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REGINALD E. HORE

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CIRCULATION.

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CONTENTS.

LIQUOR REGULATIONS

The regulation of the liquor traffic is, in most communities, unsatisfactory to at least some of the citizens. This is natural, for there is and probably always will be great difference of opinion concerning proposed measures for restricting the traffic. The laws must be made in accordance with the wishes of the majority, and if representatives keep faith with their constituents they are so made.

But there is in Canada too great a tendency to ignore the liquor laws. While our citizens generally are to be congratulated on their respect for the law, there is every evidence that many of us consider liquor regulations too lightly. This is certainly true in the mining districts. It is very unfortunate that it is true, for in these districts are many workingmen recently arrived from foreign countries and susceptible to impressions. They come into camps where we are told that the sale of intoxicating liquor is forbidden. According to our law it is. But the newcomers find no difficulty in procuring any amount of it. They laugh at our liquor regulations. Is it likely that they should have a very high opinion of Canadian laws in general?

These men become citizens of our country. Should we not endeavor to give them better first impressions? Why not enforce the laws or change them?

The non-enforcement of the liquor regulations is not peculiar to one district nor to one province. No one government is responsible. It seems to be the impression that lawlessness in mining districts is natural and to be expected.

Miners earn good wages and spend their money freely. Consequently there are in every prosperous camp many people who are willing to risk the penalty of breaking the law if they are thereby enabled to take in a large part of the miner's spending money. The miner accustomed to drinking in other countries is denied the right to purchase liquor in mining camps in Canada. There are good reasons why he should be and it is probable that if liquor were not obtainable in the camps it would be better for the miner. But it is obtainable. The "blind pigger" sees to that.

It is often stated that the laws are satisfactory, but that they are not enforced. Certainly there are many infringements and it does not seem that the mining camps in which the sale of liquor is prohibited are to be properly regarded as "dry" districts. It will always be difficult to enforce the law and especially so where the officers of the law are not in favor of it.

It is probable that much might be done to improve conditions without regard to the enactment or enforce-

ment of liquor regulations. Law and force are not the only means of fighting the liquor habit. Attention to the wants of the men may in many cases serve the purpose more satisfactorily. The man who works hard every day should not be regarded as a mere machine. When he is through with his work he wants rest and amusement. If these are readily obtainable he will not be a very good customer of the "blind pig," and he will be a better citizen and a more efficient worker.

Given comfortable homes and varied forms of amusement most miners are content without liquor. Denied these they resort to the "blind pigs" for diversion.

THE IRON ORE TRADE

The demand for iron ore this year has been very poor and it is not surprising to learn that shipments from the Lake Superior States so far are several million tons less than for the corresponding period last year. Many iron mines are idle. Particularly regrettable is the effect on the iron mining industry in Canada. This has never been in very satisfactory condition; but a few companies have struggled along in spite of many difficulties. Given a good market for their product they would have a reasonable chance of success; but under present conditions profitable operation is hardly possible. It is to be hoped that the market will soon improve and that the operating companies will yet succeed in their efforts. Handicapped by the nature of the ore bodies they have had a hard struggle.

MINERAL RESOURCES OF ALBERTA

For many years British Columbia has been widely known as a province rich in mineral wealth. The neighboring province of Alberta has, however, not been commonly regarded as one of promise for the prospector. As a matter of fact Alberta has enormous deposits of coal and many of the seams have been worked very profitably. There are a number of large mines in the western part of the province. Further east in the prairie section the coal lies in flat seams close to the surface and is mined in very many places.

The coal mined in the mountains is a very good grade of bituminous coal. That in the prairie section is a less valuable coal, but it is being used satisfactorily for several purposes. Much of it will not stand transportation, but is successfully used locally. There seems good reason to believe that methods will be devised to utilize such coal by briquetting it, distilling off volatile constituents or by burning it at the mine for the development of power. The possibilities offered will doubtless lead to the discovery of suitable methods for the use of these so-called lignite deposits.

For some years Alberta has been producing, notably in the vicinity of Medicine Hat, large quantities of natural gas. The successful developers of some of the gas fields believe that conditions in other parts of the province are promising for the occurrence of natural gas, and it is expected that in the next few years many wells will be drilled in such districts.

While gas has been profitably produced for several years oil has as yet been produced in very small quantity in Alberta. For many years evidence of the occurrence of oil has been frequently referred to. Until recently, however, little drilling had been done.

Last fall the Calgary Petroleum Products Company found oil in the Sheep Creek district near Calgary. The oil is a so-called white oil and the discovery was regarded as of importance chiefly as an indicator of the probable occurrence of larger quantities of heavier oil in the neighborhood. Some months later a larger deposit of light colored oil was encountered in the same well at greater depth. Since then the prospects of locating a profitable oil deposit have been regarded as very good.

A number of companies have been formed for the purpose of drilling for oil in the Sheep Creek district, and the territory adjoining the "Discovery" well will be explored.

It is to be hoped that the expectations of the directors of the companies will be realized and that a profitable oil field will be developed. With further development of the coal and natural gas resources of the province and with an important oil field Alberta would assume a much more prominent position from a mining standpoint.

KNIGHTHOOD FOR A CHIEF MINE INSPECTOR.

An unusual occurrence is the conferring of a knighthood on a mine inspector. The Colliery Guardian, of London, England, says: —

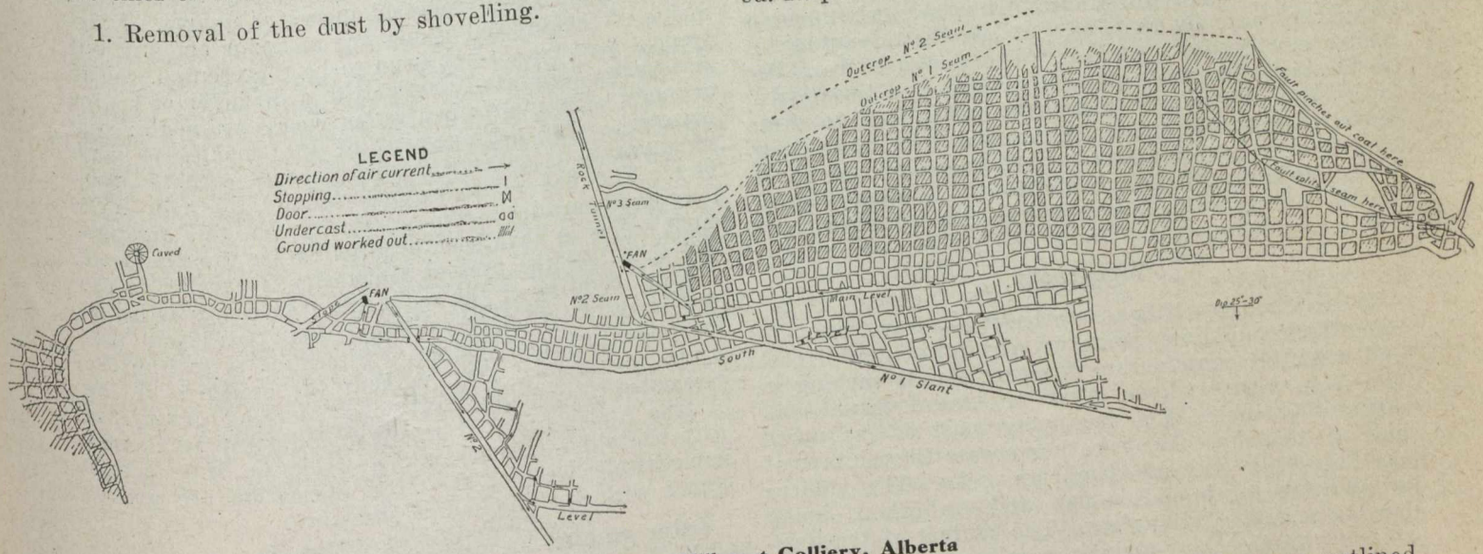
"The conferment of a knighthood upon Mr. Richard Augustine Studdert Redmayne, H. M. Chief Inspector of Mines, is a matter of no little interest to mining engineers. Mr. Redmayne was born on July 22, 1865, at South Dene, Gateshead-upon-Tyne. He was educated privately, and then passed through the Durham College of Physical Science. In 1883 he entered upon his apprenticeship at the Hutton Collieries, gaining his certificate in 1886. During 1891-3 he was in Natal, and in the latter year was appointed resident manager of the Seaton Delaval Collieries. This post he vacated in 1902 to take up the professorship of mining at Birmingham University, which he filled until 1908, when he was called upon to undertake missions for the Home Office, shortly afterward being appointed to the post of Chief Inspector of Mines, and head of the newly-created Mining Dpartment at the Home Office. Since that time Mr. Redmayne has acted on every committee or commission engaged in the examination of problems relating to coal mining in Great Britain, an enumeration of which it is unnecessary to give here. Mr. Redmayne's literary activities have been considerable, being by no means confined to the numerous official reports that have been issued above his signature; he is the author of 'Modern Practice in Mining,' which, we believe, is still incomplete; joint author with Mr. F. H. Bulman, of 'Colliery Working and Management,' and for some years edited the 'Colliery Manager's Pocket Book.' It may be added that the Chief Inspector is related by marriage to the Prime Minister."

THE HILLCREST DISASTER

The great elements of danger in coal mining are gas and coal dust. Every precaution is taken to prevent the ignition of these by the use of approved safety lamps and permitted explosives. Shooting is not permitted where gas has been found and all shots are fired by shotlighters. Notwithstanding all these precautions explosions occur, and in the case of coal mining in the Crowsnest district, where the coal rolls down chutes to the level below, there is necessarily considerable dust made. When one considers that experiment has proven that an explosion was obtained when coal dust was present only to the extent of about one-fifth of an ounce per square ft. (this is much less than the dust present in the roadways of many mines), it can be seen how important the dust problem becomes.

Many remedies have been proposed to render the galleries of a coal mine safe from coal dust explosions, the chief of which are:

1. Removal of the dust by shovelling.



Mine Plan, Hillcrest Colliery, Alberta

2. Watering by sprays, etc.

3. The provision of "stone dust" or of "wet" zones on the main roads of the mine.

4. Use of salt, calcium-chloride or other inexpensive deliquescent compounds.

5. Intermixture of stone or shale dust by sprinkling the roads with the same.

6. Prohibition of dry tamping in shot firing.

7. Prohibition of coal dust tamping in any form.

It is hoped that the investigation be not only confined to the cause of the disaster at Hillcrest, but that it may be extended to cover all coal mining operations in the Crowsnest district.

Another proper field of usefulness would be in the Government taking some action towards educating the miners with regard to the nature and hazard of the work. The importance of this matter should not be neglected because, on account of the scarcity of miners in the West, the operators have to employ men with little or no experience in coal mining. In coal mining the safety of the mine depends to a certain extent on the intelligence of the least intelligent man employed, or, in other words, it is possible for the least intelligent man to blow up the whole mine.

W. J. D.

BEAVER LAKE.

In view of the recent discoveries of gold in the Beaver Lake district, Saskatchewan, the article by Mr. E. L. Bruce, of the Geological Survey staff, in this issue has a special interest.

WEST SHINING TREE.

Good reports come from West Shining Tree district. Gold was discovered there a few years ago, but there has as yet been little work done in addition to the exploration carried on by the holders of the claims. The prospectors bring out good specimens of ore, and believe that they have valuable properties. It is to be hoped that a development company will undertake the thorough development of some of the claims. Some of the prospects are quite attractive.

GAS IN NEW BRUNSWICK.

Maritime Oilfields, Ltd., reports that in deepening well No. 36, and after passing through a bed of shale and sandstone, a gas sand giving a flow of 2,000,000 cu. ft. per day was struck on July 13. This result has been obtained by pursuance of a programme outlined by Dr. Henderson for the deepening of the wells, and we are pleased to learn of the success of this work

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The Westinghouse strike at East Pittsburg was called off by the workmen on Thursday, July 9th. While the day set for return to work was Monday, July 13th, a large number of the men reported on the Friday and Saturday preceding. The works are now running full time.

Mr. Frank Robbins, who died at Los Angeles, California, U.S.A., on June 21, was a mining engineer well known on the Pacific Coast—in California, which had been his home for a number of years; in British Columbia, where, before he removed to Los Angeles, he was in charge of mines for Mackenzie and Mann, Toronto, first at the North Star in East Kootenay and afterward at the Brooklyn and Stemwinder at Phoenix, Boundary district; at Leadville, Colorado; and in other parts of the West. He had also been connected with mining in Honduras. For about 17 years he was a member of the American Institute of Mining Engineers. As a consulting engineer he had business connections over a wide extent of country. His death resulted after only a short illness with pneumonia.

BEAVER LAKE MINING DISTRICT, SASKATCHEWAN*

By E. L. Bruce.

Beaver or Amisk lake lies in the Province of Saskatchewan just west of the provincial boundary. It is three miles west of the 102nd meridian and about 20 miles south of the 55th parallel of latitude. From Winnipeg it may be reached by two routes. The more direct is by the Canadian Northern Railway to Hudson Bay Junction, and thence by the Hudson Railway to Pas on the Saskatchewan river. From that point motor boats run regularly to Cumberland House, the Hudson Bay Company's post on Cumberland Lake, and from there north to the upper end of Namen or Sturgeon lake. From this lake a wagon road has been recently cut to Beaver lake, a distance of about 18 miles. The river from Beaver lake to Sturgeon lake is swift and difficult and is now little used by parties going north. The alternative route is by the Canadian Northern Railway to Prince Albert, thence down the Saskatchewan to Cumberland river, and up that stream to Cumberland House. It is somewhat longer than the route by the Pas, but has the advantage of being mostly down stream. The distance from Pas to Beaver lake is about one hundred and twenty-five miles and the trip requires two and a half to three days. A motor boat for the conveyance of passengers and freight is now running on Beaver lake. A canoe route leads up Sturgeon Weir river to the lakes to the north and others lead eastward to Athapapuskow and Cranberry lakes.

Topography.

Beaver lake itself is a fine body of clear water, 18 miles from north to south by about nine miles east and west. It contains hundreds of islands varying in size from mere rocks to Missi or Grand island, six miles in diameter and occupying most of the north half of the lake. The lake lies across the contact of the Palaeozoic and Pre-Cambrian rocks. The country around the south end is flat and unbroken, being largely a structural surface. The contact of the limestones with the older rocks is usually marked by a low escarpment. The country around the northern half is of low relief, but consists of narrow northerly-trending ridges separated by swamps and muskegs. Rock is abundantly exposed, but the difference in elevation is never over 50 ft. The influence of the different rock types on the topography is pronounced. The southern end of the lake is characterized by smooth curves and shingly beaches; the northern end is exceedingly irregular, and the shores consist of rocky points separated by marshy bays.

General Geology.

The geological column, as represented at Beaver lake, is as follows:

Recent—Peat.

Palaeozoic—Ordovician.

Pre-Cambrian—Granite intrusion.

Missi formation.

Amisk series.

Amisk series.—The Amisk series is by far the most extensive. The rock types are largely massive greenstones, often showing ellipsoidal weathering. The schists developed from rocks of this type. The strike of the schistosity is usually northerly; but variations are frequent. On the point north of the mouth of Sturgeon Weir river the strike is nearly east and west, and the same direction holds for some of the schists north of the lake. Along the west shore the schists have strongly contorted laminae. Some granular rocks of the type of diorites or altered diabases and some amygdaloidal lavas occur. A few exposures show a rather fresh looking light greyish felsite interlaminated with green schists.

Missi formations.—At the north end of the lake and crossing on to Missi island is a narrow band of conglomerate, striking nearly north and south. It has a well marked schistosity parallel to the strike of the band and to the Amisk series adjacent. The dip is almost vertical. The pebbles are chiefly disc-shaped fragments and well rounded pieces of quartz. Fragments of felsites and jasper are in minor amount, but typical granites do not seem to be represented. The size varies from sand particles to a diameter of a foot or more. The matrix is a rather coarse grained arkosic material. The arrangement of the pebbles is very irregular and lenses sometimes occur without pebbles. The flat schist pebbles usually lie with their long axes parallel to the schistosity, but this arrangement seems to have been original rather than induced, and therefore the present schistosity is parallel to the original bedding of the sediment. Occurring as bands and lenses is strongly schistose deep-green rock that in appearance and degree of alteration is so like the Amisk greenstone that, without the evidence of the associated fragmental formation carrying fragments of true Amisk rocks, it would undoubtedly be classed with the older formation. The rocks on Missi island immediately west of the Missi formation are greenstones with striking pillow structure.

Later granite.—A narrow belt of rather fine grained biotite granite intrudes the greenstones and schists on the west side of the lake. This tongue lies from a few chains to a mile and a half from the shore, and is variable in width, possibly discontinuous. Its maximum breadth is a half mile. Dykes from this main tongue are numerous along the lake. No tongues have been found cutting the conglomerate, but the failure of granitic pebbles in the fragmental rock, as well as the unsqueezed character of the igneous rock, seems to argue that the granite is of later age.

Palaeozoic.—Covering the Pre-Cambrian formations is the mantle of Ordovician sediments. These consist of limestones, sometimes arenaceous. They vary in color from light buff to variegated, to reddish, the latter apparently uppermost.

Glacial and recent.—This region was one of intense erosion during the glacial period, but deposits of glacial debris are not important.

Economic Geology.

Gold.—The first gold discoveries were made by Messrs. Mosher and Creighton in August, 1913. Since that time a large part of the country around the north end of the lake has been staked. Many of these claims are of the usual type located during a gold rush. Even on claims where quartz veins have been found little work has been done.

*Published by permission of the Director of the Geological Survey, Canada.

Prince Albert claim.—Up to the present real development work is confined to that being done on the Prince Albert claim of the Mosher-Creighton group. The vein has been traced for a distance of two hundred feet and a shaft is now down 25 ft. The vein is in a schistose band in the greenstone. The strike of both schist and vein is north and south. The dip is 60 degrees to the west. The vein is variable in width, ranging from 2 ft. to 9 ft. at its junction with a 20 in. subsidiary vein. Native gold is present in visible amount, and the schist adjacent to the vein is said to carry values. Other metallic minerals are present only in small amounts. Some of these are: Arsenopyrite, usually in crystals in the wall rock; a very little chalcopyrite, with carbonates from its alteration; molybdenite, and possibly some galena and stibnite. The gangue is quartz with some calcite. The quartz is variable in color, being milky white, bluish, pinkish or a variegated brownish color. In most of the samples examined the visible gold seems to lie chiefly along irregular dark greenish lines or along slip planes which are coated with a yellow micaceous mineral. Sometimes, however, it is in solid quartz.

The Monarch vein, on a small island just east of Prince Albert claim, has not been developed, but apparently has a considerable width. It strikes N.80.°W. Other finds of visible gold are reported from Copper lake, just east of Beaver lake, but these have not yet been examined.

The region is heavily timbered and so far has not been thoroughly prospected even on located claims. However, with the improvement of transportation facilities, the holders of these properties will no doubt proceed to examine them properly. In the veins already being worked careful and systematic development to prove payable values both along the strike and in depth is necessary. On the whole the Beaver lake region seems to be a not unpromising field for legitimate investigation.

GRANBY CONSOLIDATED.

Boston—The Granby Consolidated Mining, Smelting & Power Co. completed the most important year in its history on June 30, for in that twelvemonth there was equipped and put into operation the Hidden Creek property at Anyox.

The company produced approximately 21,000,000 lb. of copper in its fiscal period just ended comparing with 22,688,614 in the preceding year. Just how much profit was derived from this yield has not been determined, but the margin between costs and receipts was at no time great. In fact, dividends paid during the twelvemonth were not at all times fully earned.

Costs at Grand Forks ranged between 10 1-2 cents and 11 cents a pound. The new Hidden Creek property, which was put in commission several months ago, showed from the first a slight operating profit.

The company now has a fixed charge in the way of interest on $1,500,000 convertible bonds and has maintained dividends at the rate of $6 a year.

In the near future the Midas mine in Alaska should be in position to ship ores to the Hidden Creek smelter. By reason of their precious metals contents the cost of production will be exceedingly small.

The annual stockholders' meeting will be held in New York in October, at which time there will probably be two changes in the board of directors.—Boston News Bureau.

CLAY DEPOSITS OF NEW BRUNSWICK.

In a bulletin published by the Geological Survey, Mr. J. Keele states that up to the present time the clay deposits of New Brunswick have only been developed to a very limited extent. Wooden construction prevails, to the exclusion of almost all other kinds, except in the business portions of the cities and towns, because lumber has hitherto been plentiful and cheap in this Province. The danger from extensive fires is always present when wooden construction is so freely used in closely built communities. This was evident in the total destruction of the town of Campbellton by fire during the summer of 1910. Since then the demand for structural clay wares is increasing, but they are not yet used as largely as they might be, because everything except common brick has to be imported.

