THE CANADIAN MINING JOURNAL

VOL. XXXII. TORONTO, July 1, 1911 No. 13

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"
Devoted to Mining, Metallurgy and Allied Industries in Canada

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - - 17-21-23 Manning Arcade Annex, Toronto
Branch Offices - Montreal, Halifax, Victoria, and London, Eng.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane, London, E.C.

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SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for the issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post-office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

OPPORTUNITIES.

At risk of wearying our readers we intend once again to draw attention to little-known fields for mining investment in Canada.

In our last issue we referred to the beneficial effect that certain prosperous mining camps have had upon the country generally. There is, however, another side to the subject. The excitement that attends the development of new mining regions is apt to give to outsiders the impression that these regions are the only profitable channels of investment. To many Englishmen, Americans, and Europeans, Cobalt and Porcupine embrace all of Canada that is worth while looking at. This is one of the misconceptions that must be patiently corrected. And it is for this purpose that we are guilty of reiterating the following facts.

We shall preface what is to be said by the remark that the most numerous chances for profitable outlay of money do not lie in camps that are being boomed. The mere fact that a mining camp happens to be the focal point of public interest creates conditions that militate against equitable terms of purchase and operation. This is so obviously a truism that it requires no demonstration.

On the other hand, deposits of such minerals as iron pyrites, scheelite, chalcopyrite, pyrolusite, graphite, gypsum, barite, magnesite, and so on, are lying undeveloped in many parts of eastern and western Canada. Not a few of these deposits can be easily and quickly proven. Many of them are already known to be commercially workable. The growth of our own markets alone demands that they be exploited. The possibilities of the foreign markets lend additional inducement.

Even more attractive are the chances that offer in the older gold fields. Study of Provincial and Federal reports shows that some of the gold discoveries of from thirty to fifty years ago were as rich as anything of recent times. But not until within the memory of this generation have circumstances been such as to encourage a large measure of enthusiasm. The limiting conditions were the lack of means of communication, and the absence of adequate media of information.

Times have changed. It is now possible to work to advantage all kinds of mineral deposits throughout the length and breadth of the Dominion. To the disappointed searcher for cheap bonanzas in Porcupine we would suggest that he read up the mining history, not only of Ontario, but also of British Columbia, Quebec, and Nova Scotia; and that he take steps to ascertain for himself the merits of forgotten districts.

THE SAMPLING OF COAL IN THE MINE.

Under this caption the United States Bureau of Mines has brought out its first technical paper. The subject is one of vast commercial import, and, hence, of high technical interest. Dr. Joseph A. Holmes, the Director of the Bureau, is the author. The purpose of the paper is to describe the methods followed by the Bureau and the Survey in taking commercially representative samples of beds of coal.

After describing an ingenious and compact mine sampling kit, Dr. Holmes gives preliminary details, and proceeds to describe the method of sampling. Much emphasis is laid upon the necessity of cleaning thoroughly the face to be sampled, and of including in the sample all material that is usually comprised in the daily shipments. Only such material as is ordinarily discarded by the miner should be omitted.

Specific instructions follow as to the precise method of sampling a working face. First, the floor is to be cleaned and the sampling cloth spread close to the face. Next, a perpendicular cut 2 inches deep and 6 inches wide, or 3 inches deep and 4 inches wide if coal be soft, is made from roof to floor down the side of a foot-wide cut previously made. The cut should be uniform in width and depth. Enough coal should be chipped off to make a sample weighing at least six pounds for each foot of the width of the seam.

The sample is put through a ½-inch or ⅜-inch screen, and is mixed and quartered as usual. A suitable sample can is then filled completely and sealed. It is important that the entire series of operations be carried on in the mine. If this precaution be disregarded, errors will creep in. Exposing the coal to the outside atmosphere is found to introduce abnormal factors.

Investigation of the loss of volatile constituents when coal is freshly mined, and knowledge of the effects of weathering upon many fuels, have led the Bureau to devise and distribute exceedingly complete blank forms whereupon is transcribed the history of any given sample. These forms embrace details of the physical features of the mine, of the equipment, of the humidity report, of the explosives used, of general mining and marketing conditions, and of the sample itself. Thus the sample and the final analysis are given a value that they could not otherwise have. And herein is the point of the whole matter. There are available thousands of analyses of Canadian coals, analyses that are either misleading or meaningless because of the fact that there is no authentic record of how, and why, and when they were taken. Modern commercial engineering will not tolerate that slipshod professional work. Time was when laboratory results were accepted at their face value. Now, however, it is being more and more widely recognized, even in lay circles, that sampling is one of the most difficult and responsible tasks, and that few men are temperamentally fitted to do it fairly. But, no matter with what skill the sample may be taken, it cannot be accepted commercially without full data as to every item of its history.

SCIENCE vs. GREEK.

In many respects the educational systems of to-day are medieval. Of the number of compulsory subjects of study that are inflicted upon our youth, many have no relation either to real life or to real culture. This fact is being impressed more and more deeply upon British educationists. No one has put the case more cogently than has Sir Rae Lankester. Writing in "The Nineteenth Century and After," Sir Rae, whilst disclaiming any desire to see natural science take exclusive possession of the educational field, condemns strongly the domination of that field by Latin and Greek. The whole system of instruction and of competitive examination he scores as being an injurious perversion. He declares that "the school-teaching of the old knowledge has become sadly unreal, perfunctory, and slow . . . . The husk of it is mistaken for the kernel, the letter for the spirit, mere dexterity and verbal acrobatics for true learning and sound mental discipline. We can in the future retain some study of ancient history and literature, and even one of the classical languages—namely, Latin—while giving seriour attention to the new knowledge—the natural science of our present Renaissance."

