC MINING, YUKON TERRITORY.

Locations suitable for hydraulic mining, having a frontage of from one to five miles, and a depth of one mile or more, may be leased for twenty years, provided the ground has been prospected by the applicant or his agent; is found to be unsuitable for placer mining; and does not include within its boundaries any mining claims already granted. A rental of $150.00 for each mile of frontage, at the rate of 2½ per cent. on the value of the gold shipped from the Territory. Operations must be commenced within one year from the date of the lease, and not less than $5,000.00 must be expended annually. The lease excludes all base metals, quartz, and coal, and provides for the withdrawal of unoperated land for agricultural or building purposes.

PETROLEUM.

All unappropriated Dominion Lands shall, after the first of July, 1901, be open to prospecting for petroleum. Should the prospector discover oil in paying quantities he may acquire 640 acres of available land, including and surrounding his discovery, at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by Order in Council

JAMES A. SMART,
Deputy of the Minister of the Interior.

OTTAWA, 9th Dec., 1901.

CONTRACTORS TO H. M. GOVERNMENT

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS

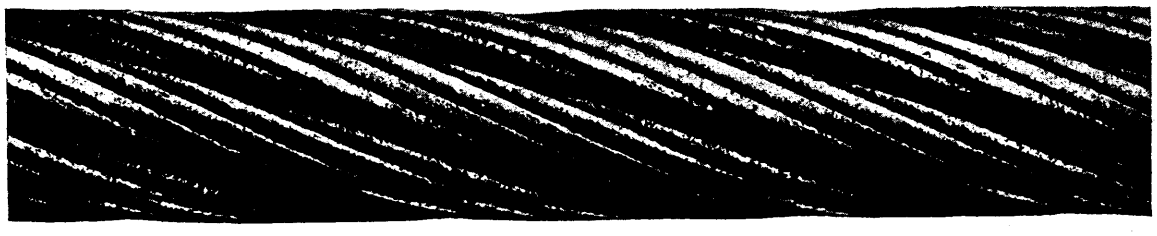
Rutherglen, Glasgow, Scotland

MANUFACTURERS OF

WIRE ROPES for Collieries, Mines, Aerial Tramways

Transmission of Power, Logging and general Hauling and Hoisting Purposes.
Wire specially selected for own exclusive use.
We have made many records with our Winding, Haulage and Crane Ropes.

Illustration of **Winding Rope,** 240 fms. long x 3½ circ. Galvanized Special Improved Patent Steel, Compound Make, supplied



to Kenneil Collieries, Bo'ness, Scot., which gave a record life of 6 years and 2 months. Shewing condition when taken off.

TELEGRAMS—"Ropery Rutherglen." A B C, A I and Lieber's Codes used.

AGENTS IN CANADA:

Wm. Stairs, Son & Morrow Ltd., Halifax, N.S.
W. H. Thorne & Co. Ltd., Saint John, N.B.

Drummond, McCall & Co., Montreal.
John Burns, Vancouver, B. C.

Drummond, McCall & Co.

IRON, STEEL and GENERAL METAL MERCHANTS

GENERAL SALES AGENTS

Algoma Steel Co. Ltd., Sault Ste. Marie, Ont.

AND IMPORTERS OF

Beams, Channels, Angles and other Structural Material.
Steel Plates—Tank, Boiler and Firebox Quality.
Cold Rolled Steel Shafting.
Mild Steel Bars—all diameters.
Wire Rope. Snow Steam Pumps. Tool Steel.

....COMPLETE STOCK KEPT IN MONTREAL....

General Offices: CANADA LIFE BUILDING - MONTREAL.

Montreal Pipe Foundry Co. Limited

MANUFACTURERS OF

CAST IRON WATER AND GAS PIPE

and other Water Works Supplies.

"LUDLOW" VALVES & HYDRANTS

GENERAL OFFICES:
Canada Life Building - MONTREAL

PIG IRON...

"C.I.F." Charcoal Pig Iron, also
"Midland" Foundry Coke Pig Iron

MANUFACTURED BY

CANADA IRON FURNACE COMPANY, LIMITED

Plants at { RADNOR FORGES, QUE., and MIDLAND, ONT.

GENERAL OFFICES
CANADA LIFE BUILDING, MONTREAL.

Geo. E. Drummond, Managing Director and Treasurer.

THE DOMINION WIRE ROPE CO. LIMITED

MONTREAL, CAN.

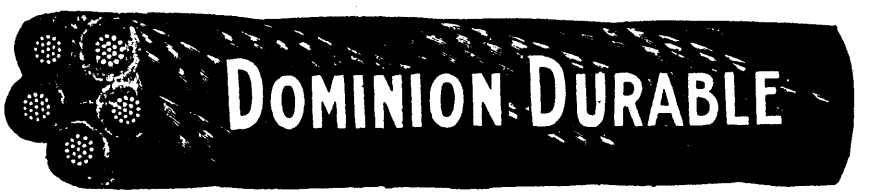
Manufacturers of **"LANG'S" PATENT WIRE ROPES**

FOR COLLIERY AND GENERAL MINING PURPOSES.

ALSO BEST STEEL WIRE ROPES FOR ALL PURPOSES.

ALSO

SOMETHING NEW...



SOMETHING TO LAST...

The Wearing Surface of Hemp.

The Strength of Wire.

The Flexibility of Manila.

UNEXCELLED FOR TRANSMISSION AND PILE DRIVING PURPOSES

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

CATALOGUE ON APPLICATION.

MINING AND CONTRACTORS' RAILS...

RELAYING RAILS 30 lbs., 45 lbs., 56 lbs., 65 lbs. per Yard

IMMEDIATE SHIPMENT.

LIGHT MINING RAILS

12 lbs., 18 lbs., 25lbs., 30 lbs., per Yard

..IN STOCK..

JAMES COOPER

ORE AND **..Mining Cars..**

WHEELBARROWS ALL KINDS

SPECIAL ORE BARROWS

Charging Barrows

PICKS, SHOVELS, HAMMERS, TOOLS. Etc.

CATALOGUE ON APPLICATION

Barrett Jacks. Car Movers.

ENGLISH OCTAGON DRILL STEEL CARRIED IN STOCK...

Office: 299 ST. JAMES ST., MONTREAL.