New Brunswick possesses in its Carboniferous rocks certain shale beds, adapted for making those higher grades of claywares which cannot be produced in the Provinces of Quebec or Ontario, where these raw materials are absent.

Proximity to markets, although desirable, is not so essential to manufacturers of the higher grades of clay wares, such as face bricks, paving bricks, sewer pipe, electrical conduits, fireproofing, etc., as these materials are frequently transported for long distances. A plant equipped for a large output of common brick can only be maintained close to cities, where the demand for them is constant during the greater part of the year. These plants frequently represent a considerable expenditure of capital, being furnished with artificial driers, continuous kilns, and machinery driven by steam or electric power. The surface clays can be worked in a primitive manner, with a small outlay of capital, to suit the demands of small towns or rural communities. Such plants are able to maintain their position, because the price of common brick would not pay the cost of carriage from large centres where their manufacture is carried on more scientifically.

When the need for underdraining the cultivated areas in the province becomes more generally known, these clays will have a much wider application. Drain tile can be made from the surface clays. Tile are made from stiff mud, usually by an auger machine having a circular die, although different styles of plunger machines and also hand presses are used in their manufacture. They are made in sizes varying in diameter from 2 in. to 3 ft. Any means of drying and burning may be used with the smaller sizes, but the larger sizes require considerable care to prevent cracking. Contrary to the popular notion, it is not necessary for drain tile to be porous, so that they should be hard burned. Besides sufficient hardness, the important requirements for drain tile are straightness, uniformity of diameter and smoothness of ends.

The only pottery in operation in the Province is located at St. John, on Loch Lomond Road. It is owned by J. W. Foley and Co., who manufacture butter crocks, teapots, jars and flower pots. Most of the raw material is imported from the State of New Jersey.

State Mineralogist F. McN. Hamilton announces the publication of Bulletin No. 67, "Minerals of California," available for distribution July 1, 1914. Price $1.00. This work which is a cloth bound volume of 250 pages has been written by A. S. Eakle, Ph.D., Professor of Mineralogy in the University of California, and is the result of many years of research and study of the minerals of the State.

PROFESSIONAL ETHICS*

By Dr. Rossiter W. Raymond, Ph.D., LL.D.

Perhaps the deepest and sharpest distinction in a man's relations to his fellow-men is the distinction between war and peace. He who takes the life of an enemy, may lay down his own life for a friend. But the progress of civilization and religion has tended to diminish this distinction, first, by abolishing private wars and restricting the practice of war to conflicts waged between organized political groups, and, secondly, by limiting the rights of such beligerents, and protecting the rights of neutrals, non-combatants, even of soldiers and of prisoners of war. Nevertheless war is still purgatory, though it need not be unmitigated hell; and apart from the lawlessness, cruelty and suffering which still accompany it, perhaps its greatest evil result is its corruption of the ways and habits of peace.

Accustomed in war, even when humanely conducted, to deceive, surprise and outwit the enemy, to capture, disable or kill his active soldiers, and, at the very least, to destroy or carry off such property as might be useful to him or to ourselves in the struggle, we transfer these habits into those contests of peace which we can figuratively describe as war. Fair notice has been given, let the adversary beware! CAVEAT EMPTOR! Let the purchaser look out for his own interests, so long as we do not warrant the horse or the goods, or do give him the opportunity to have his own expert examine the mine! Some people, professing to believe that labor and capital are at war, and that every interval of peace between them is only an armed truce, justify acts of violence and treachery as acts of war. Hysterical women declare that the breaking of laws and of windows, and all varieties of malicious mischief from riot to arson are necessary incidents to a holy warfare. And if we descend to the class of professional criminals, we find that even they satisfy what remaining conscience they possess by the theory that they are at war with society, with the world that owes them a living and hasn't paid the debt, or with the rich whom it is their duty, as champions of the poor, to plunder. Through all these and many other developments of crude and selfish ethics runs the demoralizing maxim that "the end justifies the means," the end being always a victory of some kind, which is regarded as rightly desirable and supremely important. This preverted reasoning, I repeat, is the legacy left to us by wars between nations. And the worst of it is, that in practising the ethics of war in private relations, men do not always obey the humane regulations and restrictions with which civilized nations have gradually limited the practice of public war. The warriors of peace will sometimes be guilty of acts, such as the wanton injury of neutrals and non-combatants, which have been outlawed in war. Our ethics of peace are based on the Golden Rule, under which we are to do unto others what we would have them do unto us. Yet this rule needs interpretation. Sanely construed, it means that we should treat others as we ought to wish them to treat us. It does not require us to give money to a lazy and worthless beggar, because if we were beggars of that sort, we would like to get, by simple asking, the price of a drink. Moreover, even when sanely interpreted, the Golden Rule depends in operation upon our notion of what is best for our neighbor, and would be best for us. This rule was formulated, in substance, first by Confucius, and afterwards by Christ. It therefore underlies the ethical systems of two great groups of nations comprising the greater part of the population of the world. Yet how differently it operates in these systems! We consider truth and honesty as the basis of our code. Confucius made brotherly kindness the basis of his. "Don't lie whatever you do!" is our maxim. "Don't give pain, if you can possibly avoid it," is the Confucius rule. Thus you will find in the Analects of Confucius a direction, substantially as follows: "If a man calls upon you to solicit a favor which you cannot grant, do not say, No; tell him to call again, and thus delay his final disappointment!"

I do not mean to waste your time and my strength in discussing the ultimate basis of ethics, or the difference between systems. Let me come at once to the consideration of my subject of professional ethics, as based, among us, on the principles of honesty, justice and fair play. I shall not go into the higher realm of love, in which a man sacrifices his life for others. Such altruism is not the rule of life. We may admire and reverence it, when it is not only nobly unselfish but also sane. But we cannot imagine a worse organization of human society than one in which everybody is trying to sacrifice himself, and justice is swamped in hysterical generosity. We must be just—just to ourselves, our generation and the permanent interests of our race, before we can know, even, how to be generous.

Under the term "professional ethics," I mean, not any code or set of codes, different from that general system which we recognize as binding upon us all, but the application of that system to problems peculiar to different professions. For, as I think, people generally mean to be honest and kindly and to play fair; but each class gets a training in certain directions, and is led to emphasize certain rules, which other folks, perhaps, not having had that training, do not instinctively obey.

Thus the Wall street broker, whatever other sins he may be guilty of, will calmly incur ruin, rather than go back on a bargain, made for him by a clerk, through a word or a sign in the howling crowd of the Stock Exchange. Or a merchant regards it as vital to his honor to meet his notes when they are due. He may be shifty in other ways; but he never dreams of neglecting the payment of his notes, or of supposing that his creditors will kindly wait without being asked to do so, or of regarding as a cruel oppressor any man who proceeds to collect his money when due. But take a clergyman or (in any State except Colorado!) a woman—in other words, a member of either of the two classes whom we most justly revere for their exalted, pure, unselfish lives—and you will discover that, to such an one, the man who has loaned money, and demands it again on the day when, although due, it cannot be conveniently paid, is a cruel oppressor, a member of that wicked "creditor class" against which legislators ought to legislate and preachers preach, and political parties produce platforms! If you doubt this proposition, just try to negotiate at a bank the note of a clergyman or (outside of Colorado) a woman!

The trouble in all such cases is that good people, meaning to do right, have had no ethics in the par-

*Commencement address, Colorado School of Mines, May 22, 1914.

ticular sphere in which they exceptionally and occasionally act. Let me assume, my young brothers, that you are also without experience, and suggest to you some principles which may aid you in meeting the ethical problems of your own careers. This is, in fact, the only service that I, as a veteran lagging superfluous on the stage, can offer you. In every other respect, you know vastly more than I do. I can claim but one superiority over you; I have lived longer. If, according to Darwinian hypothesis, it is the fittest who survive, I can claim the dignity of a survivor! But even that will be lost before long; so let me use it while I can.

In treating of the ethics of your profession as engineers, chemists or metallurgists, you are under implied contracts, which professional ethics require you sacredly to fulfill.

Authors.—1. You will have to write technical papers or reports. Now, what are the ethics of such authorship? This is not an unnecessary inquiry. In my experience of some thirty years as editor of the writing of the ablest American engineers, I have found among the educated young men of this generation a serious ignorance on this point.

An author who is telling somebody his thoughts, has made a tacit agreement or contract with his reader. He practically promises, as the party of the first part, to the party of the second part, that he has paid attention to a certain subject, that he has something to say about it, and will undertake to say it so that the party of the second part can understand it. This is the agreement between author and reader; and the author has no right to violate any part of it.

Clauses misplaced are simply belated afterthoughts. Confused statement means confused studying, means that you have not thought out what you want to say, do not know what you are going to say, do not know how to say it, and have not tried to find out. You went on, possibly dictating to a stenographer (which is the besetting literary sin of our age), and communicated therefore to your reader, not the product of your thought, but the process. The reader does not care for the process; he wants the result. How many of us, writing in this slipshod way, have dragged our readers through the process, and have failed to give the product?

A mixed figure is often wrong morally. An orator who mixes a figure tells a falsehood. He professes to say to his hearer, "Behold! I have seen a picture, and it is thus, and so;" then state a thing which could not have been in a picture, and which he never could have seen.

I sat in the great Music Hall of Boston and heard Wendell Phillips say that the time would come in this country when "Liberty would stand by every newborn child, to drop in its cradle the school house and the ballot-box." He uttered not merely a mixed metaphor but also an implied and unconscious falsehood, because he professed to see in prophetic vision—a performance which would have been fatal to every American baby, and therefore not glorious reform, but the meanest kind of murder.

All joking apart, there is a serious ethical basis under the question of style. It is a debt that the author owes to the reader to tell him the truth; and a mixed figure is a lie.

Again, you ought not to conceal from your reader, by any device or evasion, or circumlocution, the extent of your knowledge. You ought not to pretend to know more than you do. For instance, you know German. Most of you have to; and it is the best language outside of your own for a technical man to know. Now, suppose you get a German book, and there is in it a quotation from Plato or Pliny. You like to show culture; and when you write your paper you desire to quote this passage, and repeat it out of the German book, not out of Pliny. But most people do not quote Plato or Pliny or anybody else correctly; and you may have made yourself responsible for another man's error. You do not say, "I found this quoted in such and such a book." Now, that is a crime of authorship, to quote a thing you have not yourself seen in the original. If you found it somewhere else, say so in a footnote.

Again, do not use quotation marks unless you are citing the author's very words. Even that eminent historian, James Anthony Froude, fell into this sin. He was writing about Mary, Queen of Scots, and gave the substance of certain letters of the Queen and the ministers of Elizabeth enclosing in quotation marks words that they had not used, which gave only his idea of the substance of the letters. I think it was the Saturday Review which uttered the famous verdict, justly considered to express the utmost severity of condemnation. "Mr. Froude does not understand the meaning of quotation marks."

In my editing of the Transactions of the American Institute of Mining Engineers, a publication of more than one thousand pages octave every year, I have employed an assistant whose duty it was to look up quotations and references, and see that they were correct; and very often they were not! But I cannot stop to enlarge upon the niceties of authorship. Show perfect frankness concerning the extent and sources of your knowledge. Give every aid possible to your reader, if he should wish to go to the sources. All this is in the contract which you have made with him.

Employees.—2. In some capacity or other, you will become employees. Here also you enter into a contract, part of which is defined and enforced by the common law, while the rest is dictated by honor, and even by selfish interest. What you promise is not only service, but loyalty. Consider your duties and opportunities, rather than your present reward or your supposed rights.

Henry R. Worthington, my namesake, and a warm and helpful friend, once said to me, "I can find many young men who are competent to erect engines, but very few whom I can thoroughly trust to do it, in complete devotion to my interest as an employer. They are smart enough, but that does not prove that they are loyal enough."

Let me assure you who are younger, and call upon those who are older, to bear witness to the truth of what I say: There never was a time since civilization began or industry was set in motion by man, when loyalty was worth more than it is now. These enormous trusts and enterprises, one of the most magnificent of which adorns this city, are going to be ruined unless they find trustworthy employees. The time is past when the master could watch all the details.

The peril of the great enterprises of to-day is that they are breaking down the men at the head. It is not always the president; sometimes he is only a figurehead. But it will be the vice-president or the general manager. All these great combinations are, in my judgment, for that very reason, more dangerous to the body else. It is beyond the capacity of human brains to keep such big things going, unless they have trained and disciplined and retained a body of trustworthy

employees. Otherwise they will be ruined. That is the reason why the heads of great enterprises are looking for trustworthy men. Even had you no higher motive than your own welfare, you would be a fool to commence by looking out for yourself rather than your employer.

There is one situation testing, and, in our American history, brilliantly illustrating the loyalty of technical employees, which I cannot pass unnoticed, especially because it has received far too little recognition from press and public. I refer to the heroic courage with which the American managers of mines and metallurgical works have stood at their posts, defending the property entrusted to their charge against organized violence. The list is long—too long— already. It contains heroes and martyrs, but, so far as I know, not cowards. If it must become longer, by reason of the fear and folly of others, I pray God it may remain unstained and lustrous to the end.

Business Agents—3. You will have to act as business agents. In this case, your convenant is, that you will faithfully represent your principal, knowing no other interest than his. Perhaps the most troublesome question presented to young engineers is that of commissions. Let me tell you one case of my own. I went to buy for my employer a certain type of engine. I examined the various engines, found the kind wanted, and beat the price down by persistent negotiations until I got the very lowest price, and was just going to take the engine when the seller said, "Of course you are entitled to a commission on this purchase." I said I did not understand it so, that my services were being paid for by my principal, and I would prefer that he made a still lower price on the engine. But he said he could not make a lower price on the face of the bill, but was allowed, by a trade agreement with other men in the business, to give a commission to the agent. Now, had I been younger, I would have preached to that man. I would have said, "Sir, are you aware that you are offering me a moral insult?" But I had earned the custom of the trade, and I knew that what he said was true; that he could not reduce the face of the bill, though he could allow me a commission. "Well," I said, "I shall give it to my employer." Of course he smiled a bland smile and said that he had no objection to my giving it to whomsoever I wished. I wasted no time in further professions of honesty, but simply said, "I will take it; but I want it in a check to my order."

I took the check and endorsed it to my employer; and when I reported the purchase of the engine I said. "Here is a commission which they paid me." He looked at it; and he might have said "Good boy! you can have it." But he said nothing of the kind. What is more, it was not right that he should say it. I had been fully paid for my services; the commission belonged to him; and he knew it and I knew it. So I call your attention, not to any heroic virtue in my act, but to the common-sense which I exhibited in making my record plain. When it went back to the manufacturer, with my endorsement on it, he knew that I had given my commission to my principal, and there is the keynote to all such negotiations.

Advisers.—4. You will perhaps become advisers, either of private clients or of a public composed of investors unknown to you, or of courts of justice.

As the adviser of a private client, you should not have much difficulty as to professional ethics, except that at the beginning you ought not to let your client acquire a false idea of your qualifications as an adviser. One of the most frequent forms of advice is the letter of recommendation. I have often had to recommend young men or answer questions as to their qualifications, and I have always, in such cases, written a private letter. Do not, if you can avoid it, give general letters of recommendation, addressed to nobody in particular. In the first place, they have no weight. In the second place, they are carried around until they are dirty and dogeared and unfit to present. In the third place, to give a man a letter about himself which he necessarily has an opportunity to read, is to throw suspicion upon the fulness of the communication. Even to the best of my friends, I give letters of recommendation in the following form: "To whoever receives your application for employment, I authorize you to use my name as reference, and if he will drop me a postal, I will answer confidentially and fully."

Then when I do answer fully, my duty as an adviser is to tell the truth. I must not write for the purpose of getting a place for a friend. I must not suppress anything that might affect unfavorably the success of that friend. I must advise the inquirer as though he had paid me for my honest opinion. And I frequently have to write in this way:

I have known the applicant for so long. I know him in such and such a way, and if he is given work of that nature, he will do it very well. The kind of thing you want, I do not know about, but I am very confident he will not tell you he is proficient unless he is. If he says he is, I believe he is; and if he says he does not understand it, I believe that he can pick it up if you give him a chance."

A letter of that kind, honest and complete, goes much farther than a general letter. I wrote such a letter recently for a young man who was in competition with a number of others for a position; and when he came back he said, "I got the place; he didn't pay any attention to the others."

In my special profession as a mining engineer, a curious case of causistry often arises. A person considering the purchase of certain mining property says to me, "Here is the report of the owner. I have agreed to take the property if that report is true; and I want you to verify it." At present I will not take such an order as that from anybody; and if you have the power to choose, I advise you not to do so. Yet there is nothing dishonorable in it. It is only difficult and liable to make trouble afterwards. You see that, under those circumstances, you have nothing to do except to say whether a certain statement is true or not. The statement may be true, and yet, in your judgment, there may be reasons why your client should not buy the property at the price named.

I prefer that my clients authorize me to advise simply whether they shall buy or not. Then I can return and say, "The statement is correct, but there is another property, equally valuable, right by the side of this one, for sale at half the money." Under the first form of order, I would not have the right to say that. I would be merely sent to examine into the truth of a certain statement. It is as if you were employed to decide whether a certain horse is sound. It would not be your duty to report, "Yes. The horse is sound but I know of another sound horse that could be got for less money." On the contrary, it would be your duty to hold your tongue as to everything except the precise questions you are employed to investigate. And the acceptance of a professional duty thus limited is perfectly honorable. On the other hand, it is your right and your interest to be protected against any

misuse of such a limited opinion, either by the garbling of your report, by suppressing its qualifying passages, or the use of it, in whole or part, as an endorsement of a scheme of which you had no knowledge, made no investigation, and would not have given a favorable opinion. Make your report in writing. Phrase it so that it cannot be innocently garbled. And if it should be thus misused, protest promptly. Don't come limping in, after a scheme has failed, to protest that you never meant to approve it in all respects. Speak quick, or shut up!

A word or two as to the duty of an expert witness in court. There has been a great deal said about "expert" testimony. Every once in a while some estimable gentleman cries, "Oh! This is all wrong. Just look at the way in which experts come into court and take thousands of dollars in fees for contradictory theories. The true principle is, that the court should appoint the experts, and the experts should have nothing to do with either party, but should simply enlighten the court." With that proposition I beg to differ. I have seen it tried in France, in Germany, and in England. Court experts were appointed, and published ponderous volumes, and could not agree. After all, gentlemen, let us confess that there is nothing so wholesome for us as to be set up before twelve men who know nothing about our business, and forced to try to teach them. I believe with all my soul that the best way to get the truth in a case of law involving scientific problems is to let experts be put forward by either side and cross-examined before judge and jury. They generally come out in their true size, no matter how inflated they were at the beginning.

We must recognize the fact, however, that, in almost exery case of expert evidence, the expert is a partisan. It must be so. Nobody will pay expert fees, unless he knows what his expert is going to say. The proper course for you, as an expert, is to take pay in the beginning for the labor of examining the case and telling your client what you think of it. If your opinion is not useful to him, then drop out of the case. You cannot change your opinion honestly. But if you do drop out, you must not use the knowledge you have confidentially gained, either in that trial or in any other proceeding in which your client is involved. Your retainer should be as sacred as that of a lawyer; and a lawyer should be disbarred for such an act.

When your mind has been made up, the time for indecision is past. It was your business to make yourself thoroughly acquainted with the subject. If you are taken by surprise on the witness stand with a fact you did not know, you have failed in your preparation. But do not attempt to get out by evasion. An expert is sometimes taken by suprise, and in my judgment all he can say is, "I did not know of this fact. I have made up my mind after a careful study of the whole case. It is my honest opinion still. I have not had time to examine the relation of this fact to it. You may use this fact as much as you like. I cannot, at a moment's notice, frame a new opinion." That is the best way out of it. Any extemporaneous fencing with a lawyer brings a man to grief.

And for heaven's sake, do not be smart! Do not try to get the better of a lawyer in wit or repartee. You are fencing with one hand tied behind you; for you are under oath and he is not. I have seen many a witness beat a lawyer at repartee and then lose the case. On the contrary, I have seen many an honest witness confused and embarrassed, and the jury saw it, and gave him the case.

The best attitude for a witness is an impartial one. He must not seem to be fighting for his client. He should fight for his convictions and his theory; or rather, he should not fight at all, but assume that the examining lawyer is sincerely anxious to get at the truth of the matter, and give it to him with great courtesy and great affectation of frankness and esteem. The best witness I ever saw, spoke with such perfect freedom and pleasure whenever the opposing attorney asked insulting questions that the impertinence reacted in the witness's favor. But if you give provocation, your game is gone. You had better play the game of gentleman. If you do that the court will protect you from any insults. And if the cross-examining attorney says, "Answer me 'Yes' or 'No,'" do not commence to fence and dodge. Say, "As you ask the question, I answer 'Yes' (or 'No')"; and then request the privilege of explaining your answer. It is your right and you will get it.