This pronouncement is all the more interesting as Sir Rae was, in his youth, a product of the system that he criticizes. At St. Paul's he was the head-boy and prize-winner in successive classes of the Latin and Greek curriculum.

The cardinal point of the article is presented thus: "It is the business of the 'educator' to ascertain the various degrees and kinds of 'educability' in the young, and to adapt the course of education administered to them to their varying aptitudes." The youth of to-day must not be over-burdened with useless information. But his intelligence must be so trained as to open for him all desired branches of knowledge. The effect of proper study of the sciences is lasting and practically beneficent; the effect of unnecessary study of the dead languages is entirely mischievous.

Amongst the sciences to be taught, Sir Rae includes chemistry and geology. He recommends that these subjects be carried farthest. This is something for Canadian educationists to take to heart. A sweeping change must soon be brought about. Our young men should learn at school and at college more about nature, more about commerce, and less about the amours of heathen gods.

Each reading man can acquire a knowledge of the humanities after his formal education is completed. Every Canadian citizen should be possessed of a sound grasp of the fundaments of natural science.

GOVERNMENT DRILLING IN NOVA SCOTIA.

The Government of Nova Scotia adopts the liberal policy of keeping and operating seven core drills for the benefit of the mining community. During the year 1910, five drills, of which three were diamond drills and two calyx drills, were kept in commission. The total footage drilled was 5,222 feet. Of this footage, 4,500 feet were done by diamond drill. In all fifteen holes were sunk, and in every case coal was the mineral sought. The strata drilled included sandstones, shales, conglomerates, clays, and grits of many varying degrees of hardness, and of every kind of texture.

The average cost per foot of diamond drilling is reported at 93 cents; whilst the corresponding figure for the calyx is $1.44. The deepest hole bored was sunk with a 2-inch diamond drill. The depth attained in this instance was 1,2I7 feet; the cost per foot, 72 cents; the highest rate of boring per hour, 5 feet 3 inches; and the average footage per hour I.2 feet. It is interesting to compare these figures with the performance of a 6-inch calyx. The calyx hole was sunk to 560 feet. The highest rate of boring per hour was 6 feet 4 inches; the average footage per hour 1.27 feet; and the cost per foot $1.44.

It is not intended to institute comparisons between the two types of drills. The figures above are quoted merely because of their intrinsic interest. Incidentally it is noteworthy that the coal operators are the only persons securing the drills. It is surely worth while for a few of the gold-mine operators to put in a claim. Under proper control the diamond drill, which probably would do better work in the gold measures, could be utilized to great advantage.

DEEP WELLS.

The deepest well ever bored was started nineteen years ago near Rybuick, Upper Silesia, Germany. It was completed in one year and a half. The depth attained was 6,572 feet, and the diameter was from 3.6 inches to 2.7 inches. The total cost was $18,241. The mineral sought was coal.

Another well, probably the fourth deepest, was drilled near Leipsic, Germany. The diameter of the core in this case was 11 inches to 1.3 inches. The total depth was 5,735 feet, and the cost $53,076. The object sought was also coal.

The second deepest well was completed in 1905, after nine months' work. This was a diamond drill hole, sunk near Johannesburg. The depth reached was 5,582 feet, the core 2 to 1⅜ inches.

A remarkable well, the deepest ever drilled with a cable, was sunk near West Elizabeth, Pa. With a 10-inch to 6¼-inch core, this well attained a depth of 5,575 feet.

Very deep wells, in some instances exceeding 5,000 feet, have been drilled in Australia for water. From one well in Queensland a flow of 1,600,000 gallons of water a day, having a temperature of 202 deg. F., was obtained.

TITLES AND THINGS.

In the eyes of Canadians nothing could well detract more from the dignity of Coronation week than the announcement that the organizer of the Cement Merger had been decorated with a Knighthood. Of itself this might be a matter of congratulation. But when our most eminent economist, our leading educationist, and several other distinguished public men are awarded trifling honours; and upon a young man, whose business reputation is not yet cleared of a serious stain, a knighthood is bestowed, it is time to call a halt.

Knighthood and other forms of royal recognition are the rewards of outstanding service to the public. Sir Max Aitken has performed no such service. His claim to distinction is based upon a remarkable facility in organizing mergers, in persuading the public to buy securities at an enhanced price, and in reserving for himself a disproportionate share of the spoil. His spectacular irruption into English politics gave him advertisement. More advertisement, of a different nature, was given him when Sir Sandford Fleming accused him publicly of unhallowed practises in the realms of high finance. And now his name stands upon the list of those whom our King delights to honour! It is to laugh, or to weep!

"DATA."

We rise again to defend a cruelly bullied and maltreated word. "Data" is the plural form of "datum." In no circumstances is it permissible to use the word in the singular.

The writers of mining reports constantly err in this respect. An example will soon have to be made of someone. Condign punishment should be meted out to all and sundry who misuse a defenceless but extremely useful word.

EDITORIAL NOTES.

The prestige of Sir Max Aitkin has apparently suffered no abatement. Knighthood followed hard upon the heels of what promised to be a lively scandal in cement. It will be interesting if the critics of Sir Max put a daub or two upon his fresh title.

Somewhere about 11,000 sovereigns, representing $55,000 worth of gold, have been minted recently at Ottawa. The metal came from the Hollinger mill.

Practical encouragement has been offered in the shape of $5,000, for the production of safe and satisfactory types of electric lamps for colliery work. Full particulars may be obtained from the Department of External Affairs, Ottawa.

It has been stated that, if working costs remain as at present on the Rand, the end of profitable mining will be reached at or before a vertical depth of 5,000 feet. Future economies will affect new mines rather than established concerns. In six years total average costs per ton have been reduced from 29s. to 21.5s., but average profits have fallen from 6.03s. to 5.85s. The probable net profit from ore extracted at a depth of 5,000 feet is estimated at 1.575s.

The output of gold from Transvaal gold mines during May exceeded all previous monthly records. It amounted to the magnificent total of 685,951 ounces, which, interpreted in terms of our own currency, means nearly fourteen million dollars. Facts like this should squash effectually the purveyors of torrid atmosphere who compare Porcupine with the Rand. There is a long hard row to hoe yet.

BOOK REVIEW.

THE DREDGING OF GOLD PLACERS, BY JOHN ERNEST HODGSON, F.R.G.S., MANAGER ASHANTI RIVERS AND CONCESSIONS, LTD. — 65 PAGES — ILLUSTRATED— PRICE, $1.50 NET — PUBLISHED BY SIR ISAAC PITMAN & SONS, LTD., NO. 1 AMEN CORNER, LONDON, E.C., 1911.

There is a marked paucity of literature on dredging for gold. We therefore feel inclined to welcome any addition to the meagre list of books dealing with this subject.

Mr. Hodgson's book purports to be "a practical guide for company directors, property managers, prospectors, and those of the investing public who have acquired, or think of acquiring, a share interest in a gold-dredging concern." This, we fear, is too large a claim. The book is an interesting, but extremely one-sided, essay. It is tenuous, incomplete, and typically English.

By that last phrase we mean that the author exhibits the characteristically lofty British disregard of practice other than his own. His references to the Yukon and to California are meagre and insufficient. He is satisfied that English dredging represents the last word in modern placer-working. In this, of course, he is hopelessly wrong. There is a great gulf fixed between the adaptable, efficient, and highly sensitive American dredge (or "dredger"), and the clumsy Engdish and German machines. Also, there is decided difference between working costs on this continent and those obtaining in other countries.

Yet, despite its manifest faults, and in some instances because of them, Mr. Hodgson's book is edifying. It reads well, it is consecutive, it is clearly printed and well illustrated.

Personal and General

Mr. A. B. Willmott, mining engineer, Lumsden Building, Toronto, has recently completed examinations of mine properties near Fort Frances, Ont., and near the Maine border, in Quebec.

Mr. H. H. Sutherland, formerly of Nova Scotia, has taken an office in the new Standard Bank Building, corner of Jordan and King Streets, Toronto.

Mr. Myles Flynn, of New York, is in London, England.

Mr. George R. Rogers, mining engineer, of Toronto, is now in Porcupine at the Prince George Hotel. Mr. Rogers is conducting several examinations and will be in Porcupine for some weeks. One of his missions is to investigate probable methods of ore treatment.

Mr. J. B. Tyrrell has returned from the Swastika region.

Mr. R. B. Lamb, consulting engineer to the Swastika Mining Company, is in Toronto.

Mr. Kent Johnston, of London, England, is at the Albany Club, Toronto.

Mr. Stanley Lecky, of G. G. S. Lindsey and Company, Toronto, has returned for a visit to western Ontario.

Mr. Clifford Smith, mining engineer, of Brockville, Ont., is in Toronto.

Mr. Eugene Coste is moving to Calgary, Alberta.

For the reconstructed Jupiter Mining Company, Porcupine, in which the Messrs. Drummond, of Montreal, have a heavy interest, Mr. J. H. Rattray has been appointed manager and Mr. R. W. Brigstocke consulting engineer.

Mr. A. H. Brown, of Cobalt, has lately been visiting mining camps in the Boundary district of British Columbia.

Mr. R. H. Chapman, of Washington, D.C., one of the topographers of the United States Geological Survey, will again do topographical survey work on Vancouver Island, B.C., for the Canada Geological Survey. This will be Mr. Chapman's third field season in that part of British Columbia.

Prof. Francis A. Thomson, head of the Department of Mining Engineering, State College of Washington, Pullman, Wash., U.S.A., with a class of senior students in mining engineering and metallurgy, has been visiting mines and smelteries in Boundary and Trail Creek districts, B.C.

Mr. James Anderson, manager of the Ruth-Hope group and other silver-lead mines in West Kootenay, has returned to Kaslo, B.C., from a visit to England and Scotland.

Mr. Norman Fraser has resigned the position of superintendent of the Crow's Nest Pass Coal Company's Michel colliery to accept that of manager of the German Development Company's coal mining property at Brazeau, Alberta.

Mr. G. E. Farish, of New York City, is stated to have been appointed manager of the Summit mining property, in Sheep Creek camp, Nelson mining division, control of which is stated to have been purchased lately by Montreal and New York men.

Mr. W. G. Norrie, of Mr. Andrew G. Larson's office, Vancouver, B.C., will superintend mining operations at the Ikeda mine, Moresby Island, of the Queen Charlotte group, under Mr. Larson, who is the owning company's consulting engineer.