In conclusion, is there not some handy rule which would help us in every case of doubt? The Golden Rule and the Ten Commandments we all want to keep; but they cannot always be applied in haste or with certainly. Let me suggest something practical, which has religion in it, but not enough to hurt or scare you. "Do not do what you cannot tell," or if there be good reason for not telling, at least "Do not do what you could not tell without shame." If it is a question, whether you should take a commission or whether your employer should have it, ask him; and then there is no trouble. If it is a question of practice, doubtful as to ethics, see how it would look in print.

Lately there has been a reign of hysteria in ethics, and it has gone too far no doubt. Nevertheless, without deciding whether this, that or the other thing is wrong, and while still believing in my own mind that many honorable men are being persecuted for having done things which only a short time ago all the world was doing without such criticism, I may draw out of all this the one pervading moral. How many of these things, if they had been done openly, would not plague the doers now? Here is a railroad company, formed, after the American fashion, to drive its tracks through the wilderness, building cities as it went. And (horrible to relate) it gave rebates to men who could help to build such cities. If the company had come out and said so, no one could have found fault justly. But it gave rebates and said nothing about it. In like manner, for many another thing, sometimes necessary, sometimes even wise, some hitherto reputable person or company has been made disreputable, and the real trouble is that the people who did it kept it secret.

There is another point about this matter of secrecy. When you keep a thing secret, you are not very likely to make a complete record of it. Now, there is nothing more foolish than not to keep your record perfectly clean. It is most humiliating to a man to be, after 30 years or so, unable to explain some particular payment, which he knows was honestly made, simply because the stubs in his check-book do not tell the particulars. Keep your memorandum book up to date and in good order, so that anyone can see them. If you are ordered to do a thing which you do not approve get the whole thing in writing, and make your record clear. We have been told upon the highest authority that men love darkness better than light when their deeds are evil. If you are not of such, why not walk in the light?

EXTINGUISHING MINE FIRES BY HYDRAULIC FILLING

According to Charles Erzian in a bulletin published by the U. S. Bureau of Mines, the hydraulic method of mine filling is reported to have been employed as early as 1884 to extinguish a serious mine fire. The fire originated in one of the deep lifts or levels of a haulage slope in an anthracite mine, and after raging for several days was making its way among timbers and fallen coal to higher levels, where its extinguishment by methods then in use would have been very expensive and might have permanently ruined the mine. Water had been turned down the slope in flooding quantities at regular intervals with the hope of checking and extinguishing the flames. After considerable time had been lost in this manner with no apparent improvement or success, the idea of sending down culm mixed with water was conceived and applied. The intermittent flooding with water did not fill up crevices and openings in the debris and fallen coal and rock, but after culm had been flushed into the lower section of the slope for some time it filled the interstices of the fallen material, thus excluding the air and soon bringing the fire under control. Several years later hydraulic mine filling began to be generally employed for the purpose of extinguishing or smothering isolated mine fires, either by the direct filling of the workings affected or by the construction of temporary or permanent barriers. This practice is now common and is termed "sealing off a fire by the hydraulic-filling method."

The successful application of the various methods of extinguishing mine fires with large quantities of water, whether in steady streams, in pulsating streams, or in flooding quantities, or with mixtures of water and refuse material, depends to a great extent on the geological structure of the coal bed and the situation of the mine workings and the mine in relation to the available supply of water and "filler." At a mine operated at a considerable distance from available filling material it may be necessary to lay long pipe lines to a convenient surface location and to furnish expensive motive power.

The filler, after having been properly prepared, must be sent into the mine through a suitable opening. At many mines only bore holes are practicable. For such mines the best location of the bore hole is determined from examination of maps or other available data; sometimes from the best recollection of old-time miners. The latter necessity arises, in the case of old workings, because the maps of such workings, made at a time when the mining engineer or surveyor was seldom considered necessary, are incomplete or unsatisfactory.

The filler, after passing down the bore hole, flows unconfined into the inaccessible workings, causing blockages among the caves, and forming finally an effective permanent sealing pillar. In some mines this requires weeks of filling, and in other mines blockage is complete in less than a day. Under more favorable conditions, as in a mine where a fire may be in progress in "live" or producing workings and where the filler can be transported to and deposited at pre-determined points, the burning section is isolated so that the fire can not spread to adjacent workings, and the fire is allowed to burn to extinction within the sealed area.

The fire may be smothered by depositing filler in such a manner as to confine completely the burning district within well-defined bounds by filling the openings so as to exclude air and thus cause such a deficiency of oxygen in the atmosphere that it will not support combustion. This method was used in a Wilkesbarre mine in which a fire had been in progress for some years. The burning area was on an anticline and the fire could not be extinguished by the usual methods of flooding. Bulkheads were constructed in the mine workings at lower points, and the open space inside of the bulkheads was filled by means of pipes which were run either above the bulkheads, along crosscuts and traveling ways, or through the bulkheads, so that they discharged some distance above the bulkheads, to insure absolutely air-tight blockage at the bulkheads.

WILL OIL REPLACE COAL AS FUEL?

The world's production of crude petroleum in 1912 amounted to about 52,921,750 tons; the sources, respective quantities and percentages were as follows:

Country	1912 Tons (2000 lbs.)	P. C. of T'l Pro.
United States	32,897,060	62.16
Russia	10,174,560	19.23
Mexico	2,910,000	5.50
Roumania	1,987,360	3.76
Dutch East Indies	1,672,000	3.16
Galicia	1,298,620	2.45
India	1,101,450	2.08
Canada	38,750	0.073
Other countries	841,250	1.59

If the whole of this crude petroleum were employed as fuel in steam raising it would not replace, allowing for its higher thermal efficiency, much more than five and one-half per cent. of the world's output of coal, whilst if used in internal combustion engines it would be equivalent, as a source of power, to about 16 per cent. of the coal. Only a small proportion, however, of the crude petroleum can be regarded as available for use as a source of power, for by far the larger part is in demand as an illuminating agent and as a lubricant for machinery.

As the United States produces over 62 per cent. of the world's production of petroleum, it is interesting to note that Dr. Day, of the United States Geological Survey, considers that, at the present rate of increase of the output of petroleum, the known oilfields of the United States will, on the basis of the minimum quantity of oil obtainable, be exhausted by the year 1935, while, even if only the present output were maintained, the supply would, on the same basis, not last more than nineteen years.

In many countries there are, no doubt, vast tracts of undeveloped petroliferous territory, but only drilling can determine this. Even if the available deposits were far larger than there is reason to believe them to be, the cost of doubling the present output would be great. In view of these circumstances, it is not probable that there can be any general substitution of petroleum for coal as a source of power, although there is undoubtedly opportunity for making provision for a larger use of liquid fuel for certain purposes in which its advantages are conspicuous.—W. J. D.

SESEKINIKA.

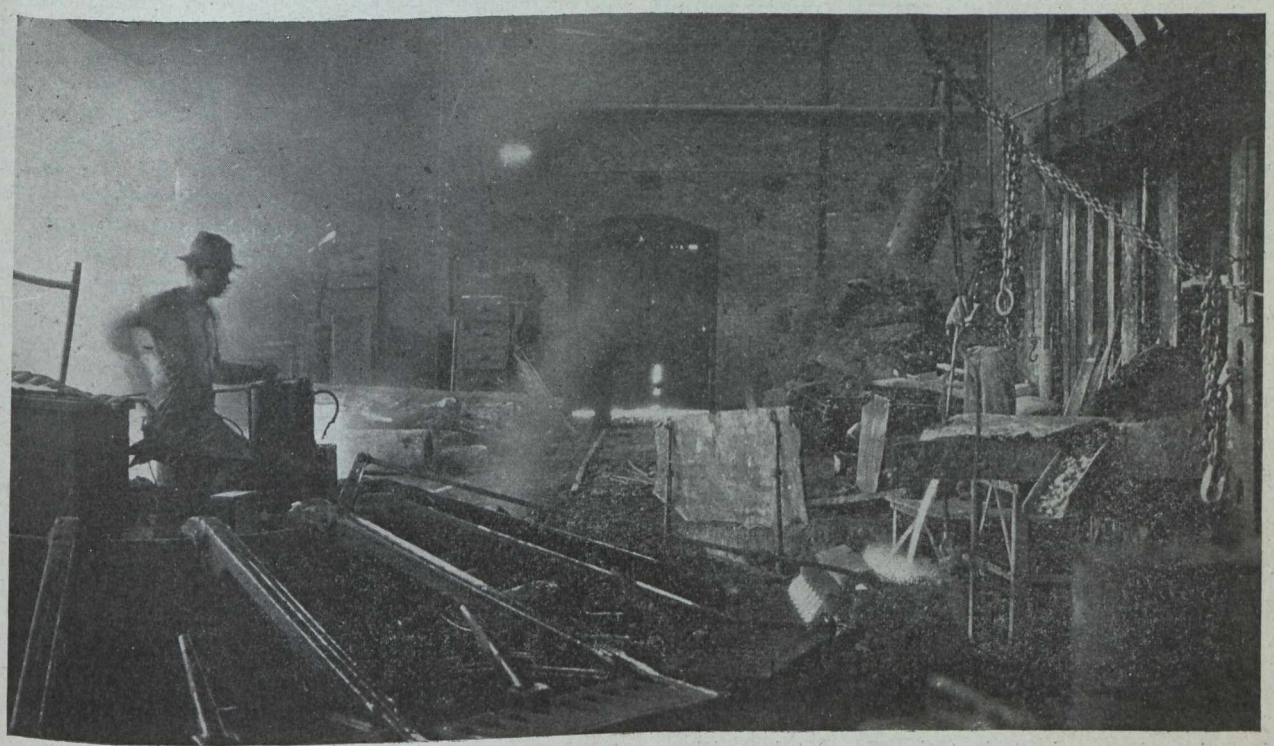
The discovery of gold by Messers. Smith and Labine on a claim near Sesekinika, north of Swastika, is believed to be quite important. Several engineers have examined the vein and state that the showing is a very good one. So far as the actual value of the deposit is concerned, little is yet known; but the surface indications are regarded as promising.

SMELTING MICHIGAN COPPER ORES

Michigan copper ores are comparatively easy to smelt. The operations are chiefly, (1) melting the concentrates and mass in reverberatory furnaces, (2) refining the copper and (3) recovering what copper goes into the slag.

The chief product of pure copper comes from the first melting. The concentrates and mass are melted without, (or in some cases with) fluxes in reverberatory furnaces, the slag formed by adhering rock is skimmed off as it forms, and the copper refined in the same furnace, or at one plant in a second furnace. The whole process takes one day for a small furnace, (capacity 30,000 pounds copper) and longer for larger charges (80,000-150,000 pounds). When one small furnace is used for both melting and refining, it is charged in the afternoon, melting and skimming continued over night, and refining done in the morning. In refining, the melt is rabbled by compressed air several hours to oxidize impurities, principally iron and sulphur, which then come up to the surface and are skimmed off. In the process a little copper is oxidized. Some of the oxide is skimmed off with the impurities. The completion of the rabbling operation is determined by observation of the texture (granularity) of the copper in test buttons. When the original impurities have all been removed, the copper still contains some cuprous oxide—as much as 7 per cent. This is reduced by submerging wooden poles in the melt. Polling is continued until the copper is in the best possible physical condition. This point is determined by observing test buttons until a stage is reached at which they set flat on cooling. There is then still some cuprous oxide, but the metal is in its best physical condition, and without further poling it is poured into moulds. This is the final product ready for market, and unusually pure. In one plant the copper is tested for conductivity before pouring, and if the test proves unsatisfactory the melt is rabbled and tested again before pouring. The completion of the poling operation is checked by a copper assay.

A smaller, but important, quantity of copper is obtained by treatment of the reverberatory slag. This is allowed to cool in deep pots and the copper settles to the bottom. The buttons are broken off and returned to the reverberatory furnace, while the slag, containing 15 to 30 per cent. copper, is melted in a cupola furnace with suitable fluxes. Limestone is added for all slags. For the ferruginous slag from conglomerate ore, a siliceous flux is necessary, and for the siliceous slags from amygdaloid ore, ferruginous fluxes must be added. Anthracite is added as a reducing agent. The fuel is coke and the anthracite.



Furnace and Walker Casting Machine, Michigan Smelter, Houghton, Mich.

The charge is treated slowly under a low pressure blast. As the melt is inclined to chill, deep crucibles are used to allow the copper to settle, and there is no forehearth. The slag is allowed to flow off continuously. The copper is run off at intervals and cast into blocks. These cupola blocks, containing small amounts of iron, sulphur and arsenic, are refined in the reverberatory furnaces in the same way as the copper formed on melting the original charge of ore and concentrates, but on account of greater impurity must be rabbled much longer.

To obviate dust loss in treating fine slimes, one smelter has a briquetting plant. The slimes are thoroughly mixed with lime and pressed into briquettes. These are sealed up in a steel cylinder and highly heated. They are then smelted with the reverberatory slag in a blast furnace.

At one plant the fines are melted in a reverberatory furnace and the product run off into pots. It is allowed to cool and then broken up for treatment in the blast furnace.

Casting methods differ at the different smelters. In some cases the ladle is brought over stationary moulds, while in others the moulds are moved up to the ladle. At the Quincy smelter the copper is dipped by hand ladles suspended from beams, so that they can be swung over the moulds. At the Lake Superior smelting works the moulds are brought up to the ladle on an endless chain. At the Michigan smelter, and at the newer furnaces of the Calumet & Hecla company, the moulds are brought up to the ladle by a Walker casting machine rotating in front of the furnace.

The copper is cast into several shapes, the most common of which are known as ingots, ingot bars, wire bars, cakes, slabs, billets and anodes. The ingots weigh about 20 pounds each, and are much used in manufacture of alloys. Ingot bars consist of two or three ingots joined together endways for convenience in shipping. For wire drawing, the copper is usually cast into rectangular bars, weighing about 225 pounds. Cakes, square or round, and weighing from 120 to 6,000 pounds are used for rolling into sheets. Slabs are thin cakes. Billets are for manufacture into seamless drawn tubes. Copper containing appreciable amounts of silver is cast into anodes for electrolytic recovery of the white metal. Some cupola blocks, containing considerable impurities, are recast into anodes for electrolytic refining. Until recently no electrolytic refining was done at the Michigan smelters; but the Calumet & Hecla Mining Co. has now in operation at Hubbell a splendid plant.

COLORIMETRIC ESTIMATION OF GOLD IN CYANIDE SOLUTIONS.

It sometimes happens that conditions of precipitation are disturbed temporarily, and frequent determinations of gold in barren solution are desirable in order to control the precipitation process. Time is not available for the ordinary assay, and a rapid method is required which can be performed by the foreman or shiftman in charge of the work. In discussing a paper on the metallurgy of the Homestake ore, presented to the Institution of Mining and Metallurgy by Messrs. A. J. Clark and W. J. Sharwood, Mr. Charles B. Brodigan recorded such a method devised by Mr. Dowsett, reduction officer at the Brakpan mines, South Africa.

With slight modifications, the method of Mr. Dowsett has since been adopted at the Homestake mill for testing barren solution, and we are advised that by its use the mill foremen are able to detect with surprising accuracy variations of 1 cent per ton, in solutions carrying from 1 up to about 15 cents per ton. Seven minutes is sufficient for a test, and the method is extremely useful when conditions of precipitation are unsettled and frequent determinations necessary. No standards are used, the grade of solution being estimated by the depth of color obtained. The color for a 1 or 2-cent solution is very faint, but is readily detected after a little practice. For successful work it is important that the cyanide solution used be of the highest possible strength.

In his original contribution Mr. Brodigan states: "If gold is present to the extent of 0.02 dwt. (2 cents) per ton of the original cyanide solution a very slight coloration will be perceived in the liquid; 0.03 shows a slight yellow; 0.04 slight pinkish-yellow; 0.06 strong pink; 0.08 the purple of Cassius."

Details of the method as employed at the Homestake are as follows:

Reagents required.. Zinc dust, sifted through 200-mesh sieve.

Hydrochloric acid, concentrated C. P.

Nitric acid, C. P., 1 acid; 2 water, in dropping bottle.

Lead nitrate, saturated solution, in dropping bottle.

Sodium cyanide, saturated solution.

Tin chloride, about 12.5 per cent crystals + 10 per cent. concentrated hydrochloric acid.

Place about 500 cc of the sample to be tested in a light-colored sample bottle having a very slight shoulder; a quart beer bottle is about the right size. Add a measured quantity, 10 to 15 cc, of saturated sodium cyanide solution; two or three drops of saturated lead nitrate solution; and from 1 to 2 grams of zinc dust. One gram of the dust usually will be found sufficient. Stopper the bottle with the thumb and shake violently for at least two minutes, or until the precipitate is completely coagulated and will settle rapidly.

Invert the bottle over a casserole and allow the precipitate to settle. Remove the bottle and decant the clear solution from the casserole. Add hydrochloric acid to the precipitate, drop by drop, until the reaction ceases, and then add a few drops in excess. Add three to five drops dilute nitric acid, heat and evaporate to a volume of 1 or 2 cc. Transfer the solution to a small (½-in.) test tube, cool, and add about 1 cc tin chloride. A purple color indicates gold.

With low-grade solutions the tube should be allowed to stand a minute or two to bring out the full color. Faint colors may be seen better by looking down the tube. Some variations in the amount of cyanide, zinc dust or lead nitrate may be necessary with different solutions. The lead should be kept down as far as possible, using the minimum that will give a precipitate that settles rapidly, as this will require a minimum of nitric acid. Too much nitric acid may interfere with the production of the final color. Mercury also gives a dark coloration, and somewhat affects the color given by gold.—Metallurgical and Chemical Engineering.

ELECTRIC POWER FROM ANTHRACITE CULM.

A remarkable plant for generating electricity from unmarketable anthracite culm has been recently installed at Hauto, Pa., by the Lehigh Navigation and Electric Company. Two factors have previously hindered the utilization of this low-grade coal; its cost of transportation is the same as that for the higher grade of anthracite, and the large quantity of coal dust in the refuse renders a special furnace necessary for its proper combustion. The transportation difficulty can be overcome by turning the energy of the coal into electricity and transmitting the power by wire. The type of furnace to be used has received great attention from the designers of the Lehigh company's plant.

Grates for both hand and mechanical firing have been installed and their respective performances will be watched with interest. The combustion chambers are large and the air supply has been so arranged as to ensure a thorough burning of the fuel. The other features of the equipment, both for generating and transmitting the power, are modern and of a high standard. Evidently the men who are behind the project are confident that the proximity of a good market—Philadelphia and New York being within the radius of economical transmission—justifies the building of an expensive and up-to-date station, even though the fuel to be used is of a kind which is ordinarily wasted.

At Bankhead, Alberta, coal of a similar quality occurs. Huge dumps of this unmarketable material are to be seen near the mines, but the market for electricity in the vicinity is, unfortunately, limited. However, a certain amount of this culm is being used for making briquettes, although there is more of it than can at present be profitably utilized even in this way.

CAUSES AND PREVENTION OF TUNNEL ACCIDENTS*

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

Data collected by the U. S. Bureau of Mines show that an average of nearly four men for each 1,000 employed in and about the metal mines of the United States were killed during the year 1911, as compared with 3.8 per 1,000 in coal mining during the same period. Although complete figures for accidents in tunnel driving can not be obtained, a study of such data as could be collected indicates that the number of deaths per year per 1,000 men employed has been somewhat greater than the above figures, the result obtained by averaging data extending over periods of 1 to 10 years for 16 representative tunnels being 4.7 deaths per year per 1,000 men employed. In addition to the men killed outright by accidents in tunnel work, nearly three times as many more have been seriously injured or perhaps maimed for life, and almost thirteen times as many slightly injured. By far the largest part of these deaths and injuries was caused by falling ore or rock from the roof or walls of the tunnels, but explosives, haulage, electricity, and other causes have each contributed their quota of casualties.

Are these accidents preventable? Not entirely, because some elements of danger are inherent in the work of driving tunnels; such, for example, as the danger from some unforeseen falls of roof, from the derailment of tunnel cars, or the risk involved in handling even the least dangerous explosives by the most approved methods. But it is equally true that much of the present mortality and injury is the result of ignorance or gross carelessness, and can be avoided. When, for instance, a man sees fit to thaw frozen dynamite in a frying pan or by a candle flame, there is nothing accidental about the explosion that ensues, except, possibly, the fact that a man so ignorant or reckless should have been intrusted with so dangerous a substance. Nor is the responsibility for accidents all on the part of the miner. The manager and his representatives are in many cases either ignorant of the precautions that should be taken for the safety of the men or most negligent in seeing that they are properly and consistently carried out. The following discussion of causes of tunnel accidents is presented in the hope that, by bringing these matters once more squarely to the attention of the men interested, much of the needless death and suffering may be prevented.

Causes of Accidents.