Mr. W. B. Thompson, of the firm of Thompson, Towle & Co., New York City, has been appointed a director of the British Columbia Copper Company, Ltd., in succession to Col. J. C. Reiff, deceased. Mr. Thompson is connected with several large mining companies operating in North America, among others as president of the Inspiration Copper Company, of which Mr. W. H. Aldridge, formerly managing director of the Consolidated Mining and Smelting Company of Canada, Ltd., is now managing director, and which owns a large copper mine in Arizona.

STANDARD METHOD OF WELL DRILLING.*

By Isaiah Bowman.

The largest and deepest wells put down art those sunk to obtain oil, and the heavy standard outfit, now so extensively used, acquired its essential characteristics in the development of the oil industry in Pennsylvania. In overcoming the difficulties encountered in drilling deep holes the tools have been enlarged and the several parts of the outfit have been modified and improved until the size and weight of the tools and the ease with which they are handled surprise those unfamiliar with this class of machinery.

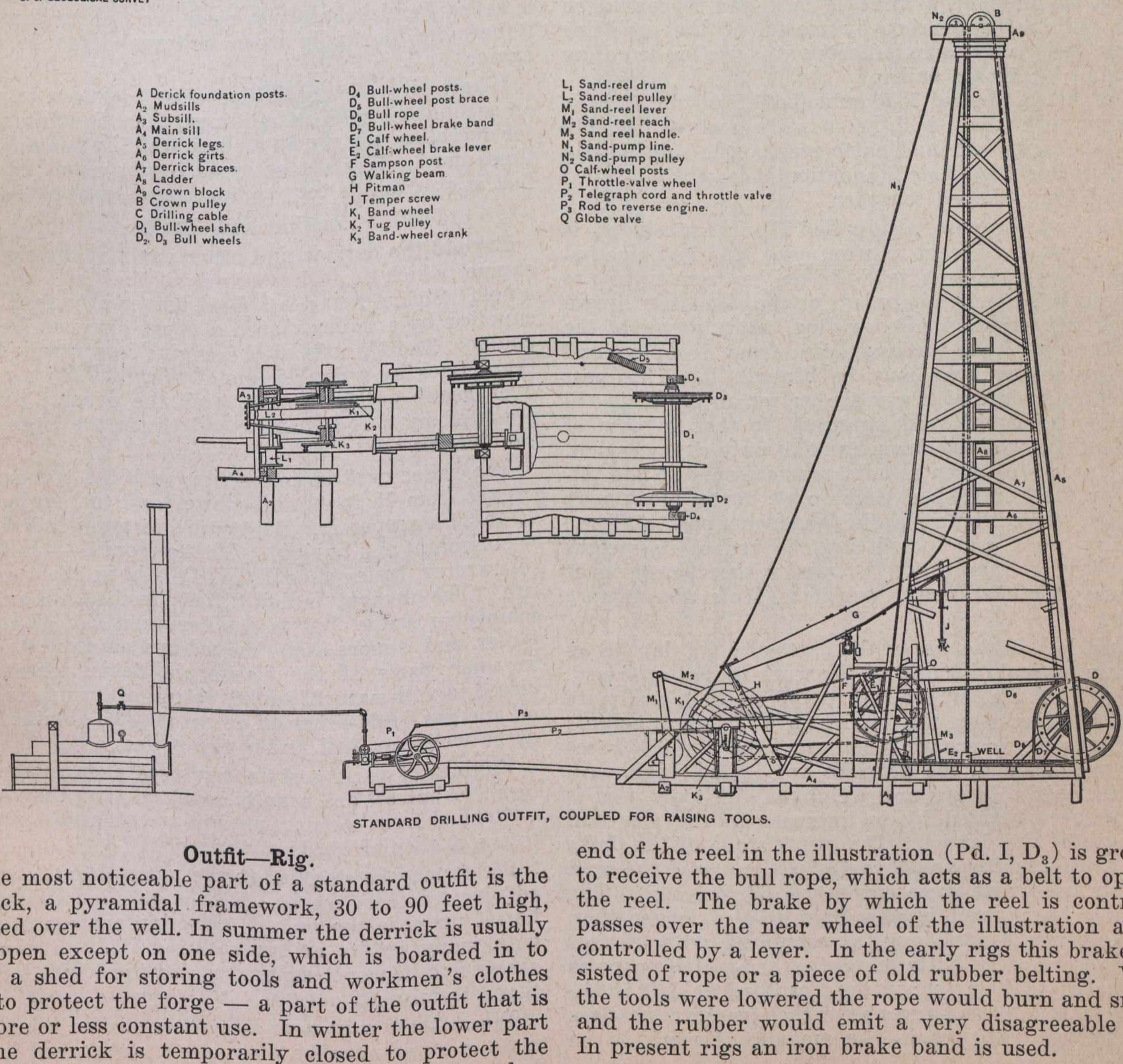
Standard outfits differ little in essential features, but hardly two can be found alike in every detail; the slight variations that exist are due not to some fancy or whim of the driller, but to the need for adapting the outfit to special conditions.

The derrick consists of four legs, steadied by girts and braces and surmounted by a crown block. In this block is set the crown pulley, over which the drilling cable passes. A ladder extending up one side of the derrick provides access to the crown block. The weight of the derrick rests on foundation posts, which are set deep in the ground to render the structure firm.

At one side of the derrick are the bull wheels. This part of the rig consists of a reel, on which the drilling cable is wound, at each end of which is a wheel, usually built up of wooden arms and segments, fastened together with wooden pins. These parts are known to the trade as arms, cants, and handles. The whole is sent firmly into the bull-wheel posts and strengthened by the bull-wheel post brace. The wheel at the farther

U. S. GEOLOGICAL SURVEY

WATER-SUPPLY PAPER 257 PLATE



STANDARD DRILLING OUTFIT, COUPLED FOR RAISING TOOLS.