Falls of Roof.—There are many causes that combine to make falls of rock from the roof by far the greatest source of danger in tunnel work, but perhaps the chief of these is the common practice of greatly overloading the holes with explosives. Extremely heavy charges shatter and crack rock that would ordinarily stand without any danger of falling, and render it extremely dangerous to the men working underneath. Of course it is essential to efficient work in tunnel driving that the blast should completely "break bottom" without any necessity for a second loading and firing; still every foreman and superintendent should see that the smallest amount of dynamite that will do the required work is employed in the holes near the roof. Economy of explosive demands this, all other considerations aside; but the dangers, also, of the heavier charges should be thoroughly appreciated by the superintendent and, when such charges seem imperative, extra vigilance should be exercised and extra precautions taken for the safety of the men.

Another prolific source of accident is the fact that men sometimes return to the tunnel face, after shooting a round, without thoroughly testing the roof just exposed by the blast. It should be the duty of every man employed in the tunnel to examine the roof under which he must work, and especially in that part of the tunnel newly exposed after shooting; the foreman, upon reaching the heading after the blast, should at once detail one or two men (or as many as prove necessary) to clean down thoroughly all the loose pieces of overhead rock. Fortunately, this is done regularly at all well-organized tunnels and it is a practice that can not be too highly recommended for universal adoption.

It must be admitted that from a roof declared by experienced men to be sound, a large block may suddenly and without warning crash into the tunnel. This occurrence will undoubtedly be claimed to have been purely accidental; yet even the danger from such a block (which perhaps was perfectly solid when first exposed, but became loosened by the concussion of subsequent blasting) is, in many cases, overlooked because of the lack of illumination in which all tunnel work must be done, and may be discovered in time if there is a systematic and regular examination of the entire roof of the tunnel. Some one has pointedly observed, "The fall of a slab of rock weighing anything less than one ton should at once be charged to carelessness."

It should be said in this connection that the "sound" of the roof is not a proper criterion of its safety, because there are numerous cases on record where the sound of the roof was satisfactory and indicated rock that seemed solid even to experienced men, although a big block or bowlder was actually loose. The better method of testing the roof—one used by many large mining companies and recommended by the Bureau of Mines—is to strike it with a pick or a heavy stick, at the same time touching the doubtful pieces with the free hand. If any vibration is felt the rock is unsafe and should be taken down or supported at once. If the roof is too high to reach with the hand, a stick should be held against the doubtful piece while it is being struck, and if it is loose the vibration can be felt through the stick.

Prompt and adequate timbering is extremely important. But timbering is a laborious process and it either takes the men of the tunnel crew from their regular work, or it requires extra men. Extra men, however, add to the confusion in the heading and, as their work is done simultaneously with the other work of the tunnel, it seriously hinders either the drillers or the shovelers, or both. So it has become recognized among tunnel men that in most cases timbering seriously impedes the progress of driving, and therefore, although it may be well understood that the roof is dangerous, there is almost always a tendency on the part of those responsible to delay timbering as long as possible. Perhaps the American willingness to "take a chance"—a trait particularly noticeable in the Western States—may be a contributing cause; but the fact remains

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

that the work of timbering is too often delayed until a so-called "accident" brings the necessity forcibly and unavoidably to the front. It is impossible to urge too strongly that all necessary timbering be done promptly, that it can not be done too soon, and that any delay seriously jeopardizes the lives and limbs of the men who have to work under a roof improperly supported.

It is true that in many tunnels the weight of the roof or pressure against the walls has been too great even for the strongest and heaviest timbering, and although such breakage can not always be prevented, it may often be alleviated by means discussed in the section on timbering. The important consideration in these cases as regards safety is the fact that actual failure of the timbers and caving of supported ground rarely comes without warning. Either the timbers will at least be bent appreciably before they break, or, as is usually the case, they will crack and splinter and so give unmistakable warning to the miner that the time is approaching when they will collapse. With such warning any subsequent accident is chargeable to carelessness or negligence in heeding the danger signal. It may be said in this connection that, other things being equal, timber that has a fiber that will split, crack, or splinter out, rather than that which has a fiber that will break off short under a transverse strain, is on this account more desirable for such work.

Falls of rock also caused by cars becoming derailed and knocking out the supporting timbers under a heavy or loose part of the roof, allowing the roof to fall and kill or injure any men who happen to be underneath. Such accidents are in many cases unavoidable because of the difficulty of preventing derailments. Owing to the lack of illumination, it is usually impossible to see whether the track ahead is clear, and it is therefore necessary to run somewhat blindly and assume that nothing has fallen upon the track since the previous trip; and the mere work of keeping the roadbed of a tunnel track in such shape that its unevenness would no longer cause the cars to jump off would be enormous. The only way, therefore, to lessen these accidents (which fortunately are not so numerous as from other causes) is to keep the track in as good condition as possible, and to use all reasonable watchfulness and caution in tramming, and to avoid in particular running trips at a high speed over bad track.

Use of Explosives.

Next in importance as a cause of injury in tunnel work is the careless, reckless, improper, or ignorant use (or rather misuse) of explosives. Such accidents are of various kinds, the most frequent being those arising from handling, storing, and thawing dynamite, from premature blasts, from misfires, or from poisoning by gases from explosives. The subject of the proper ways to handle, store, and thaw dynamite is treated at some length in the chapter on blasting, but as it is impossible to place too much emphasis upon the necessity for care and caution in the use of explosives, a recital here of the precautions to be taken is well warranted.

Precautions as to Handling.

Don't forget the nature of explosives, but remember that with proper care they can be handled with comparative safety.

Don't smoke while handling explosives and don't handle explosives near an open light.

Don't shoot into explosives with a rifle or pistol, either in or out of a magazine.

Don't attempt to manufacture any kind of an explosive except under the supervision and direction of a trustworthy person who is skilled in the art. Many serious accidents, which have destroyed lives or inflicted injury on persons and property, have been caused by such attempts.

Don't carry blasting caps or electric detonators in the clothing.

Don't tap or otherwise investigate a blasting cap or electric detonator.

Don't attempt to take blasting caps from the box by inserting a wire, nail, or other sharp instrument.

Don't try to withdraw the wires from an electric detonator.

Precautions as to Storing.

Don't leave explosives in a wet or damp place. They should be kept in a suitable, dry place, under lock and key, and where children or irresponsible persons can not get at them.

Don't store dynamite so that the cartridges are on end, as this position increases the danger of nitroglycerin leaking.

Don't store or handle explosives near a residence.

Don't open packages of explosives in a magazine.

Don't open dynamite boxes with a nail puller, or powder cans with a pickax.

Don't store or transport detonators and explosives together.

Don't keep electric detonators, blasting machines, or blasting caps in a damp place.

Don't allow priming (the placing of a blasting cap or electric detonator in dynamite) to be done in a thawing house or magazine.

Precautions as to Thawing.

Don't use frozen or chilled explosives. Most dynamite freezes at a temperature between 45 and 50 deg. F.

Don't thaw dynamite on heated stoves, rocks, sand, bricks or metal, or in an oven, and don't thaw dynamite in front of, near, or over a steam boiler or fire of any kind.

Don't take dynamite into or near a blacksmith shop or near a forge.

Don't put dynamite on shelves or anything else directly over steam or hot-water pipes, or other heated metal surface.

Don't cut or break a dynamite cartridge while it is frozen, and don't rub a cartridge of dynamite in the hands to complete thawing.

Don't heat a thawing house with pipes containing steam under pressure.

Don't place a "hot-water thawer" over a fire, and never put dynamite directly into hot water or allow it to come in contact with steam.

Loading Precautions.

Don't allow thawed dynamite to remain exposed to low temperature before using it. If it freezes before it is used, it must be thawed again.

Don't fasten a blasting cap to the fuse with the teeth or flatten the cap with a knife; use a cap crimper. The ordinary cap contains enough fulminate of mercury to blow a man's head or hand to pieces.

Don't "lace" fuse through dynamite cartridges. This practice is frequently responsible for the burning of the charge.

Don't explode a charge to chamber a hole and then immediately reload it, as the bore hole will be hot and the second charge may explode prematurely.

Don't force a primer into a bore hole.

Don't do tamping with iron or steel bars or tools. Use only a wooden tamping stick with no metal parts.

Don't handle fuse carelessly in cold weather, for when it is cold it is stiff and breaks easily.

Don't cut the fuse short to save time. Such economy is dangerous.

Don't worry along with old broken leading wire or connecting wire. A new supply will not cost much and will pay for itself many times over.

Firing Precautions.

Don't explode a charge before every one is well beyond the danger line and protected from flying debris. Protect the supply of explosives from the flying pieces.

Don't hurry in seeking an explanation for the failure of a charge to explode.

Don't drill, bore, or pick out a charge that has failed to explode. Drill and charge another hole at least 2 feet from the missed one.

Premature Explosions.

It is often difficult to determine just what were the causes of premature explosion, because the persons responsible for the explosion rarely survive to tell the tale and even eyewitnesses are scarce; but carelessness in handling the dynamite in the heading is no doubt the most potent factor. In many cases the so-called accident does not result from the first instance of carelessness or recklessness, but is the disastrous climax of a series of practices that have become habitual; hence persons knowing the common disregard for dynamite on the part of the men who handled it and were killed are able to draw accurate conclusions as to the probable cause of the "accident." As an example might be cited the case of two men who were accustomed to throw sticks of dynamite to each other along the tunnel, over distances of 15 or 20 feet, especially if visitors with "nerves" were present. But even at other times, perhaps because of long familiarity with dynamite and hence a contempt or disregard of its true dangerousness, the sticks were thrown to one another rather than carried the few intervening feet. However, the practice as far as these two personally were concerned, was finally stopped by a disastrous explosion in which they were blown almost to atoms. The subsequent appearance of the tunnel indicated that the explosion was caused by the detonation of a stick falling near the full supply for the entire round.

Another cause of premature explosions is the practice of carrying dynamite to the face of the tunnel in a box or sack and dropping it rather roughly to the ground at the end of the journey. This contempt is also bred, no doubt, by familiarity. It is true that often times gelatin dynamite is not as sensitive to direct shocks as one might imagine, and that many times it will stand very rough usage without detonation; but in other cases, and there are very many of them on record, serious explosions have ensued as a result of inexcusable carelessness in handling. It is neither safe nor advisable to rely in any degree whatsoever upon the "inertness" of dynamite. Nor is it possible to condemn too strongly the practice of carrying detonators or primers (sticks of dynamite containing a detonator and a fuse) in the same bundle with the rest of a supply of explosive for a round. The detonators should always be brought in separately and should under no circumstances be placed in the same box or even near together in the heading. Many serious accidents have resulted through disregard of this rule.

A certain risk must always attend the loading of a bore hole with dynamite, especially during the insertion of the primer, but much of the danger that often needlessly accompanies this work can be minimized or avoided by proper care. Efficiency of course demands that there shall be no air spaces in the charge of explosive when it is finally ready for detonation; hence the dynamite must be rammed down so that it fills all the unequal spaces in the bore hole; but tamping should always be done by pressure rather than impact. Never use a tamping bar as if it were a javelin. But even in pressing down the charge, great care must be taken that too much force is not employed, especially if a cartridge seems to stick in a hole; for should it become suddenly loosened the miner might not be able to recover himself in time to prevent its being rammed hard against the bottom with disastrous results. Anything more than light pressure should never be given the primer and under no circumstances should it or the succeeding cartridge be struck a blow with the rod.

Irregularity in the rate at which fuse burns is also a cause of premature explosions. Different makes and brands of fuse burn at different rates, and a miner accustomed to a slow-burning fuse will perhaps not realize the necessity of cutting the faster fuse longer, so that he may have time enough to reach a place of safety before the detonation takes place. There are several causes of variations in the burning rate even of the same brand of fuse. For example, experiments conducted by the Bureau of Mines show that mere confinement in a closed vessel is sufficient to cause a fuse to burn three or four times faster than its normal rate. It is true that under ordinary conditions of mining, variations of this magnitude are not apt to be reached, but irregularities of 20 or even 30 per cent. are quite possible and in long bore holes in which a quantity of tamping is used, especially of a type impervious to the escape of gases (such as closely packed wet clay), the variation may be much greater. Therefore, with such tamping, the rate of burning may be increased to a dangerous extent, unless due allowance be made for the extra speed. But even more important is the effect produced by mechanical injury, which is more apt to be a common occurrence. Mere bending of fuse (if it is in proper condition for use), such as might result from coiling it near the collar of the hole to prevent its being struck by flying rock from other blasts, or even placing it with some force within the hole, has little if any effect upon the rate of burning; but abrasion, blows, or too great pressure produces serious variations in this rate and in some cases may even cause fuse to burn almost instantaneously. It is therefore essential that none but fuse in good condition ever be brought into the heading, and that care be taken while it is there to see that it is not injured by rocks or tools falling on it, and that it is not abstracted or otherwise injured with the tamping bar while the hole is being loaded.

Mention should be made of the seemingly obvious danger of reloading a bore hole before it has had time to cool off sufficiently from a previous blast. In tunnel work this danger occurs in connection with the "guns"—the ends of holes that have not broken to the bottom with the first explosion.

Misfires.

Many deaths and injuries are caused by the subsequent detonation of a charge of dynamite that failed to explode at the proper time. Such misfires do not, however, cause accidents unless the charge is detonated unexpectedly. Sometimes this happens by drilling into it during preparations for the next round, or by striking it in the muck pile, where it has been thrown by the blast from a neighboring hole, or perhaps by the sudden explosion of a delayed shot from a fuse that has long been smouldering.

Many misfires can be traced directly to some injury to the fuse. The insertion of the primer into the hole, fuse end first, often causes fuse to crack at the sharp bend thus made; the danger of such cracking is especially great when the fuse is cold or the hole is full of cold water. Sudden and rough uncoiling of the fuse in cold weather will usually cause it to break. Obviously, therefore, cold fuse should not be bent, twisted, or roughly handled. It is claimed by some persons that misfires are caused through fuse being cut off ahead of the fire by the explosion of a neighboring hole, so that the charge fails to explode. There is some question whether this really happens or not; but, if it does, it is a pretty strong argument that the hole was misplaced, for if a hole is properly placed, only in rare instances, if ever, will enough of it be shot away to cut off the fuse ahead of the fire. It is also claimed, and with somewhat more reason, that the fuse is apt to be torn out by flying pieces of rock from the explosion of other holes, but this result can be largely obviated if the fuse is properly coiled close to the mouth of the hole before it is "spit."

The failure of a fuse properly to ignite a detonator is often the result of improper storage. When the asphalt waterproofing composition used in some fuses gets too hot it becomes viscid and agglomerates the powder grains in the core of the fuse and thus delays, and in some cases actually prevents, the fuse from burning. Experiments conducted by the Bureau of Mines indicate that prolonged exposure at a temperature of 60° C. is sufficient to cause a marked retardation in the rate of burning of fuse. It follows, therefore, that fuse should not be stored near boilers, steam pipes, or other sources of heat, where the temperature is apt to be high. Cold is likewise deleterious, for it renders the asphalt composition brittle and liable to crack, and these cracks either decrease the rate of burning by permitting the gas from the powder core to escape more readily than usual, or, if they are large enough, they may stop the travel of the fire entirely. The fuse should be carefully protected from moisture during storage for, with waterproof fuse of the type almost universally employed in tunneling, if the dampness once gets into the powder train its removal is difficult. As the fuse burns, the moisture is driven ahead of the fire in the form of steam and even if it does not accumulate in sufficient quantity to quench the fire in the fuse, enough of it may be driven into the detonator to prevent ignition and thus cause a misfire.

Many misfires originate from improperly prepared primers. Before the fuse is inserted into the detonator, an inch or two should be cut off and thrown away, for gunpowder (which forms the core of the fuse) is somewhat hygroscopic, and the end of the fuse may have gathered moisture enough to quench the burning powder or prevent the ignition of the cap. This cut should be made with a sharp-cutting tool, squarely across the fuse, for if made diagonally the point may curl over the end of the fuse when inserted in the detonator and thus prevent the spit of the powder train from reaching the detonating composition in the cap. Care should also be taken that the powder grains in the end of the fuse do not leak out after the fuse has been cut, for this would tend to weaken the force of the spit into the detonator and might prevent its ignition. The open end of the cap should be carefully crimped around the fuse with a proper crimping tool, so that it will be tight enough to hold the detonator and the fuse together and keep out moisture, but the crimping should not be tight enough to cut off the powder train in the fuse. This is particularly liable to happen with a narrow crimping tool that presses a narrow groove in the detonator and the underlying fuse. There are tools on the market that have a crimping face of at least a quarter of an inch, and the extra price of these tools would be no more than the cost of the explosive wasted by a single misfire—to say nothing of the loss of life that might arise therefrom. It is, of course, obvious that the teeth or knife should never be used for crimping, for, as previously stated, there is enough explosive in an ordinary detonator to blow a man's head or hand to pieces. After it is crimped, the detonator should be buried in the end of the stick of dynamite, with its axis parallel to that of the stick, and the top of the detonator should be flush with the top of the dynamite. For if the cap is buried deeper, the explosive is liable to become ignited from the side spitting of the fuse before it is properly exploded by the detonator, a result that not only destroys the efficiency of the explosive, but causes a larger amount of gases, especially those most dangerous to the men who must breathe them. It is also important to use a detonator of sufficient strength. Although 3X blasting caps were considered strong enough for "straight" nitroglycerin dynamite, the less sensitive gelatin dynamite requires a much stronger detonator to explode it properly. For this reason nothing weaker than 5X caps should ever be used with gelatin dynamite, and the universal experience is that better results have been obtained when a change has been made to even stronger detonators. These insure the complete detonation of the explosive and thus produce only a minimum amount of dangerous gases.

It is very difficult to count the explosions during blasting and be sure that the charges have all been detonated, so it is not always possible to determine whether there has been a misfire. For this reason the face, or as much of it as is not covered by the debris resulting from the blast, should be inspected for evidences of missed holes, and it should be carefully watched during the removal of the muck. If a missed hole is discovered, under no circumstances should an attempt be made to pick out the material. If no tamping has been used, a stick of dynamite containing a detonator should be inserted in the hole and exploded. If tamping has been employed, another hole should be drilled and blasted at least two feet from the missed one. In picking down the muck pile the pick should be handled as if it were a hoe and not like a sledge hammer; that is, the material should be pulled or scraped down and never struck violently with the point of the pick. In this way, should there happen to be a piece of unexploded dynamite in the debris, there is much less danger of its exploding. The importance of this precaution can not be too strongly

emphasized. Should a piece of dynamite be discovered in the muck, it should be removed carefully and handed to the foreman who should at once take it to a safe place, and extreme care should be used if a piece of fuse accompanies it or is discovered near it, for this would indicate that an unexploded detonator may possibly still be inside of the stick of dynamite, the danger of which is obvious. Under no circumstances should a new hole be started in the remnants of a hole that has ever held dynamite; for although the inference is always, of course, that the dynamite has been detonated, still there remains a chance that detonation has not occurred—a chance not as slight as ordinarily might be supposed, to judge from the number of accidents traceable to this source. And even if a rod be used to test the hole, it might encounter a small obstruction thus seeming to show the bottom of the hole and fail to reveal the dynamite beneath.

Gases From Explosives.

Poisoning from the gases produced by explosives is common in tunnel work. The ailment is familiar to most miners; in its mild form it is usually called "powder headache" and produces little more than temporary inconvenience, but in severe cases it has been known to produce death within a very short time. In the section on blasting it is explained that the harmful gases resulting from the complete detonation of dynamite under normal conditions are usually carbon dioxide and carbon monoxide; that although carbon dioxide will not support respiration, and when present in sufficient quantities may cause unconsciousness and even death, it has no very injurious effects when sufficiently diluted; that carbon monoxide is exceedingly dangerous and even small amounts of it may prove fatal if breathed for a sufficient length of time. This gas probably causes the familiar symptoms after a dose of "powder smoke." By reference to the table on page 153, it will be seen that gelatin dynamite, the explosive almost universally used in tunnel work, under proper conditions generates comparatively little of the more dangerous gas. Experiments conducted by the Bureau of Mines indicate that even this can be obviated by a slight modification in the chemical composition of the gelatin dynamite. But when even such a dynamite is not completely detonated (either through the use of too weak a detonator or any other cause), and especially when it burns rather than explodes, a much greater volume of monoxide is formed, and in addition there are a number of other harmful gases developed, including the dangerous peroxide of nitrogen. It is therefore essential that the detonators employed be strong enough to explode the dynamite completely, and that every precaution be taken to prevent the dynamite from taking fire through the side spitting of the fuse or in any other manner.