Outfit—Rig.

The most noticeable part of a standard outfit is the derrick, a pyramidal framework, 30 to 90 feet high, erected over the well. In summer the derrick is usually left open except on one side, which is boarded in to form a shed for storing tools and workmen's clothes and to protect the forge — a part of the outfit that is in more or less constant use. In winter the lower part of the derrick is temporarily closed to protect the workmen. In a new territory drillers sometimes close the derrick, even in summer, to keep the results of the drilling secret.

end of the reel in the illustration (Pd. I, D_3) is grooved to receive the bull rope, which acts as a belt to operate the reel. The brake by which the reel is controlled passes over the near wheel of the illustration and is controlled by a lever. In the early rigs this brake consisted of rope or a piece of old rubber belting. When the tools were lowered the rope would burn and smoke, and the rubber would emit a very disagreeable odor. In present rigs an iron brake band is used.

In the California style of standard rig a second reel, known as the calf wheel, is placed on the side of the derrick opposite the bull wheels. It carries a cable that is used in lowering and in pulling casing. It is claimed that in deep drilling it saves much time as it

*Abstract from bulletin issued by the U. S. Geological Survey.

obviates the necessity of disconnecting the tools from the drilling cable for these operations.

Opposite the bull wheels is the samson post, usually about 14 feet long. This post is strongly braced and supports the walking beam. The derrick end of this beam is directly over the well and carries the temper screw to which the tools are fastened and by which they are fed downward. The other end of the beam carries a pitman, which is connected with the crank of the jack or band wheel by a wrist pin. This band wheel is supported on jack posts and transmits power to the several parts of the rig — to the walking beam by means of crank and pitman, and to the bull wheels through the tug wheel and bull rope. In the California rig the calf wheel is also operated by the band wheel through a second tug wheel and rope belt. The operation of the calf wheel is usually controlled by a lever and clutch, and the bull wheels are usually thrown in or out of gear by putting on or removing the bull rope.

The sand reel is just behind the band wheel and is operated by the latter through a friction pulley. This reel is mounted on a knuckle post and is controlled from within the derrick by means of the sand-line pulley, and, as its name indicates, it is used in handling the sand bucket or bailer.

The part of the rig that extends beyond the derrick rests on mud sills, which are usually sunk in trenches and have gains cut in them to receive the subsills and main sill, and the whole foundation is carefully levelled up and firmly keyed together.

The headache post, also called the life-preserver, is a comparatively recent improvement. As its name implies, its purpose is to save the driller from injury to the head if the wrist pin breaks or the pitman is thrown out of adjustment while drilling, as it prevents the derrick end of the walking beam from dropping and injuring anyone who may be beneath it. This post is usually a piece of heavy timber set on the main sill directly under the walking beam, so that in case of accident the walking beam can fall only a few inches. It is also useful when repairs are necessary to the pitman or the band wheel and crank, for a block may then be placed between the headache post and the walking beam, and the pitman relieved of its weight and slipped from the wrist pin without making it necessary to disconnect the tools from the temper screw.

Variations in the size of the parts of a rig depend on the amount and difficulty of the work to be performed. At Bradford, Pa., where few of the oil wells are more than 2,000 feet deep, the derricks are 72 feet in height; at Kittanning, where wells between 2,000 and 3,000 feet deep are common, the derricks are 82 feet high. An increase in the length and weight of the tools used is always accompanied by an increase in the size and strength of the derrick. The stems alone of the drills used at Kittanning are 39 to 42 feet long, and the sand buckets used with some outfits are 60 feet long. The walking beam used in this field is also larger than usual, being 24 feet long, as compared with 16 feet at Bradford. At Kittanning the hemp drill rope is $2\frac{1}{4}$ inches in diameter; in the Bradford field it is $1\frac{1}{4}$ to $1\frac{1}{2}$ inches. These figures show the structural changes that follow a change in the amount of work to be done.

For a 72-foot derrick about 13,000 board feet of lumber are required for the framework and wheels, and, if the derrick is closed in, about 3,000 feet of siding. In places where it is difficult to get skilled rig builders, as in the Philippines or in newly developed oil regions, bolted wood derricks are very serviceable. The timbers are all framed and distinctly marked, so that the derrick can be easily erected.

Steel derricks have not found much favour, though they are easily taken down, transported, and set up again, and offer slight resistance to the wind. The driller objects to them chiefly because of the delay and expense entailed by the necessity of sending to the supply house for repairs when a part becomes broken or twisted, whereas repairs on wooden derricks can be made quickly by unskilled labour and with cheap material. The loosening of bolts — a serious defect of the steel derrick — has been overcome, at the expense of considerable additional time in erection, by using a guard nut on each bolt.

A bolted wood or steel derrick may be set up in two or three days. Three or four skilled workmen can set up an ordinary nailed derrick in from three to five days, the time depending on the size of the rig and the quality and accessibility of the lumber; but after a nailed derrick has been used for two or three jobs it becomes too badly worn and racked to be set up again.

Where oil wells are drilled close together, or where, on account of trees or buildings, there is limited space for operation, a rig with a short walking beam is sometimes used. This rig occupies a plot about 20 by 50 feet in size, and is very compact and serviceable.

Engine and Boiler.