The deadliness of the gases resulting from explosives improperly detonated may be illustrated by describing an accident that is known to have cost 9 lives. A study of the attendant circumstances, as described to the writers, indicates that the explosive, or at least a large part of it, must have burned rather than detonated. Gelatin dynamite was employed and the charge was even smaller than previous blasts of which the men had inhaled the fumes without serious effects, but in this case the fumes are described by the men as being brownish yellow rather than the usual grayish or bluish white. After igniting the blast the men retired about 500 feet to wait for the smoke to clear, and while they were waiting the smoke drifted slowly over them and then, owing to some change in the current, drifted slowly back again. The men soon felt the usual symptoms of carbon monoxide poisoning—slight choking, nausea, profuse perspiration, and headache—but they all revived upon reaching the open air about an hour and a half after the blast was fired. Within a short time, however (and in one case before the man could walk to the bunk house), the men began to cough up bloody mucus and to exhibit other symptoms of nitrogen peroxide poisoning, and in less than three days 9 of the 13 men who had been in the tunnel and exposed to the fumes had died. The 4 who escaped were either not exposed to the gas for the full time, or else found some other source of air supply which served partly to dilute the gases; but some of these men as well as those who went in with the motor to bring the men out were ill for days and even months after the catastrophe.

It is the opinion of physicians who have studied the matter that many swift deaths among miners, formerly diagnosed as pneumonia, may really have been caused by the inhalation of gases from burning dynamite.

Gases From Other Sources.

Although any carbon monoxide encountered in tunnel work is liable to be a result of the use of the dynamite, there have been cases where this dangerous gas has been generated by the combustion of oil and grease in the air receiver and transmitted to the heading by the compressed-air pipe. The causes of such combustion are fully discussed in the section on air compressors, but mention is here made that the ignition of accumulated oil and grease is generally due to faulty valves in the compressor. These permit warm compressed air to leak back into the cylinder; this air upon being recompressed becomes still hotter, so that after a time the temperature of the air in the receiver may be far higher than the ignition point of the lubricant employed. If an explosion does not then ensue, the oil on the sides and bottom of the receiver will burn and produce carbon dioxide or carbon monoxide, either of which jeopardizes the safety of the miner in the heading. It is therefore necessary to inspect the valves of the compressor regularly; moreover, dependence should never be placed on the compressed-air line for tunnel ventilation.

There are several tunnels in which bodies of gas have been encountered, the gases most frequently found being carbon dioxide and hydrocarbon gases. The former is, of course, chiefly dangerous because of the possibility of men being suffocated, but this can be largely obviated by proper ventilation. In one of the tunnels of the Los Angeles aqueduct, flows of carbon dioxide were encountered in a series of crevices across a zone about 150 feet wide. In order to make it possible for the men to work in the tunnel this zone including 300 feet on either side, was tightly sealed with concrete; in addition it was found necessary to leave in the center of the gas zone back of the concrete an annular space to which an exhaust "blower" was connected that constantly drew off the gas during the driving of the tunnel, while an additional blower forced fresh air in to the men. If either of these machines stopped the men had to get out of the tunnel as fast as possible, but as long as the machines kept running the air was sufficiently pure.

The chief danger from hydrocarbon gases lies in their explosibility, but they are so commonly encountered in coal mining that precautions to be taken in their presence are fairly well known. However, a rather unique although highly dangerous method of

dealing with them was employed in one of the tunnels examined by the writers, and is well worth describing.

The gas was encountered in a zone approximately 2,300 feet in extent, through about 500 feet of which oil could be distilled from the rocks, although there was no seepage. The gas was highly explosive, and had an odor of kerosene or gasoline rather than of crude petroleum. The largest quantities of it came into the tunnel immediately after blasting, and the maximum accumulation was approximately 30,000 cu. ft. There did not appear to have been any particular seepages in the gaseous zone, but rather there was always an unknown quantity ahead of the work. As the gas was highly explosive extra precautions had to be taken for the safety of the men at work. The mere requirement of safety lamps in the tunnel was not considered sufficient, because the very nature of the rock was such as to cause dangerous sparks from a pick or from the starting of a drill hole, which it was thought would be sufficient to ignite the gas and produce an explosion. The expedient adopted was to explode the accumulation after each blast and to burn any new gas as fast as it appeared in the tunnel during the remainder of the work.

For this purpose the tunnel was wired from the portal to the heading with a 550-volt circuit, into which there were introduced at intervals of about 200 ft. throughout the entire gas-bearing section a number of arcing devices. Any ordinary street arc lamp could have been adapted for this work, provided that the carbons were not exposed for more than 2 in.; otherwise the concussion from ordinary blasting, as well as from the gas explosions, would have broken them. The use of one soft and one hard carbon was found to give the best results. The system was operated as follows:

Immediately after blasting, a fire boss and his helper took charge of the tunnel. After waiting 30 minutes after the blast had been fired they turned a current of electricity through the arc line by means of a switch at the portal. The arcs were purposely placed in series in order to make certain that if any one of them burned they would all burn; an ammeter was placed at the control switch to show whether they had lighted. If the arcs did light, an explosion generally ensued, sometimes a severe one. But whether or not there was an explosion the switch was always opened for 15 minutes and then closed a second time as an added precaution, although a second explosion never resulted. When the line was dead once more two men carrying safety lamps proceeded to a protected station approximately halfway to the heading, where they again sent a current through the arcs. A few explosions resulted from this practice, but they were unusual rather than customary. After having made this test the fire boss and his helper proceeded to the heading, testing the entire tunnel for gas by means of the safety lamps they carried. They would ordinarily find in the heading an accumulation of gas extending back a distance of 125 to 150 feet, because the nearest arc could not be placed much nearer to the heading than 150 feet on account of the danger of the carbons being broken by the concussion from the blasting. The fire boss would then take an arc kept 150 feet from the face and attached to the circuit by an armored cable and place it over the muck pile; the two men would return again to the midway station and once more close the circuit and ignite the remaining gas. Then, and then only, with all the arcs burning, they would return to the heading and place torches as near the roof as possible at intervals of about 150 feet throughout the gaseous section. The torches were lighted from the arcs, and the men were not permitted to light them in any other way, or, indeed, to carry into the tunnel any other means of lighting them. By this time all the seepages that were strong enough to support a steady flame would have been lighted and would be burning, and the gas that came from pockets that could not sustain a flame would be ignited by the torches before it could accumulate in any quantity.

The fire crew then returned to the mid-station, where they extinguished a red light and lighted a white one, indicating that the tunnel was safe for the incoming crew, for no one but these two men were allowed in the tunnel beyond this point unless the red light was out and a particular white one burning, in order to obviate danger through any accidental extinguishing of the red light without the knowledge of the fire crew and before the tunnel was safe. The fire crew was allowed four hours for this work, although ordinarily that length of time was not required.

The working crew upon reaching the heading ordinarily found the muck pile too hot to be handled, if, indeed, it was not actually in flames, for it burned usually for one-half to two hours after each blast, and once at least it burned for 14 hours. After it had been cooled sufficiently by streams of both air and water, the machines were set up and the round of holes drilled in the regular manner. Any gas that developed during the drilling of a hole was lighted as soon as the hole had been completed, and if sufficiently strong to support a flame it would burn until the end of the shift. At one time as many as 6 out of 8 holes on the top round were burning like blow-torches, giving flames 6 to 18 inches in length. When the round had been finished the holes had to be cooled before loading. This was accomplished by turning water and air lines through ordinary blowpipes, both into the holes and over the face of the tunnel. The flames were, of course, extinguished by this process, and as soon as the gas had accumulated in the tunnel sufficiently to become apparent in a safety lamp placed near the roof about 30 feet from the heading, it was ignited by a torch and the resulting flames were at once put out again by air and water. This process was continued until the holes were cool, when they were at once loaded as rapidly as possible and fired, the fuses being always lighted from near the bottom of the tunnel.

Although the fact that there were no accidents in driving through the gas-bearing zone after the installation of the "safety arcs" shows that this system was efficacious in this particular instance, it is not one that can be recommended unqualifiedly for general use. In the opinion of engineers who have made a special study of the question of safety in mining, the use of anything but safety lamps or their equivalent in mines or tunnels where explosive gases are known to exist is never without risk, whereas the practice of burning the gases as fast as they make their appearance is in itself extremely hazardous. Indeed, the fact that no disastrous explosion occurred under this system seemed to them remarkable. Moreover, it is obvious that long delays were necessary before the men could start to work, and even after they had reached the heading the heat must have greatly decreased their possible efficiency. A less dangerous method of handling the gas, and one that would probably prove more economical in the end, would be the installation of a ventilating system large enough to dilute to harmlessness several times the amount of gases ordinarily encountered. Safety lamps only should be allowed in the tunnel and all blasts should be fired by electricity.

(To be continued)

ANNUAL REPORT OF THE MINISTER OF MINES FOR BRITISH COLUMBIA

The Annual Report of the Minister of Mines for British Columbia for the year 1913 has just been issued by the Department of Mines, Victoria, B.C. It has been prepared by the Provincial Mineralogist, Mr. Wm. Fleet Robertson, and is of greater bulk, by nearly 100 pages, than was the report for 1912. It includes reports by the Provincial Mineralogist, his assistant, Mr. J. D. Galloway, and Messrs. W. M. Brewer and D. G. Forbes, who were engaged to examine and report on several mining districts in the province. In addition, information is quoted from reports of Messrs. C. H. Clapp and R. G. McConnell, of the Geological Survey of Canada. Much information also is contained in the official reports of the Chief Inspector of Mines, district gold commissioners, mining recorders, district mine inspectors, and others. The report is freely illustrated with numerous excellent half-tone reproductions of photographs, and with maps, diagrams, sketches, etc. A full index adds to the usefulness of the publication. The printing was done in the Provincial Government printing office, Victoria, and the work in both text and illustrations is creditable to printers and pressmen alike.

Mineral Production.

The gross value of the mineral production for 1913 was $30,296,398, as compared with $32,449,800 for 1912. There was, therefore, a decrease in value of $2,144,402 or about 6.6 per cent. Leaving out 1912, however, no other year's production reached so high a total value, the nearest having been $26,377,066 in 1910. The smaller output of coal, due to labor troubles at Vancouver Island collieries, and that of copper, were the chief causes of the decrease; as compared with 1912, the decrease in value of coal and coke produced was $1,589,352, and in copper $1,314,024. Then there was less placer gold by $45,500 recovered last year than in 1912.

The following comparative table gives the particulars—quantities and value—for the two years, 1912 and 1913, respectively:

	1912		1913	
	Quantity.	Value.	Quantity.	Value.
Gold, placer, oz.	.....	$555,500	272,254	$510,000
Gold, lode, oz.	257,496	5,322,442		5,627,490
Total gold		$5,877,942		$6,137,490
Silver, oz.	3,132,108	1,810,045	3,465,856	1,968,606
Lead, lb.	44,871,454	1,805,627	55,364,677	2,175,832
Copper, lb.	51,456,537	8,408,513	46,460,305	7,094,489
Zinc, lb.	5,358,280	316,139	6,758,768	324,421
Total metalliferous		$18,218,266		$17,700,838
Coal, tons*	2,628,804	9,200,814	2,137,483	7,481,190
Coke, tons*	264,333	1,585,998	286,045	1,716,270
Building materials, etc.		3,435,722		3,398,100
Total value of production		$32,440,800		$30,296,398

*2,240 lb.

It may be noted that the production of lode gold was the highest in the history of mining in the province, the largest output in previous years having been 267,701 oz., in 1910. Of the miscellaneous products, cement was highest, with a value of $1,290,500.

The total value of the mineral production for all years to the end of 1913 is $460,433,920, in the following proportions:

Gold, placer	$ 72,704,603
Gold, lode	76,486,512
Total gold	$149,191,115
Silver	35,832,546
Lead	29,696,585
Copper	80,818,051
Iron, zinc, platinum, etc.	1,852,824
Total metalliferous	$297,391,121
Coal and coke	$142,068,615
Building materials, etc.	20,974,184
Total non-metalliferous	$163,042,799
Total value of production	$460,433,920

Production by Divisions and Districts.

Cariboo—Cariboo mining division	$131,000	
Quesnel mining division	55,000	
Omineca mining division	40,024	
		$ 226,024
Cassiar		412,748
East Kootenay		5,947,935
West Kootenay—		
Ainsworth mining division	627,150	
Slocan and Slocan City div.	2,258,300	
Nelson mining division	863,966	
Trail Creek (Rossland) div.	3,306,771	
Other divisions	36,911	
		7,092,107
Boundary—		
Osoyoos, Grand Forks, Greenwood	6,833,902	
Similkameen, Nicola, Vernon	1,019,340	
Yale, Ashcroft, Kamloops	72,094	
		7,925,336
Lillooet		71,445
Coast—Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver		8,620,803
Total		$30,296,398

An analysis of the production of the several districts shows the proportions of the several classes of minerals to be as under:—

	Metalliferous.	Non-metalliferous	Coal and Coke.
Cariboo	$ 201,024	$ 25,000	
Cassiar	259,748	53,000	
East Kootenay	1,036,597	50,500	$4,860,838
West Kootenay	7,012,407	79,700	
Boundary	6,700,439	295,500	929,397
Lillooet	31,445	40,000	
Coast	2,359,178	2,854,400	3,407,225
Totals	$17,700,838	$3,398,100	$9,197,460

In Cariboo and Quesnel divisions of Cariboo district production was chiefly of placer gold, these divisions having contributed $161,000 of that metal. From Omineca division there was silver, lead, and placer gold, in that order, with relatively small amounts for lode gold and copper. Cassiar district produced $328,000 in placer gold of which $315,000 was from Atlin

division. Of the remaining production $53,000 was for structural materials. East Kootenay produced more coal and coke than any other district in the province—to a value of $4,860,838. The gross production of coal was 1,331,725 long tons, of which 433,277 tons was made into 286,045 tons of coke. There was an increase, as compared with 1912, of 70,513 tons in the gross output of coal. Of the metalliferous minerals produced, the greater part was of lead-silver ore from the Sullivan Group mines, near Marysville.

As may be seen, West Kootenay district produced more than $7,000,000 in metals. In Ainsworth division, production was mainly of lead and silver. The chief products of Slocan district mines were silver $1,045,816, lead $890,096, and zinc $317,188. Nelson division produced lode gold $544,117, silver $73,278, lead $76,101, and copper $124,470. From Rossland mines, in Trail Creek division, came lode gold $2,831,873, silver $62,244, and copper $387,654. Practically all of the production from "other divisions" was from the Lardeau district, where silver-lead ore was the chief product.

Of the comparatively large total shown as the production of Boundary district—second only to the Coast district—nearly all of the $6,700,439 for metals came from the big copper mines of the Granby Consolidated and B. C. Copper Co., in the neighborhood of Phoenix and Greenwood, and the Hedley Co's gold mine in the Similkameen country. The several proportions were copper $4,376,313, gold $2,098,238, silver $224,081, and lead $1,807; total $6,700,439. The production of structural materials was fairly well distributed over this big district. Mines in Nicola valley produced most of the coal credited Boundary district in the foregoing table. Lillooet's metalliferous production was largely in lode gold.

In the Coast district, the large amount shown as the value of coal produced was contributed by Vancouver Island coal mines. Other non-metalliferous products were cement $1,280,000, clay products $636,900, building and other stone $612,500, sand and gravel $325,000. The value of the several metals produced was as follows: Copper $2,205,567, gold $95,255, and silver $58,356.

As the Britannia mine in Vancouver mining division was by far the largest producer of ore containing copper and silver, it follows that a large proportion of these metals was from that mine. Texada Island mines came next, with gold, silver, and copper as their production.

As compared with 1912, both East and West Kootenay districts made an increase in total value of output of minerals, the former of $224,931, and the latter of $926,852. Ainsworth, Slocan, Nelson, and Rossland, all shared in the advance in West Kootenay. In Lillooet district, too, there was an increase of $66,445. On the other hand, there were decreases in all other districts, to the extent of $2,474,753 in Coast district, and $791,070 in the Boundary, with a smaller falling off in value of production in Cariboo and Cassiar districts. However, the unfavorable conditions are believed to have been temporary, an improvement in 1914 being expected.

General Notes.

The total quantity of ore mined in the Province in 1913 was 2,663,809 tons, as against 2,688,532 tons in 1912—a decrease of 24,723 tons. There were 110 mines that shipped ore, and of these 58 each shipped more than 100 tons. Of 95 non-shipping mines only 28 were worked. The corresponding figures for 1912 were 86 shipping mines of which 51 shipped more than 100 tons each, and 96 non-shipping mines, of which 45 were worked.

The number of men employed in the metalliferous mines was 4,278, of whom 2,773 worked below and 1,505 above ground. The figures for 1912 were: Worked below ground 2,473, above 1,364, total 3,837. There were 441 more men at work in these mines last year than in 1912.

At the coal mines, there were 6,671 hands employed (including 124 boys), as compared with 7,130 (221 boys) in 1912. Of these there were, in 1913, 5,828 whites, 837 Orientals, and 6 Indians; the proportion employed underground was 4,950, (of whom 409 were Orientals), and above ground 1,721. In 1912, of 5,275 employed underground, 323 were Orientals, while of 1,855 at work above ground 416 were Orientals. The gross production of coal in 1913, with 6,671 hands employed, was 2,570,760 long tons, as compared with 3,025,709 tons in 1912, with 7,130 employed.

The percentage of the several districts in regard to production of the 2,663,809 tons of ore mined in the Province in 1913 was as follows: Boundary, 69.30 per cent.; Rossland, 9.52 per cent.; Coast, 8.67 per cent.; Slocan, 4.35 per cent.; Ainsworth, 3.46 per cent.; Nelson, 2.99 per cent.; East Kootenay, 1.60 per cent.; all other parts, 0.11 per cent.

Approximately 73 per cent. of the lode gold produced in 1913 was obtained from smelting ores also copper-bearing; the remainder by stamp-milling. Silver came chiefly from Slocan district—about 67 per cent. of the whole—and about 10.5 per cent. from East Kootenay, all from argentiferous galena. Lead, like silver, came chiefly from Slocan-Ainsworth district—57.26 per cent. of the whole—and East Kootenay 37.94 per cent. Copper was obtained from Boundary mines 61.60 per cent., Coast mines 31.10 per cent., Rossland mines 5.46 per cent., and Nelson 1.76 per cent. The average assay returns in copper from ores of the several chief copper-producing districts are: Boundary 0.777 per cent., Coast 3.123 per cent., and Rossland 0.5 per cent. The whole of the zinc produced came from mines in Slocan-Ainsworth divisions.

Miscellaneous Minerals.

Concerning minerals other than those included in the tables of production, the Provincial Mineralogist remarks:

"**Iron Ore**—The situation in regard to iron ore remains unchanged, no material advancement having been made in the utilization of the numerous deposits throughout the Province. At present there is no market in British Columbia for iron ore, and, as a consequence, very little development work has been done. There are, undoubtedly, a number of iron ore deposits in different districts which are of considerable size, and which, as a rule, are very free from injurious elements. In considering the possibility of the successful establishment of an iron and steel industry, other factors beside availability of ore are important, namely, a sufficient market for the products, a supply of fuel nearby at a price comparable with what it is in the East, and a steady supply of suitable labor. So far as is at present known on the Coast, there is no developed body of hematite or other ore of iron, such as would be desirable to mix with the magnetites for blast-furnace smelting. In the Coast district the iron ores are all magnetites, as far as have been developed in any quantity, and, although these

sometimes contain sulphur, as pyrite, they are singularly free from other impurities. As to the electrothermic smelting of such iron ores into commercial pig iron, the process has not as yet been sufficiently perfected, although it is looked upon as one of the possibilities of the future. Considerable interest has been manifested during the past year in regard to iron deposits generally, and there have been many rumors of intended installations of iron-smelting plants, but nothing at all definite has yet become public.

"**Platinum**—No production of platinum in 1913 has been reported, and it is not likely the Tulameen district output was more than a few ounces. The Mines Branch of the Dominion Department of Mines, Ottawa, in October last, had one of its officers, Dr. Wilson, sample the dikes in the vicinity of Nelson, which it had been claimed contained platinum. He took some seventeen samples, and Dr. Haanel, the Director, now writes that, upon assay, none of the samples were found to contain any platinum or metals of the platinum group.

"**Diamonds**—Nothing has been heard concerning diamonds in the Tulameen country, the earlier discovery by a geologist of the Geological Survey still remaining of purely scientific interest. Prospectors have been examining the gravels in the district for the precious stones, but, so far, have not found any of commercial value.

"**Oil**—Drilling for oil was continued in the Fraser valley, and also in the neighborhood of Otard Bay, Graham island, but although the results are said to be encouraging, no appreciable flowage of oil has yet been reported. The British Columbia Oil and Coal Development Co. has put down three or four bores on Sage creek, in the Flathead country, Southeast Kootenay, and it is reported that in the last two holes, sufficient oil was encountered to induce the company to proceed at once to bore a big deep well.

"**Mica**—A small amount of development work was carried out on the mica claims in the vicinity of Tete Jaune Cache, but no output has yet been recorded. Now that the Grand Trunk Pacific Railway has been built to within a few miles of these claims, it is pretty well assured that they will be seriously investigated during the coming season."

The report may be obtained gratis on application to the Minister of Mines, Victoria, B.C.

SUPERVISION OF COAL MINING.

In Western Canada there are usually a number of coal seams quite close together, and, should the lower seams be the more desirable with regard to quality and ease of working, there is nothing to prevent the operator from mining them first. In fact, this practice is now being followed in a number of cases in the west. As a result, caving of the measures will render it difficult, and, in many cases, impossible, to recover the coal from the upper seams. Owing to the wide distribution of coal, and the granting of leases to any one desiring to mine it, the operator who looks to the future and mines the coal in a systematic manner, at an additional cost to himself, has to compete with the operator who takes the easiest available coal. There is, therefore, little encouragement to use other than wasteful methods. A case came under notice where, owing to a great demand for coal, the directors instructed a mine-manager to produce an output greater than the development work justified. The mine manager was forced, against his better judgment, to obtain the coal wherever he could. Some pillars were extracted and others were reduced to such dimensions that they were not able to bear the weight of the superincumbent strata. As a consequence, there was a squeeze; and to-day the mine is badly wrecked and much coal has been lost. In this case, the opinion of an engineering authority would have stood between the mine-manager and the directors of the company.

It is suggested that an engineering authority be appointed by the Dominion Government to approve of the methods to be employed at all mines operated under a Dominion Government lease, and that the chief inspector of mines of each province be associated with the engineering authority in so far as matters relating to the operation of mines in that province are concerned. It would also be the duty of such authority to investigate all applications for leasing of coal lands and to determine the conditions under which such leases should be granted.

It is of interest to note, in this connection, that the Dominion Government exercises a stricter supervision over the leasing of water powers than that suggested with regard to coal; yet coal is just as important as water power, and, unlike it, can be exhausted.—From "Conservation of Coal in Canada," by W. J. Dick.

SAFETY AND EFFICIENCY IN MINE TUNNELLING.

A very interesing bulletin on this subject, prepared by David W. Brunton and John A. Davis, has been published by the United States Bureau of Mines.

The purpose of the report, as stated by the authors, is to present the results and conclusions obtained from investigations carried on during recent years by the U. S. Bureau of Mines, which undertook to make a special examination of safety in mining operations in connection with an investigation of mining methods and means for preventing accidents.

Emphasis is placed on safe, efficient, and economic methods and good points of equipment, whereas bad practice and obsolete machinery are ignored except when referred to as inadvisable, or as having some bearing historically. The aim has been to set for them a guide for future work rather than a mere record of present practice.

TAR FORMING TEMPERATURES OF AMERICAN COALS.

The nature of the volatile matter in bituminous coal is attracting considerable attention at the present time. This is due not only to the enormous amount of coal annually used, but also to the important part volatile matter plays in determining how the coal must be handled in order to obtain the best results.

One of the most important and troublesome constituents of the volatile matter is tar, especially when the coal must be used in boiler furnaces or in power-gas producers.

Investigations discussed by O. C. Derby in a bulletin published by the University of Wisconsin, had in view: (1) the determination of the temperature limits between which tars are distilled from the various classes of coal; (2) the temperature limits of the maximum rate of evolution of tars; and (3) the relative quantities of tars distilled from various general classes of coal.

Briefly stated, the results show that with any coal, tars commence to distil at about 300 deg. C. and are completely distilled at 550 deg. to 600 deg. C. The greatest evolution of tar vapors occurs (on the average) between 375 deg. and 475 deg. C. The amount of tar produced depends not on the relative amount of volatile matter in the coal but upon the ratio of carbon to the hydrogen as shown by an ultimate analysis.

OIL PUMPING IN CALIFORNIA.

According to Ralph Arnold and V. R. Garfias in a bulletin published by the U. S. Bureau of Mines, the majority of oil operators believe that the best means of increasing net production is to add to the number of producing wells, and although in many cases this plan may be advisable, in others it leads only to greater expenditure without proportionate return. The financial success of an oil enterprise frequently depends on the factors controlling the ratio between gross production and recoverable oil; that is, on the efficiency attained in the recovery of the oil from the underground reservoir. Efficiency of recovery will assume greater importance as the production of the fields decreases and as uses for crude petroleum are developed.

The pumping of oil under the conditions prevailing in California presents difficulties seldom encountered in mechanical problems of like nature. The character and extent of the difficulties will be evident in some measure if one realizes that a fluid having the consistency of molasses and carrying a large quantity of sand has at many wells to be lifted through a column of tubing 2 or 3 inches in diameter and half or three-quarters of a mile in depth.

The recovery of oil from shallow wells naturally may be effected by apparatus relatively cheaper and simpler than that required for deep wells, and in order to obtain uniformly successful results from different properties it is necessary that the extra cost of operating in deep territory be compensated by a correspondingly greater yield or better quality of oil.

In some of the fields of California wells 200 to 1,000 feet deep, producing about 5 barrels a day, can be operated at a profit if the selling price is as low as 30 cents a barrel, whereas in others, where the oil has to be lifted 3,000 to 4,000 feet, it is not economical to pump the wells unless the yield equals or exceeds 100 barrels a day, or unless the wells contain sufficient gas to assist materially the action of the pump. Some properties in the Santa Clara Valley district afford a striking example of high efficiency. The wells are drilled in 10 to 15 days, tapping the oil sand at about 700 feet; these are pumped in groups of about 20 by means of a pumping "power" operated by a gas engine using natural gas from the wells. The oil produced, owing to its quality, is sold at a price about three times that commanded by the heavy grades in California. The other extreme is well exemplified in the San Joaquin Valley fields, where small quantities of oil are being recovered after more than a year has been consumed in drilling to a depth of over 4,000 feet. Between these extremes the range in types of producing oil properties is great, and the line separating profitable from unprofitable investments fluctuates under the influence of the various factors affecting the industry.

One might conclude from the foregoing discussion that the only oil properties worth developing at the present time are those in which oil is encountered in commercial quantities at comparatively shallow depths but such an assumption is incorrect, as in many instances the increased cost of deep operations is more than compensated by greater thickness of the oil-sand strata, better quality of oil, stronger gas pressure, and the resultant large production and longer life of the wells. In the Coalinga field several wells over 4,000 feet deep, producing oil rated at 0.9210 to 0.8805 specific gravity (22 to 29 deg. B.), are being pumped at a good profit.

FATAL ACCIDENTS IN BRITISH COLUMBIA MINES.

The statement of the coal and metal mine fatalities in British Columbia during the second quarter of the current calendar year has been issued by the Provincial Department of Mines. It has been compiled by the Chief Inspector of Mines, Mr. Thomas Graham. The following is a summary of this return:

Coal Mine Fatalities.

There was only one man killed in and about the coal mines of the Province during the second quarter of 1914, as against 12 during the corresponding period of 1913. The figures for the expired six months of this year are: Killed during January-June, 1914, 8; during the same months of 1913, 19, as under:

	1914.	1913.
January	1	2
February	4	1
March	2	4
April	1	9
May	0	2
June	0	1
Totals	8	19

The collieries at which the fatalities occurred in 1914 were: At Hosmer colliery, Crow's Nest Pass, 3; at Crow's Nest Pass Coal Co.'s colliery, Michel, 1; at Canadian Collieries, Ltd.'s colliery, Cumberland, V.I., 3; at Western Fuel Co.'s colliery, Nanaimo, V.I., 1.

Six of the fatalities are placed under the heading, "Killed Underground," one under "Killed in Shaft," and one under "Killed on Surface." The causes of death underground were: By falls of roof and rock, 2; falls of coal, 1; mine-cars and haulage, 1; suffocation in fine coal, 2. That in the shaft was "by cage." That on the surface was "by coke-oven larry."

Metal Mine Fatalities.

There were nine men killed in and about the metal mines of the Province during the second quarter of this year as compared with four in the corresponding period of 1913. For the six months of the two years the numbers are 14 for this year, as against 7 for last year, as under:

	1914.	1913.
January	1	1
February	0	0
March	4	2
April	1	0
May	3	1
June	5	3
Totals	14	7

The mines at which the fatalities occurred were: Rambler-Cariboo, Slocan, 1; Centre Star, Rossland, 1; War Eagle, Rossland, 1; Granby mines, Phoenix, 2; Rawhide, Phoenix, 2; Jewel, Greenwood, 2; Hedley, Similkameen, 1; Britannia, Vancouver, 1; Granby, Anyox, 3; total, 14.

The causes of death were: Drilling into unexploded powder, 1; premature blasts, 4; from powder fumes, 3; falling down winze, 1; falls of ground, 3; by mine car, 1; returning on unexploded shot, 1; total, 14.

VIPOND.

The foundations for the cyanide plant at the Vipond mill have been completed and there should be no great delay in erecting the machinery and tanks when they arrive.

PERSONAL AND GENERAL

Mr. A. E. Blair is now general manager of the ranches, mines and other properties of Francisco Madero (Sr.) in Mexico.

Mr. J. Swent, formerly of the Buffalo mine, is now in California.

Mr. J. Siefert, formerly at Copper Cliff, is now on the staff of the Mond Nickel Co.

Mr. R. E. Hore has returned to Toronto from Calgary.

Mr. A. J. Young was in Calgary for two weeks in July.

Mr. J. C. Murray is in Calgary.

Mr. Geo. B. Burchell spent three weeks last month in Nova Scotia examining some coal properties for Montreal parties.

Mr. A. H. Bromley, who some years ago was engaged in mining in Atlin camp, B.C., and afterward in Mexico, has returned to British Columbia and is now in charge of development work on the Silver Creek group on Hudson Bay mountain, Omineca division.

Mr. Walter Campbell, formerly outside superintendent for the Crow's Nest Pass Coal Co. at its Coal Creek colliery, near Fernie, B.C., is now with the Brazeau Collieries, Ltd., at Nordegg, Alberta.

Mr. James Cronin, of Spokane, Washington, for a number of years manager of the St. Eugene lead mine in East Kootenay, B.C., has recovered from his recent illness and gone to Babine mountains, Omineca division, where he has mining property in course of development.

Mr. Clarence Cunningham, who used to have his headquarters in Seattle, Washington, at the end of June went from Spokane to Sandon, Slocan district of British Columbia, to investigate progress at the Wonderful mine, in which he is interested.

Mr. W. D. Dalglish, in charge of the Mineral Section of the Canadian Government Exhibition Commission, is in British Columbia, with Mr. Wm. Thomlinson, mineral collector for the Commission, getting together a thoroughly representative collection of the minerals of the Province for display at the Panama-Pacific Exposition in San Francisco, California, next year.

Mr. W. B. DeWitt, for several years in charge of gold-milling operations at the Queen 20-stamp mill on Sheep creek, Nelson mining division, British Columbia, with several associates has leased the Porto Rico mine and small mill, near Ymir, in the same mining division.

Mr. R. G. Drinnan, who was for years superintendent of coal mines of the Crow's Nest Pass Coal Co., in British Columbia, and afterward of the Hosmer colliery, in the same district, has been giving expert evidence at an official investigation following the recent calamitous explosion at the Hillcrest colliery, in Blairmore-Frank district, southwest Alberta. Mr. Norman Fraser, formerly Provincial Inspector of Mines for Alberta, was also similarly engaged to make an examination of the mine and express his opinion as to the cause of the disaster.

Dr. C. W. Drysdale, of the Geological Survey of Canada, is now at Rossland, B.C., obtaining additional data for the completion of his report on that camp, in connection with which he spent half of last year investigating the geology and mineral deposits of the locality, following several seasons' field work previously done by Dr. R. W. Brock, now Deputy Minister of Mines for Canada.

Mr. Samuel S. Fowler, general manager for the New Canadian Metal Co., owning the Bluebell lead mine and concentrating mill near the east shore of Kootenay lake, British Columbia, has returned to Riondel from a business visit to San Francisco, California.

Mr. J. D. Galloway, assistant Provincial Mineralogist for British Columbia, is spending the summer investigating mining conditions and properties in the country traversed by the Grand Trunk Pacific Railway between New Hazelton, in Skeena district, and the eastern boundary of the Province.

Mr. C. P. Hill, of Montreal, director in the Hillcrest Colliery Co., Alberta, and the Pacific Coast Coal Mines, Ltd., Vancouver Island, B.C., is paying a visit to the latter Province.

Mr. Lionel E. Hill, assistant to the manager of the Le Roi No. 2 Co.'s Josie group of mines at Rossland, B. C., has gone on a round trip to Japan, expecting to return to British Columbia a few weeks hence.

Mr. A. W. B. Hodges, of Los Angeles, California, late general manager for the Cerro de Pasco Mining Co., at Lima, Peru, was in Vancouver, B.C., recently, on his way to visit the Granby Consolidated Co.'s Hidden Creek mines and smelting works near Granby bay, Observatory Inlet.

Mr. Joseph S. C. Hudson, of the Explosives Section of the Canada Department of Mines, has been at Hillcrest, Alberta, making an investigation there following the recent explosion in a coal mine there.

Mr. R. G. McConnell, of the Geological Survey of Canada, is engaged in geological work on Hudson Bay mountain, in Omineca mining division of British Columbia.

Mr. H. J. Pollard, late consulting engineer for the Pollard Florence Mining Co., Goldfield, Nevada, U.S.A., is now with the Broken Hill Mining and Milling Co., which is developing a silver-gold-copper property on Bridge river, Lillooet district, B.C.

Mr. Robert C. Sticht, who prior to his leaving the United States for Tasmania was superintendent of the A. S. & R. Co.'s smelting works at Great Falls, Montana, and has since been general manager for the Mount Lyell Mining and Railway Co., Ltd., is now president of the Mount Lyell School of Mines, which is affiliated with the University of Tasmania and is established at Queenstown, near the Mount Lyell copper mines and smelting works, on the west coast of Tasmania.

Mr. Norman Stockett a few weeks ago left the mines of the Consolidated Mining and Smelting Co., at Rossland, B.C., to take the position of mining engineer for the Paragon Consolidated Mining Co., operating in the Coeur d'Alene district, Idaho, U.S.A.

Mr. Arthur L. Walker, professor of metallurgy at the School of Mines, Columbia University, New York, left Vancouver, B.C., on July 9 by the "Empress of Asia" on a vacation visit to the Orient. After touring parts of China and Japan, he will return to New York via the Suez canal and Europe.

Mr. Louis A. Wright, of New York City, was at Rossland, B.C., in the early part of July.

The Roberts & Schaefer Co., engineers and contractors, Chicago, have just been awarded a contract by the Elkins Coal & Coke Co., for a large Marcus patent fireproof coal tipple for installation at Masontown, W. Va. Approximate contract price, $24,500.

The efficiency of asbestos roofing as a fire stop is illustrated by the fact that, in the Salem fire, sparks

and burning embers were literally showered upon the roof of the Naumkeag Steam Cotton Co.'s storehouse, yet this building was absolutely unharmed because protected by J.M. Asbestos Roofing, while other buildings all around it were burned to the ground.

Roberts & Schaefer Co. has been awarded by the Clinchfield Coal Corporation a contract for the building of a large Marcus patent coal tipple for installation at their mine at Dante, Va. Contract price approximately $55,000.

The Westinghouse Electric & Mfg. Co. East Pittsburg, Pa., announces that it has supplied the following apparatus to metal mines during May, 1914:

August Mining Co., Landusky, Mont. Three 75-kw., 11,000 volt, type SK transformers; one electrolytic lightning arrester; one complete switchboard equipment; one 125 h.p. belted motor for tube mill drive; one 35 h.p. motor for driving rolls; one 25 h.p. motor for driving crusher; one 15 h.p. motor for driving belt conveyor; one 10 h.p. motor for driving air compressor for agitator; two 7½ h.p. motors for driving triplex plunger pumps; one 3 h.p. motor for driving placer firer; four 7½ h.p. slow speed motors for driving slime pumps; complete line material for 23,000 volt high tension line; two 4 kw. type S lighting transformers.

Anaconda Copper Mining Co., Boston and Montana Reduction Dept., Great Falls, Mont. Four 30 h.p. motors with P.B. brakes. These motors are to control 8 ft. gate valves in the air line supplying blast to the copper furnaces.

Anaconda Copper Mining Co., Butte, Mont. Three 3½ ton, 18 in. gauge, 250 volt bar steel locomotive with 901-B equipment. The above are to be exact duplicates of locomotives previously furnished this customer, making approximately the fifth repeat order for this class of machine.

International Smelting & Refining Co., Miami, Ariz. Seven 50 h.p. back geared A.C. mill motors with magnetic brakes for operating 12 ft. Great Falls type converters; two 150 h.p. motors for belt driving rolls and crushers; two 35 h.p. back geared D.C. mill motors for matte casting machines; ten D. C. mill motors with brakes and magnetic control. All of the above apparatus for a new copper smelter.

Anaconda Copper Mining Co., Butte, Mont. Four 7½ h.p. motors for fans; one 35 h.p. motor with double extended shaft for pump; three 5 h.p. motors; one 10 h.p. motor; one 50 h.p. motor; one 100 h.p. motor. The above for use in a new leaching plant being built at the Washoe smelter.

International Smelting & Refining Co., Tocale, Utah. Two 10 h.p. motors; two 3 h.p. adjustable speed, totally enclosed, back geared commutating pole D. C. motors with drum controllers; two 5 h.p. motors; one 75 h.p. motor. The above for a sintering plant in an old smelter.

International Smelting & Refining Co., Tooele, Utah. One motor generator set, switchboard and regulating devices for Cottrell fume deposition process.

Ray Consolidated Copper Co., Hayden, Ariz. Sixteen 10 h.p. special vertical slow speed motors. The above for driving agitators in an installation using the oil flotation process.

Fraser & Chalmers of Canada, Limited, of Montreal, have been awarded a contract by the Siemens Company of Canada Limited, for a 2,000 k.w. steam turbine, condensing plant and pumping equipment. This machinery will be installed by the Britannia Mining & Smelting Company, Limited, at Britannia Beach, B.C.

Utah Copper Co., Magna, Utah. Seven 10 h.p. special vertical slow speed motors. The above for driving agitators in an installation using oil flotation process.

Daly West Mining Company, Park City, Utah, one 300 h.p. 2,200 volt hoist motor with liquid controller and complete switchboard equipment.

Alaska Gastineau Mining Co., Juneau, Alaska, one 6-ton storage battery locomotive; one 50 kw. motor-generator set.

Empire Mines & Investment Co., Grass Valley, Cal., one 500 h.p. motor; one liquid controller for the above; three 200 kva. 4,000 volt O.I.S.C. transformers; one 3-phase induction regulator, 45 kw.; six 35 h.p. special back geared stamp mill motors. The above 500 h.p. motor is for double drum hoist. The control equipment furnished will include all switchboard apparatus and a number of special safety devices.

Calumet & Arizona Mining Co., Bisbee, Arizona, two 300 kva., 3 phase O.I.S.C. transformers and switchboard equipment.

BOOK REVIEW.

CHEMICAL REAGENTS, THEIR PURITY AND TESTS—by E. Merck—Translated by Henry Schenck D. Van Nostrand Company, New York—Price $1.00 net—For sale by Book Department, Canadian Mining Journal.

This is the second edition of "Prufung der chemischen Reagenzien auf Reinheit," presented in English.

The text has been adapted to the needs of American chemists, and it has thus been necessary to deviate somewhat from the German standard. For the most part, however, it is a close translation of the German text.

The properties of reagents are stated and several tests are given for the determination of the purity of the materials. One hundred and eighty-six pages are devoted to the description of properties and tests. In addition there are tables of atomic weights and of methods of preparing test solutions in common use.

OBITUARY

Mr. Arthur A. Austin, chief chemist at the International Smelting & Refining Co.'s smelter at Tooele, Utah, met his death on June 29 as the result of an accident which occurred at the works while he was experimenting with oil as fuel for the smelter furnaces. With an assistant, he was engaged in pumping oil by air pressure when the oil tank burst, and both men were drenched with oil. The assistant escaped without injury, but the oil on Mr. Austin caught fire, and he was seriously injured before the burning clothing could be torn from his body. He was hurried to the hospital at Tooele by special train, but despite prompt surgical attention, he died a few hours later. He had been employed at the Tooele smelter for about four years, and previously for a similar period at the smelting works at Anaconda, Montana. In 1909 he married Miss Marion Hodges, one of the daughters of Mr. A. B. W. Hodges, then general superintendent for the Granby Con. M. S. & P. Co., at Grand Forks, B.C. He leaves a widow and an infant daughter. His parents are Mr. and Mrs. L. S. Austin, of Salt Lake City, Utah, U.S.A.