Beyond the derrick and other parts of the rig is the engine, which furnishes power to the band wheel by a belt. Steam power is almost universally used and is supplied by a boiler placed a short distance from the engine. The throttle of the engine is controlled from the derrick by a double line of telegraph wire passing over small pulley wheels, and the reverse lever is operated by a rod that extends from the engine into the derrick.

The boiler used in connection with the standard rig ranges from 15 to 40 horsepower and the engine from 12 to 30 horsepower. Boilers are of two general types —horizontal and upright. The horizontal — called the oil-country boiler (see Pl. I. Q)—is in most general use. The upright boiler differs from the horizontal mainly in shape, but is smaller than the oil-country boiler, and is more easily moved and set up. It is used in some parts of the California fields, where it is closed in with natural adobe instead of brick. In many oil and gas fields either oil or gas may be obtained from other wells for fuel under the boiler.

Engines of various styles are used even in the same locality, but all are usually so fitted that they can be controlled from the derrick and are otherwise adapted to the particular needs of the work.

Steam may be supplied to the pump through insulated pipe led from the boiler, or a gasoline engine may be set up near the pump. Gasoline engines are used with many outfits in Indiana and Pennsylvania and are said to be more economical and to require less care than steam.

Where there is no near-by well or stream from which a water supply can be obtained, a water well is sunk by means of the outfit before work on the oil well can be begun. The water well is usually put down immediately beneath the walking beam, about 3 feet back from the point where the deep hole will be drilled, in order to lessen the labour of drilling it and of pumping the required water. Water for drilling this well and for the boiler is hauled from the nearest available source. After a water supply has been obtained a pump is so installed that it can be connected with the walking beam, by which it is operated when water is needed.

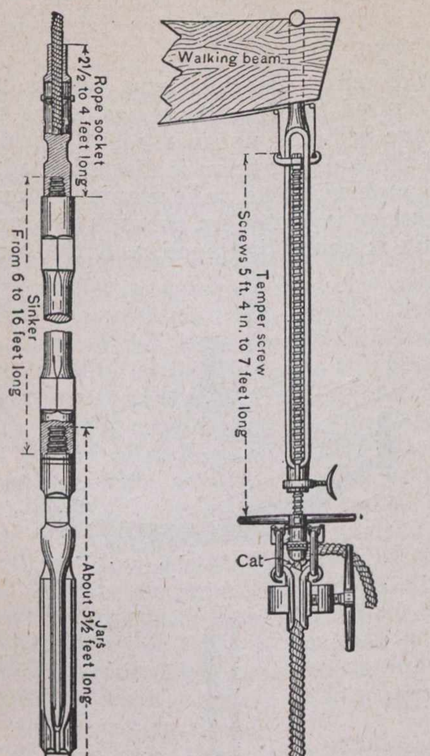


FIGURE 5.—*A*, String of tools used with standard drilling outfit; *B*, temper screw.

In the vicinity of Bradford, Pa., water is obtained from wells about 60 feet deep in the valleys and 200 to 300 feet deep in the hills. The cost of sinking water wells adds considerably to the expense of putting down oil wells.

Tools.

The string of tools used in deep drilling consists of several parts, all of which have certain definite functions and are the outgrowth of years of experience. A full string (fig. 5, A) comprises rope socket, sinker bar, jars, auger stem, and bit. Whether or not the complete string is used depends on the conditions under which drilling is done.

The socket may be fastened to the drilling rope in several ways. It may have a tapered hole in which the rope is secured by knotting; the rope and socket may be riveted together, or the rope may be threaded back and forth through several holes in the socket and secured by wedging.

The sinker bar is a long, heavy bar, which is used to add weight and length and thus aids in keeping the hole straight. It was formerly thought to be an essential part of the string, but it is now seldom used unless a wet hole (one partly filled with water) is being drilled. It then assists in sinking the cable

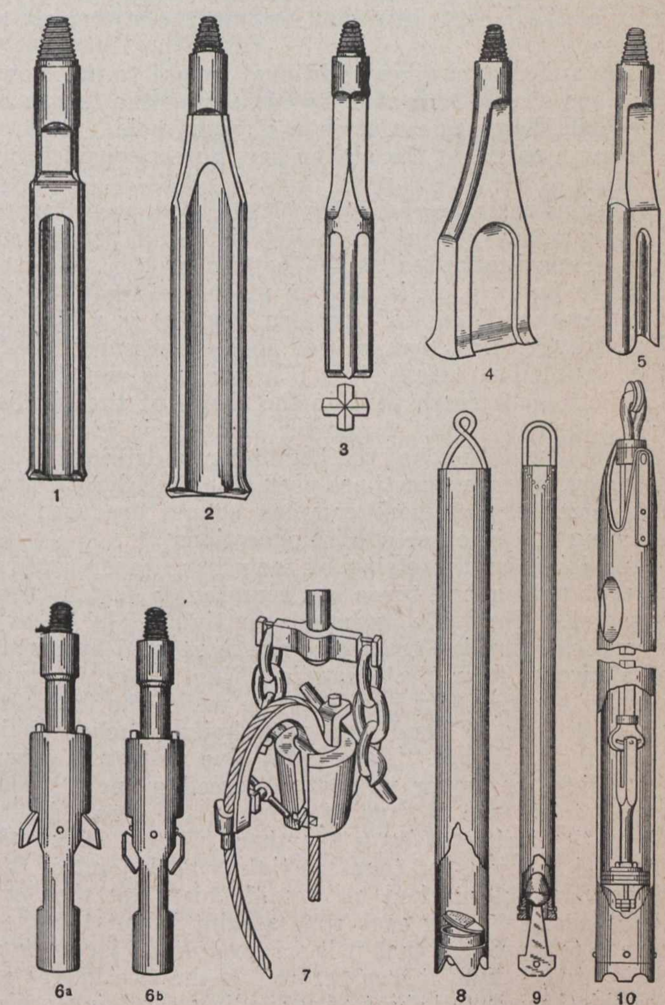


Figure 6. Drilling tools used with standard drilling outfit. 1-5, Bits; 6a, 6b, reamers; 7, rope clamp; 8-9, sand bailers; 10, sand pump.

rapidly. If it is placed between the jars and the bit, it adds force to the blows of the latter.