SPECIAL CORRESPONDENCE

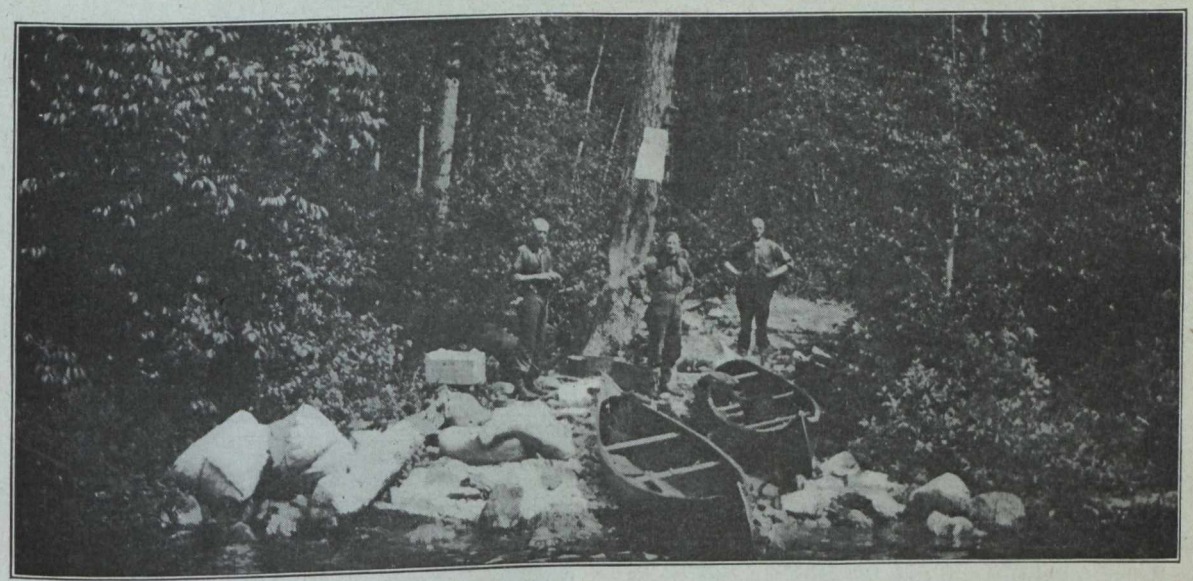
COBALT, GOWGANDA AND SOUTH LORRAIN

There have been several inevitable occurrences in the Cobalt camp within the past month which have led to a strong reaction from the prevalent high optimism a year ago, in regard to Cobalt's future. The extreme optimism with which many outsiders viewed the camp a year ago was no more shared by engineers here than the extreme pessimism which is just as manifest now that the Hudson Bay has closed down, the Nipissing has found nothing in their big vein at 900 ft., and there have been several other manifestations of the depletion of the ore reserves in several mines. But there have been gains to make up for these losses which have been known and discounted for some time in the camp; gains which have not received much credence because the public is just now generally sceptical of Cobalt and is not in a mood to receive any good news with much faith.

No one with any knowledge of the camp will strive to contend that the camp is not past its zenith; the apex was reached in production three years ago, in actual value two years ago. But there will be no sudden decline such as many who are but superficially acquainted with the camp would have us consider.

There have been gains within the past six months. At the Kerr Lake one or two small veins of good ore not hitherto discovered have been unearthed under the lake and these are positive gains. Again several veins which have been worked underground have been found to be much better down below than on the surface, and by the measure of their betterment the ore reserves blocked out have been increased. At the old No. 3 too, several new leads have been found. These may or may not yield much ore, but they are very direct incentives to further prospecting in this famous old working in the diabase.

On Glen Lake at the foot of Diabase Mountain the Penn-Canadian has resuscitated a property which was



Scenes on a Northern Ontario Canoe Route

in the hands of the receiver for more than a year, and is shipping steadily. The Pennsylvania syndicate who have salvaged the old Cobalt Central are now in good hopes of making a mine of some permanence of the old Big Pete. The Bailey Cobalt, as a company, has gone under the flood, but as a mine it was probably never more promising. During the past three years when only it has been carefully and systematically mined it paid a good premium over and above working expenses; but expenses incurred before that period and not put in the ground, swamped it. It may very closely follow the career of the Penn-Canadian.

At the Seneca Superior, the company is at least holding its own. It has already paid over 100 per cent. on its modest capitalization, and while the enrichment is confined almost entirely to the actual veins these are very rich and very persistent along their whole length. The Gould ran into a pocket of ore and ran out of it, and the discovery on the Peterson Lake, which at first appeared to be so promising, is now very spotty.

In the very heart of the camp the City of Cobalt and the Cobalt Townsite, both controlled in England, have improved their position considerably in the last six months, and the Coniagas has good hopes of picking up the continuation of the City's veins from the shaft which is now so prominent a feature of the town itself.

This is, of course, the bright side of the shield only, but it serves to indicate that the year has not been pure loss, and that all the ore taken out is not lost without any compensation to the camp as a whole.

Dividends paid by companies in the Cobalt camp up to June 30 amounted to the enormous total of $53,638,011. In the past six months $4,319,879 has been disbursed in dividends. This shows a very considerable decrease from last year.

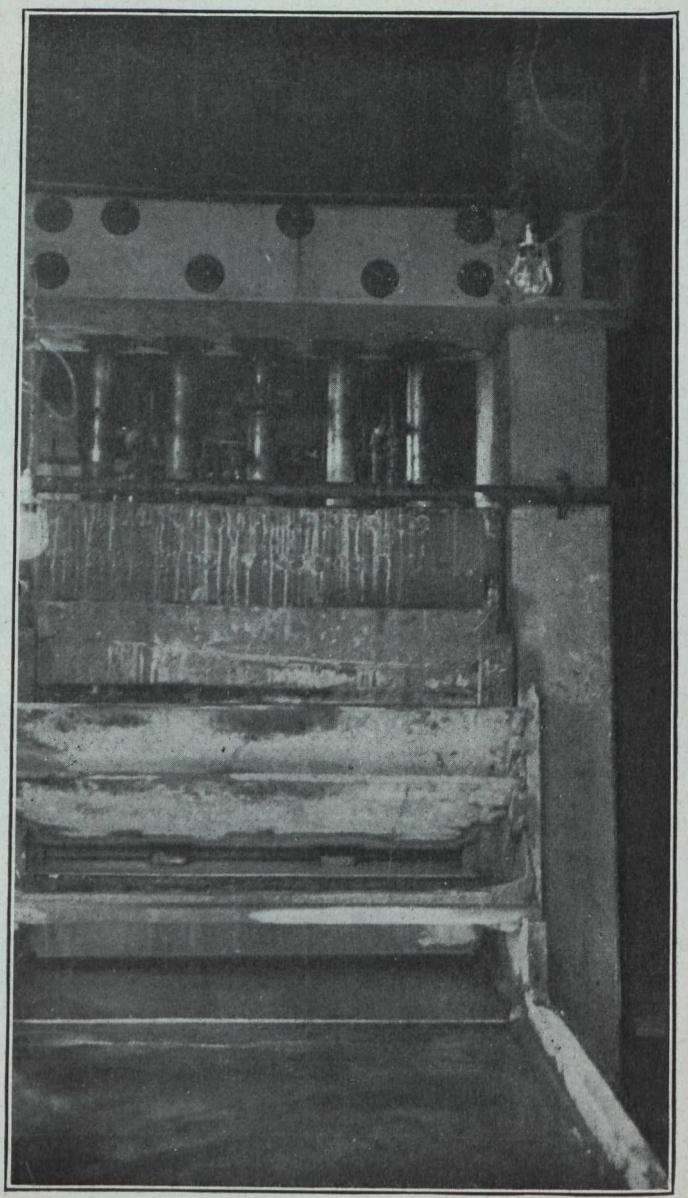
As stated in the last issue of the Canadian Mining Journal the result of the exploration work on the Nipissing at the 900-ft. level, has not yielded promising results. It will be remembered that for the past year a shaft has been put down vertically in order to tap the No. 64 vein some distance below the conglomerate in the Keewatin and decide whether there was any promise of reward of exploration in that formation in this particular section of the camp. The last monthly report states in regard to this work:—"No. 64 vein was encountered at the 900-ft. level. The vein varies in width from four to seven ft., whereas it was only 18 in. wide at the upper levels. Some of the vein is similar in appearance to that where previously encountered. Silver contents are now practically nothing. After continuing the cross-cut for 30 ft. past the vein drifts were started east and west. Further drifting will decide what the next development will be."

The estimated net production from the Nipissing mine for the month of June was $183,558 as compared with $211,256. Bullion from Nipissing and customs ore was shipped of an estimated net value of $360,486.

Most of the month's work underground was done from shaft 73 on veins 73 and 98. In addition to these main producers four branch veins are being developed by drifts. The branches vary in width from one to two in. and the grade averages about 1,800 oz. The drifts are producing a small amount of high grade ore but will eventually send a large amount of low grade to the mill.

The Little Silver vein is still good. From the stope came most of the ore on the west side of the lake, the vein averaging 2,500 oz. over a width of 2 in. During the month a crosscut found the vein 40 ft. higher than the top of the second level stope, and it is fine high grade.

A change is made in the management of the Trethewey Cobalt mine by the retirement of Mr. H. G. Young, who leaves Cobalt to become consulting engineer of the Algunican Development Company, a Belgian syndicate with a Canadian charter. Mr. Young has been at the Trethewey two years after leaving the Hudson Bay, and he made an excellent record there managing to pay dividends each year, and at the same time to find more ore to take the place of that mined. He was given a silver service by the staff when he left. He will superintend operations at properties of the syndicate so far apart as Renfrew County and Alaska, and will make his headquarters at Montreal.



Tough-Oakes Stamp Mill

Another loss to the camp is the resignation of Mr. R. H. Hutchison from the Coniagas staff. Mr. Hutchison will take charge of the mining branch of the Sudbury High School, succeeding Mr. McKay, who has become private secretary for Mr. R. W. Brock, the Deputy Minister of Mines at Ottawa.

Dividends paid by Cobalt companies to June 30, 1914, are:—

	P. C.	Amount
T. & H. B.	25,000	$1,940,250
Cobalt Silver Queen	21	315,000
Casey Cobalt	15	203,249
Cobalt Lake	15½	465,000
Beaver Consolidated	20½	410,000
Buffalo Mines	282	2,787,000
Caribou Cobalt	7½	75,000
City of Cobalt	23	129,321
Cobalt Central	4	192,845
Coniagas Mines	176	6,640,000
Crown Reserve	327	5,784,082
Kerr Lake	174	5,220,000
La Rose Consolidated	64	4,600,346
McKinley-Darragh.	172	4,269,597
Nipissing Mines	199	11,940,000
Right of Way Mines	12	202,260
Seneca Superior	102.5	490,356
Timiskaming Mining Co.	56	1,384,156
Trethewey.	108	1,061,998
Wettlaufer Lorrain	45	637,465
Foster Cobalt	5	45,774
Peterson Lake	1¾	43,032
Cobalt Townsite	97.5	966,726
		$53,638,011

Dividends paid in 1914, are:—

	P. C.	Amount
Coniagas.	19	$720,000.00
T. & H. B.	900	69,849.00
Caribou Cobalt	5	50,000.00
Crown Reserve	14	247,633.96
Kerr Lake	10	300,000.00
La Rose	7	524,525.44
McKinley-Darragh.	18	404,584.56
Nipissing.	17.5	1,050,000.00
Trethewey.	5	50,000.00
Seneca Superior	37.5	179,581.50
Casey Cobalt	..	93,750.00
Buffalo.	28	280,000.00
Cobalt Lake	5	150,000.00
Cobalt Townsite	20	199,953.34
		$4,319,879.80

PORCUPINE, SWASTIKA AND SOUTH LORRAIN

Following the precedent of the McIntyre, the Porcupine Crown is making a geological survey of their property. On the McIntyre the system of faults has been examined by a geologist, with the result that the extensions of several ore bodies have been picked up. No work is proceeding at present on the 500-ft. level of the Crown, it being decided to follow the ore down from the 300-ft. level, and ascertain exactly where the break occurs. So far in the winze the bottom of the ore has not been reached.

Spectacular surface finds are again reported from McArthur township. It is stated that much visible gold has been found in the big quartz vein uncovered on the Lohner and Forbes claims. These claims are located about 50 miles due south of South Porcupine and the owners have already started on the construction of a summer trail from the end of the present government road. There is also a good canoe route.

The Dome report for June shows tons milled 18,250, gold recovered $83,421, and values recovered per ton milled $4.57. This is a considerable improvement from May in every respect, when the grade was $3.83, but it is still very much lower than the average. It is anticipated that the tonnage milled will now show a substantial increase every month. There have been considerable changes in the personnel of the staff within the past month.

The six four-weekly statements of the Hollinger issued this year show that the average value of Hollinger ore has been $14.25 per ton, and the average costs $4.667 per ton. For the four weeks ending June 17 the average value of ore per ton treated was $14.59, which was roughly a dollar and a half higher than the previous month. The working costs amounted to $4.578 per ton, which also was fractionally higher. Expenditures written off for plant amounted to $10,438 on the mill extension and $3,328 for the sprinkler system. The mill ran 90 per cent. of the possible time, treating 13,928 tons, of which 30 tons were treated for the Acme Gold Mines. The approximate extraction was 95.2 per cent., the milling costs $1.220 per ton, and the mining costs $2.192 per ton.

NOVA SCOTIA

DOMINION COAL OUTPUTS.

The output obtained by the Dominion Coal Company's Glace Bay mines in June will in all probability stand as the maximum monthly output of this company for some time to come. The tonnage raised was 452,270 tons, which compares with the largest previous output of 438,272 tons produced in October, 1913. Notwithstanding the large production in June it would have been much larger had it been possible to work the mines to full capacity, as but for the enforced idle time the output would have reached 490,000 tons, or 50,000 tons greater than the previous maximum.

For many years past now your correspondent has had occasion to record a continuously increasing production by the Dominion Coal Company, every month showing an increase over its predecessors, but the slackening in demand which has been threatening the coal-trade for some time past has now developed to an appreciable extent, and it will shortly become necessary to record a diminution in production. In July the Glace Bay outputs will probably not exceed 380,000 tons, or about 100,000 tons less than the capacity of the collieries if operated full time.

All the Nova Scotian mines are affected by the depression, those on the mainland more so than the island collieries. Up to the end of the half year, however, very little reduction will be shown as compared with last year's figures, and for this reason the royalty returns of the Nova Scotia Government will show but a small shrinkage, as the Government's fiscal year ends 30th September.

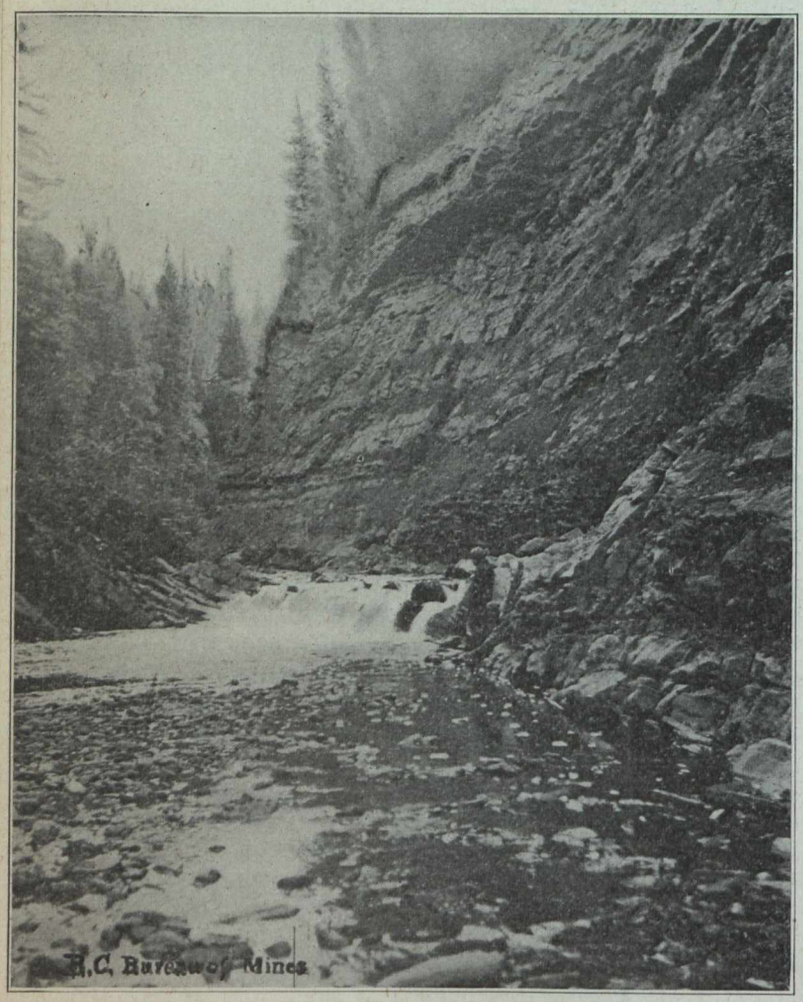
The production of the Dominion Coal Company for the first half of 1914 was 2,254,043 tons from the Glace Bay mines and 199,961 from the Springhill mines, comparing with 2,295,082 tons from Glace Bay and 193,797 from Springhill in the first half of 1913. There is, therefore, only a difference of 34,000 tons between the two half years.

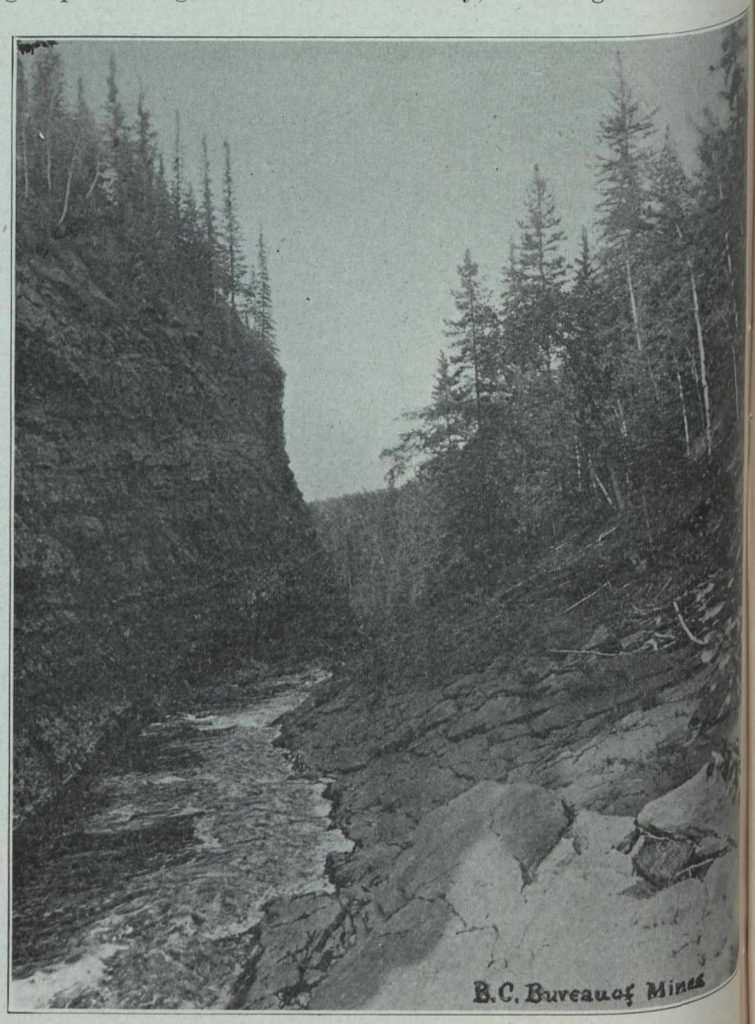
A fire which may prove serious occurred during July in the McGregor pit at the Albion mine of the Acadia Coal Co. Owing to the dangerous conditions attend-

ing the attempts which were made to extinguish the fire it was found necessary to seal the pit. It is not known when attempts at reopening will be made. The Acadia Coal Company have in recent years spent a considerable amount of money in modernizing this colliery. Many extremely serious fires have in the past been successfully fought in Pictou County mines, and it is to be hoped that the Acadia Company will be equally successful in the present instance.

BRITISH COLUMBIA

Reports of new strikes of placer gold in two or three different parts of Cariboo district have recently been published in provincial newspapers, but authentic information in confirmation has not yet been received. One report was to the effect that gold had been found on Willow river, low down toward its confluence with Fraser river. Another gave the neighborhood of Quesnel as the scene of a new discovery. As both rivers flow through country in which much gold has been recovered over a long period of time, it is, of course, quite possible that new finds may be made, but it is a fact that notwithstanding its having been prospected by numbers of the old Cariboo miners little pay ground was found well down Willow river, so old-timers are not yet attaching much importance to the reports so far as that stream is concerned.





Peace River Coalfield—Measures showing on Johnson Creek.

Rossland.