The jars, as previously stated, consist of a pair of linked steel bars. When drilling in rocks in which the bit is apt to stick they are necessary to "jar" the drill loose. The drill responds to the powerful upward blow of the jars as they are jerked violently together by the stroke of the walking beam when it will not yield to the slow and relatively steady pull of the rope. In ordinary brittle rock the jars are now almost universally discarded, but they have a very important use in "fishing" for lost tools; those intended for this purpose are made longer than jars used in ordinary drilling.

The jars in no sense act as a maul to drive the drill into the rock, as many people suppose. In fact, a good driller so adjusts the cable that it is impossible for the upper jar to strike the lower one except when the cable is raised. The only weight which adds effectiveness to the blow of the drill is the weight of the lower jar, the auger stem, and the drill. The weight of these three parts, or of the two last-named parts, makes up three-fourths to seven-eighths of the total weight of the string of tools. This weight, falling through a distance of several feet, is all that the drill can bear. Some inexperienced drill men give the drill too much rope, so that the bottom of the upper jar strikes into the bottom of the slot of the lower jar at each downward stroke, and in a short time the links are seriously damaged. The stroke must be carefully adjusted to the play of the jars, taking into account the stretching of the rope.

The auger stem gives additional weight to the blows that are struck, and also, by increasing the length of the drill, helps to maintain a straight hole. It is of the same shape as the sinker bar, but is considerably shorter.

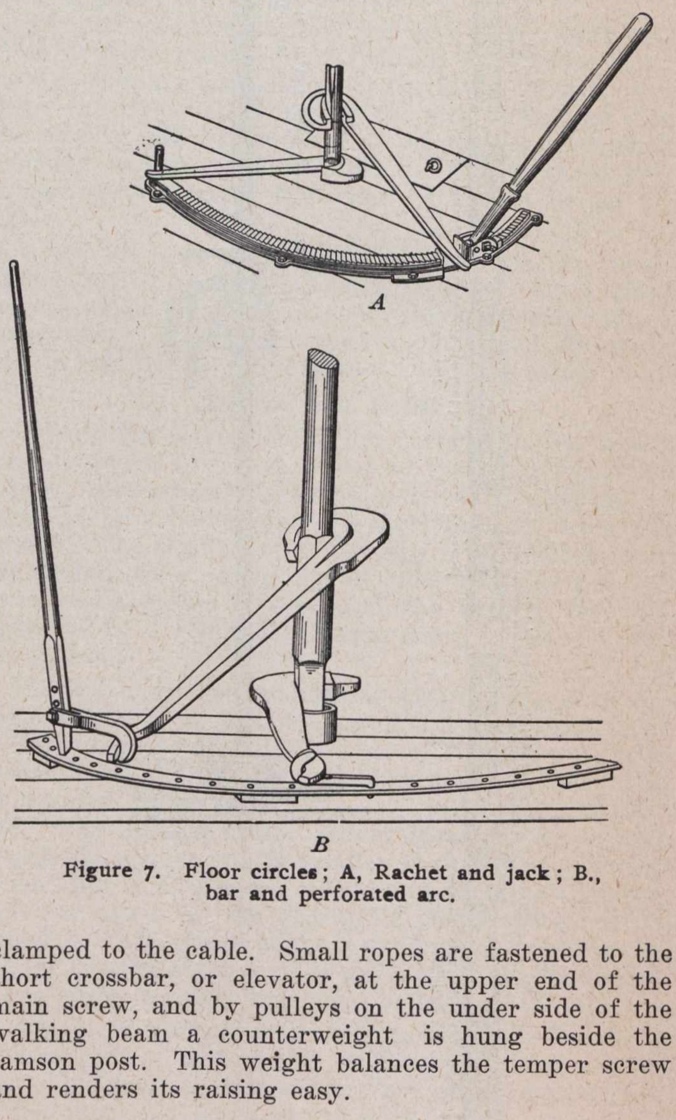
Various patterns of drilling bit are used, according to the character of the rock that is being penetrated. The shape illustrated at the bottom of the string of tools in figure 5, A, is used in moderately hard rock; the "Mother Hubbard" pattern (fig. 6^1) is a similar, but thicker, drill that is used in hard, fissured rock; the California pattern (fig. 6^2), which is concave on the bottom, is much used in the shales of the oil districts in that State. A shorter, lighter bit (fig. 6^3) is used in "spudding" at the beginning of drilling. Star bits (fig. 6^4) are sometimes used in creviced rock that dips steeply, and more complex shapes are used in reaming and in other special operations.