Another copper smelting furnace having been blown in at the Consolidated Co.'s works at Trail, a larger quantity of ore is being shipped from the company's mines in Rossland camp. The total quantity of ore shipped hence to Trail during four weeks ended May 28, was 19,495 tons, which was an average of 4,874 tons a week; during four weeks ended June 25, it was 19,779 tons, an average of 4,945 tons; for the week ended July 2 the quantity was 6,622 tons. Of the total of 45,896 tons shipped during the nine weeks, only 4,343 tons was custom ore, that having been sent to the smelter from the Le Roi No. 2 Co.'s Josie group of mines; the larger part was from the Consolidated Co.'s mines, namely, Centre Star group 28,604 tons, and Le Roi 12,949 tons. The output from the Josie group was larger in June than in May, it having averaged 573 tons a week for four weeks, ended June 25, as against 426 tons a week for the corresponding period ended May 28. The greater part of the Josie mines product shipped was crude ore, but it also included concentrate from second-class ore milled at the mine. More ore has been opened lately in the deep of the Le Roi No. 2 Co.'s mines than on levels nearer the surface, while in the Consolidated Co.'s mines, both in the Le Roi and the Centre Star group, available ore in the lower levels is much greater than for several recent years.

BOUNDARY.

North Fork of Kettle River.

The Union claim, in Franklin camp, on the east fork of the north arm of Kettle river, about 50 miles from

Grand Forks, continues to ship ore of a sufficiently high grade to leave a good margin of profit above freight and treatment charges of approximately $30 a ton. The ore occurs in what is described as a vein of dark blue silica containing small quantities of iron pyrites. In an open cut the vein is about 8 ft. in width. While consisting largely of silica it does not appear to be a true quartz vein, but is rather a complete replacement of limestone, probably along a fissured zone. The vein matter is about three-quarters quartz, the remainder being calcite and iron pyrites, with a little hematite and garnet. The gold value is probably associated with the iron pyrites, while the silver seems to occur as silver sulphide, and possibly in part as ruby silver. The ore is deceptive in appearance, as it shows very little mineralization and would hardly be taken at first glance as high-grade ore. The ore as shipped to the smelter in carload lots assays about $60 a ton. The district was visited late last autumn by Mr. J. D. Galloway, assistant provincial mineralogist, whose report on it has been published, and now another engineer is reporting on the camp for the Department of Mines.

Granby Smelter, Granby Bay, B.C.

Phoenix.

Three men were killed by a fall of rock at the Granby Consolidated Co.'s Knob Hill mine, near Phoenix, on July 5. They were J. F. McDougall and Wm. Tatham, shift bosses, and Frank Riordan, motorman. According to evidence adduced at an inquest held by the district coroner, the fatality occurred in No. 2 adit of the mine, near where the cars enter and leave the big "gloryhole," in which an electrically operated Bucyrus shovel had recently been installed. A mass of rock, estimated at more than 1,000 tons, came down without warning, burying the three men and the electric motor, of which Riordan was in charge. The accident happened shortly after nine o'clock in the morning. When it was found that three of the morning shift were missing, as many men as could work with expedition and the big shovel were employed removing the fallen rock, but it was not until late at night of the following day, after about 37 hours' work, that the last of the bodies was recovered. A verdict of "unavoidable accident" was returned. McDougall's body was sent East, for burial near his old home on Prince Edward Island, while the bodies of Riordan and Tatham were buried near Phoenix. Riordan, who was about 38 years of age, was born at Woodstock, Ontario. He went to Phoenix from Michigan. Tatham's native place was Magog, Province of Quebec. He was 61 years of age and had been 14 years with the Granby Co.

COAST.

Vancouver Mining Division.

The Britannia Mining and Smelting Co. has well on for 100 men at work prospecting and developing mineral claims in the mountainous country surrounding its Britannia group of mines. Two properties in particular are being developed under option of purchase, namely, the Red Mountain group, at the head of Stawamus river, which flows into Howe Sound at its head near Squamish, the present tidewater terminal of the Pacific Great Eastern Railway, now in course of construction northward through Lillooet and Cariboo districts to Fort George, and the Bank of Vancouver group, near the head of Seymour creek which flows in the opposite direction and enters Burrard inlet across the water from the City of Vancouver. On the latter group there are known to occur two parallel veins, between 200 and 300 ft. apart, traced for a distance of fully 1,000 ft. One of these has been crosscut 25 ft. without reaching the other wall; it is a massive body of copper ore, running about 4 per cent. copper with some gold. A crosscut adit is being driven to cut this ore body at approximately 300 ft. lower down the mountain. This adit was in 250 ft. at the end of June, and was believed to be nearing the orebody, it is about 6 ft. wide by 7 ft. high, and is intended to be used as a working tunnel until much more development shall have been done. The showing of ore on the Red Mountain group is not so large, but this is also a promising property. The ore runs 4 to 5 per cent. copper and $3 to $4 a ton in gold. This has also been opened by adits, but there is also quite a big bluff in which there is a fairly good showing of ore.

Texada Island.

The Provincial Department of Mines has published a report by Mr. Donald G. Forbes on a number of mining properties in the lower Coast district. One of these is the Marble Bay mine, owned by the Tacoma Steel Co., of Tacoma, Washington, and situated near Van Anda on the east side of Texada island about five

miles from its northern end. This mine has been shipping ore to Tacoma for a number of years; it is remarkable on account of the unusual depth at which bornite occurs in it. Mr. Forbes reports, in part:

"The mine is situated in limestone cut by numerous dikes of diabase, along some of which considerable movement has taken place. Since the intrusion of the dikes fresh movements have occurred and new fracture planes have been formed. It is along these later lines of fracture that the ore bodies are found, and that alterations and replacements have been made in the limestones. The mineralization, consisting of chalcopyrite and bornite containing some gold and silver, occurs in a gangue of felsite, gametite, and some tremolite. Native silver is also found in the mine, though not often present in great quantity.

"The main shaft has been sunk to a depth of 1,000 ft., and from this level, at a point 180 ft. north of the main shaft, another vertical shaft or winze has been sunk for 300 ft., making the bottom level 1,300 ft. vertically below the surface, and 1,250 ft. below sea-level. The 1,200 and 1,300 ft. levels are being worked at present, and exploration work is being carried on along the fracture planes and following small stringers of ore. One fair-sized pocket of ore has been found between the 1,300 and 1,200-ft. levels and is now being stoped out. The ore consists of chalcopyrite and bornite in a gangue of lime, felsite, and garnetite. Bornite is present in considerable quantity in this ore, and is here found at a depth of more than 1,200 ft. below sea-level, an occurrence quite unusual at such a depth. The stope also contains some banded siliceous ore of a kind not found in other parts of the mine. A winze has been sunk for 40 ft. on the incline below this stope, but as it did not disclose anything of value sinking here was discontinued.

"The principal exploration work in the mine has been carried out in a north-and-south direction, as the irregular and disconnected bodies in which the ore occurs pitch to the north. The orebodies are distributed over some 300 ft. from east to west, and very little exploration work has been done beyond these limits. The orebodies are irregular in form and extent and are disconnected; they vary from small kidneys to large deposits."

Observatory Inlet.

The Granby Consolidated Co.'s hulk "Gerard C. Tobey," formerly an American barque, which left Tacoma, Puget Sound, on July 3 in tow of the steamer "Amur," was wrecked in Seymour Narrows, off Vancouver island, on Sunday morning, July 5. She was laden with 1,581 tons of coke for the company's smelter at Anyox, Granby Bay. When in the narrows the strong tidal current caused the hulk to sheer so that she struck a rock which so damaged the hull that the vessel sank in deep water. It is thought that both hulk and cargo are a total loss.

Portland Canal Division.

Three men who left Stewart several weeks ago to explore the country between that town and Groundhog coal basin, with the object of finding a better route for a trail between these places than that now in use, reached Hazelton after a hard trip of 22 days, during which they covered a distance of about 275 miles. Development work on coal lands in the basin being seriously retarded by transportation difficulties and heavy costs—the packing charge from Hazelton, which is 180 miles by rail from Prince Rupert, to the Groundhog field, being 20 cents per pound—the Provincial Government is seeking a trail route with an easier grade and shorter in distance than either the existing one from Hazelton or that from Stewart. A route was found 40 miles shorter and with a maximum elevation of 3,500, as against 5,200 ft. now reached by the trail in use.

During the month of June the Portland Canal Tunnels, Ltd., advanced its main adit 122 ft. and the drift on its Lucky Boy claim 147 ft. At the beginning of July the face of the Lucky Boy drift was in a strong vein of quartz and pyrite, but value of this ore was low. At 3,368 ft. in from its portal the main crosscut adit, which had previously passed through several veins, appeared to be breaking into another vein, for pieces of ore were found there. This was the best-looking showing that had been opened by the crosscut.

Omineca Division.

Ore is being taken from Hunter basin down to Telkwa whence a carload shipment—the first from this place—will be made. The ore is from the Thomann property; its chief valuable metal content is silver, and it is expected that smelter returns will show it to be high-grade ore. W. Hunter, who has been working in the basin off and on during the last eight years, has about 200 tons of ore ready for shipping, which will be commenced soon, after completion of the wagon road now being constructed to his property.

Another car of ore from the American Boy, owned by the Harris Mines, Ltd., near New Hazelton, is to be shipped from there early in July. This ore is from the shaft on No. 1 vein; it will be smelted at the Consolidated Co.'s smelter at Trail.

MEXICAN PETROLEUM.

N. Y.—Accompanying annual report of Mexican Petroleum Co., Pres. Doheny presents a statement to shareholders regarding history of the company, its present position in Mexico and effect of disturbed governmental conditions, in which he says: Company officials have always endeavored to hold the company neutral with reference to politics and contrary to general opinion the company has found the Mexican "peon" a most satisfactory employee.

The statement says: "In brief your company discovered the basis for, and pioneered development of, a hitherto unsuspected resource in the republic of Mexico, which increased wages and brought about better conditions of living for all the poor people, which increased land values, which gave increased business to the farmers, merchants, bankers and artisans, reduced cost of operation to railroads and other industries, all without taking away anything the existence of which had theretofore been known or even suspected. We claim those who include petroleum companies among corporations that have exploited the people of Mexico or their country disadvantageously, are misinformed."

Regarding withdrawal of Americans from Mexico in latter April and early May, Pres. Doheny says: "The product of your continuously flowing wells was so faithfully conserved by Mexican employees in charge that your general manager was able to report that not more than 5,000 barrels of oil were lost during the 30 days' absence of your American employees from the properties.

"The present, though apparently cloudy and uncertain, shows evidence of the nearness of a future brightening by auspicious events which portend the establishment of peace and order in the republic of Mexico."

During 1913 company's total sales were 12,325,228 barrels for which was received $7,115,092.

CANADIAN COLLIERIES, LTD. VS. DUNSMUIR.

Advices recently received from London, England, by the Canadian Collieries (Dunsmuir), Limited, are to the effect that the company's appeal in its action against the Hon. James Dunsmuir, of Victoria, Vancouver Island, British Columbia, has been allowed by the Privy Council, while the cross appeal of Mr. Dunsmuir against the company has been dismissed.

About four years ago Mr. Wm. Mackenzie, of the well-known railway-building firm of Mackenzie & Mann, of Toronto, obtained from Mr. Dunsmuir and his associates, who owned and had been operating for years the Union colliery in Comox district and the Extension colliery in Cranberry district, both on Vancouver Island, an option of purchase on all the coal properties and other interests of the Dunsmuirs in their coal mining, shipping, and selling business. The purchase price was stated to have been $11,000,000. It was agreed that until such time as the Mackenzie & Mann interests should be prepared to take over and operate the coal mines the Dunsmuirs should continue to keep the business going as usual and for doing so should receive the profits on same. Later, the purchasers having meanwhile acquired possession of the mines and undertaken their operation together with the carrying on of all the business connected therewith, disputes arose as to the meaning of certain terms of the purchase contract. The sellers disputed several important claims of the buyers, chiefly that the assets covered by the sale did not include two colliers engaged in the coal trade between Vancouver Island and San Francisco (the latter place being the chief market for the product of the coal mines concerned), nor a reserve stock of coal in Vancouver city valued at about $160,000, nor approximately $500,000 in cash in the bank, which cash was distributed by the Dunsmuirs among themselves as a dividend before Mackenzie & Mann took over the property.

While the total amount in dispute was nearly $1,000,000, the final result of the actions at law between the parties does not mean that so large an amount has now to be paid to the Canadian Collieries (Dunsmuir) Limited, for there are certain amounts acknowledged to have been due to the Dunsmuirs, primarily the profits from the business during the five or six months they operated it under the agreement above mentioned. The Canadian Collieries Company, however, will benefit by the final judgment to the extent of between $400,000 and $500,000, which is the approximate amount in favor of the company still to be received by it.

BLAIRMORE—FRANK DISTRICT.

The financial statement of the McGillivray Creek Coal & Coke Company, Limited, which held its annual meeting last month in Spokane, is just being printed and will be distributed to the shareholders of the company in a few days. The company's mine is in the foothills of the Rocky Mountains at the Alberta end of the Crow's Nest Pass.

That the McGillivray Company is on an excellent footing and is making highly satisfactory progress is indicated in the statement. The figures are for the year ending March 31, 1914. The item of chief interest is that of the net profit for the year, which is entered at $87,377.02. The balance sheet is certified to by James B. Sutherland, chartered accountant, Calgary. The total assets of the company are placed at $3,207,131.53. This includes $211,261.21, as the value of plant, buildings, roads and railway sidings, also $2,297,724.45, as the value of coal lands.

In his report to the shareholders, the president, Mr. Lorne A. Campbell, of Rossland, states that the development work carried on during the past year has turned out to the entire satisfaction of the company. The advance in the main entry, north, during the year was 2,413 feet. Mr. Campbell's statement goes on:

"The total tonnage of coal marketed during the past year was 198,175.65 short tons, this tonnage being distributed in Alberta, Saskatchewan, and the States of Washington and Idaho. In addition to the tonnage as stated, we had ready for immediate extraction on March 31, 1914, 659,728 tons.

"During the past year we have added to our equipment thirty steel pit cars of four tons capacity each, one 65-h.p. boiler, one 160-h.p. engine, one 100-k.w. generator, as well as motors having capacity of 75-h.p., also two 6-ton electric storage battery locomotives for underground haulage.

"During the past year the mine worked 274 days, which goes to show that the delays during the operative period have been very few.

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

The directors of the company are: Lorne A. Campbell, Rossland, president; James A. Nowell, Spokane, vice-president; T. M. Paine, Glencoe, Minn.; Fitzhugh Burns, St. Paul, Minn.; W. E. Cullen, jr., Spokane, secretary and treasurer; George Kellock, Coleman, Alberta, colliery manager.

TORONTO UNION STATION.

The P. Lyall & Sons Construction Company, Ltd., has been awarded one of the largest contracts ever given to one firm in Canada.

For some time bids have been asked for the construction of a new Union railway station at Toronto, the same to cost between $4,000,000 and $5,000,000. The tenders of the Lyall Company have proved the lowest and as the firm was in a most suitable position to handle such a large contract successfully, the contract was awarded to them. The contract is to be finished not later than July 1, 1916. Construction work will commence about the 1st of January, 1915.

This contract will place the company in a very strong position, as when the company issued its annual report in March last, it stated that over $3,300,000 worth of contracts were being carried over into the next year. With the present contract the company's unfinished contracts will equal nearly $8,000,000.

The station will be constructed of granite and the exterior has been designed in an adaptation of Roman classic architecture.

That the examining mining engineer is kept in training by his work was exemplified in the recent 200 mile canoe race from Mont Laurier to Ste. Rose, Que.—Mr. Jas. G. Ross, Consulting Mining Engineer, of the Milton Hersey Co., Montreal with his partner, Mr. T. M. Papineau, representing the Cartierville Canoe Club, Montreal, came second. The winners were two Gowganda prospectors, Messrs. R. Gamble and F. Thompson representing the Rideau Aquatic Club of Ottawa. The course down the Lievre and Ottawa Rivers was covered in 40 hours paddling and portaging, the elapsed time from start to finish being 60 hours.

MARKETS

STOCK QUOTATIONS.

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

July 24, 1914.

New York Curb.

	Bid.	Ask.
American Marconi	2.75	2.87
Alaska Gold	26.75	27.00
British Copper	1.37	1.87
Braden Copper	7.00	7.62
California Oil	319.00	320.00
Chino Copper	39.87	40.00
Giroux Copper	.50	1.00
Green Can.	30.00	32.00
Granby.	...	...
Miami Copper	22.12	22.37
Nevada Copper	1.62	1.87
Ohio Oil	174.00	176.00
Ray Cons. Copper	20.75	20.87
Standard Oil of N. Y.	213.00	215.00
Standard Oil of N. J.	401.00	405.00
Standard Oil (old)	1375.00	.....
Standard Oil (subs)	975.00	.....
Tonopah Mining	6.50	6.75
Tonopah Belmont	6.25	6.50
Tonopah Merger	.30	.32
Inspiration Copper	18.50	18.75
Goldfield Cons.	1.37	1.43
Yukon Gold	2.12	2.37

Porcupine Stocks.	Bid.	Ask.
Apex.	.01	.01½
Dome Extension	.09	.09¼
Dome Lake	.38	.39
Dome Mines	9.00	9.70
Eldorado.	...	...
Foley O'Brien	.28	.31
Hollinger.	18.10	18.35
Jupiter.	.06	.06½
McIntyre.	.33	.33¼
Moneta.	...	...
North Dome	...	...
Northern Exploration	1.00	1.75
Pearl Lake	.02¾	.03
Plenaurum.	...	.40
Porcupine Vipond	.23	.28
Imperial.	.01¼	.01¾
Porcupine Reserve	...	...
Preston East Dome	.01	.01½
Rea.	.10	.20
Standard.	...	...
Swastika.	.01½	.02
United	...	...
West Dome	.05	.10
Porcupine Crown	.85	.95
Teck Hughes	.11	.12

Cobalt Stocks.	Bid.	Ask.
Bailey.	.00½	.00¾
Beaver.	.23	.23½
Buffalo.	.95	1.10
Canadian.	.08	.10
Chambers Ferland	.14	.16
City of Cobalt	.40	.44
Cobalt Lake	.42	.46
Coniagas.	7.50	7.70
Crown Reserve	1.18	1.19
Foster.	.04	.06
Gifford.	.01	.02
Gould.	.01	.01½
Great Northern	.07½	.08
Hargraves.	.01	.02
Hudson Bay	40.00	45.00
Kerr Lake	5.80	6.00
La Rose	.88	.90
McKinley.	.51	.54
Nipissing.	5.80	6.00
Peterson Lake	.33	.33½
Right of Way	.03	.04
Rochester.	...	...
Leaf.	...	...
Cochrane.	...	.15
Silver Queen	...	...
Timiskaming.	.10½	.12
Trethewey.	.16	.20
Wettlaufer.	.06	.07
Seneca Superior	2.35	2.50

TORONTO MARKETS.

July 28—(Quotations from Canada Metal Co., Toronto).
Spelter, 5¼ cents per lb.
Lead, 5 cents per lb.
Tin, 32 cents per lb.
Antimony, 8½ cents per lb.
Copper, casting, 14½ cents per lb.
Electrolytic, 15 cents per lb.
Ingot brass, yellow, 10; red, 13 cents per lb.
July 28—Coal—(Quotations from Elias Rogers Co., Toronto).
Anthracite, $7.50 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

July 24—Connellsville Coke (f.o.b. ovens).
Furnace coke, prompt, $1.75 per ton.
Foundry coke, prompt, $2.25 to $2.50 per ton.
July 24—Tin, straits, 31.25 cents.
Copper, Prime Lake, 13.50 to 13.62½ cents.
Electrolytic copper, 13.25 to 13.37½ cents.
Copper wire, 14.62½ to 14.87½ cents.
Lead, 3.90 cents.
Spelter, 5.00 to 5.10 cents.
Sheet zinc (f.o.b. smelter), 7.00 cents.
Antimony, Cookson's, 7.05 to 7.15 cents.
Aluminum, 17.50 to 17.75 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $43.00 to $44.00 per ounce.
Platinum, hard, 10 p.c., $46.00 to $47.50 per ounce.
Platinum, hard, 20 p.c., $49.00 to $51.50 per ounce.
Bismuth, $1.95 to $2.15 per pound.
Quicksilver, $36.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
July 9.	56⅛	25 13/16
" 10.	56⅛	25 11/16
" 11.	55⅞	25¾
" 13.	55¾	25 11/16
" 14.	55¼	25 7/16
" 15.	54⅞	25¼
" 16.	55⅛	25⅜
" 17.	54⅜	25 1/16
" 18.	54¾	25 1/16
" 20.	54⅛	24 15/16
" 21.	53⅜	24 9/16
" 22.	53½	24⅝
" 23.	54¼	24 15/16
" 24.	53⅞	24¾