All joints of the string of tools have taper screws, so that only a few turns are required to fasten them together. They are screwed up tightly by heavy wrenches on which great leverage is exerted by means of a ratchet floor circle and jack (fig. 7, A), or by a simpler arrangement (fig. 7, B) in which the floor circle is an arc of band iron with holes punched in it every 2 or 3 inches. These holes give footing to a bar by which the upper wrench is forced around. The great stress that is thus brought on the screw joints binds the string of tools together. When first assembled and screwed together tightly each joint of the string may be marked by a cold chisel cut that extends across it, and each time a joint is put together care is taken to see that it is screwed up as far as or a little farther than it was before. If the two halves of the chisel mark fall short of coinciding, sand or mud in the threads may be the cause, and if this material is not removed and the joint screwed together tightly, the sand may work out, leave the joint loose, and cause loss of all tools below the joint.

Temper Screw.

The cable supporting the string of tools is connected to the walking beam by a temper screw (fig. 5, B), which allows the drill to be fed downward as the drill hole is deepened. The temper screw consists of a frame or reins, at whose lower end is a split nut held together by a yoke clamp. Through this nut the main screw passes, and to its lower end is fastened a handle, by which it is turned. Below the handle is attached a ball-bearing swivel, from which depend the rope clamps by a C clamp and is prevented from slipping by means of a "cat," made of strands of ravelled rope or strips of coarse cloth, loosely plaited or twisted so as to form a cord about as thick as a man's finger in the middle, and tapering toward each end. The "cat" is wound about the cable at the point where the clamps are attached, and the set screw is then turned so as to bring the rope clamps firmly against it. Slightly different forms of clamp (fig. 6^7) are sometimes used with wire rope.

When the screw has been run out its full length, and it is desired to bring it up again, the slack of the drilling rope is taken up on the bull-wheel shaft, the pitman of the walking beam is disconnected, and the C clamp is loosened. The yoke clamp is then loosened, the main screw is drawn up through the split nut, the yoke clamp is again tightened, and the temper screw clamped to the cable. Small ropes are fastened to the short crossbar, or elevator, at the upper end of the main screw, and by pulleys on the under side of the walking beam a counterweight is hung beside the samson post. This weight balances the temper screw and renders its raising easy.


A

B

Figure 7. Floor circles; A, Rachet and jack; B., bar and perforated arc.

Cable.

Both hemp and steel-wire ropes are now used for drilling cables, the steel wire having come into more general use during the last ten or fifteen years.

The best quality of hemp rope is that made of manila hemp (not common hemp nor sisal) and is hawser laid, that is, it consists of three ropes of three strands each, twisted together into a single rope. In its manufacture a "nap" is formed, of the ends of hemp fibres, nearly all of which point toward one end of the rope. The rope socket should be fastened to the end toward which the fibres point, for although when the tools are attached to this end the fibres spread out and retard the downward stroke in a hole that is partly filled with water, they protect the rope better from being frayed by rubbing against the casing on the upstroke.

Steel-wire drilling cable is composed of several strands wound about a hemp centre, each strand being formed of several wires. Rope consisting of six strands of seven wires each is a style commonly used.

The advisability of substituting steel-wire cable for hemp cable in drilling deep wells has been much discussed, some maintaining that hemp can never be replaced by steel, and others that steel will shortly be used altogether. The importance of the substitution of steel for hemp is better appreciated when it is known that a hemp cable ordinarily can not be used to drill more than one or two wells, but the hemp cable possesses certain important qualities which are not found in the steel cables and which must be considered in dealing with the problem. The careful driller never allows his tools to fall as a dead weight on the rock which he is drilling, but so adjusts the rope that the tools will stretch it in reaching the bottom of the hole. The nature of this action may be illustrated by suspending a weight by a piece of rubber elastic a little above a table or other surface. It will be found that by giving a slight reciprocal motion to the rubber the weight may be made to strike the surface with considerable force. Manifestly, the force of the blow is diminished by this arrangement, but in drilling this loss of force is more than compensated by the springing blow that is struck; and if the rock is easily cut by the drill this rebound is essential, as otherwise the drill will be imbedded so firmly as to make it difficult to remove except by jarring.

In drilling a deep well the stretch of the rope is often underestimated, and it may happen that the tools are falling when the walking beam is rising, thus bringing a great strain on the cable and making the blows of the drill very ineffective. The operation of the tools is rendered still more difficult when the hole contains several hundred feet of water, which interferes with the free upward and downward motion of the cable.

Steel cable, with its smaller diameter and greater weight, has the advantage of passing comparatively freely through water which may stand in the drill hole, the water friction being much less than on a hemp cable, and the water also reduces the shock of the steel cable by acting as a deterrent to the rapid drop of the tools. On the other hand, steel cable has very little elasticity, and drilling by the stretch of the rope is hardly possible. Every blow that is struck by the drill is a dead blow, as there is no compensating rebound and the upward stroke causes severe strain, both on the derrick and on the cable itself where it is attached to the tools at its lower end and to the temper screw at its upper end. The difference in stretch of the two kinds of cable is shown by the fact that with a 5-foot temper screw 7 or 8 feet may be drilled with hemp cable, while at best a distance of only 5½ feet is possible with steel cable. Some drillers use 150 or 200 feet of hemp rope between the tools and the steel rope, and this gives some elasticity to the cable and rebound to the tools.

The use of the steel cable was considerably increased during the Spanish-American war by the fact that the price of hemp cable became so high that its use seriously increased the cost of a well.

In the last few years at least half of the oil wells put down in the California fields, where the wells are usually drilled "wet," have been drilled with steel cables. In other oil fields a very small proportion of the drilling is done with steel cables. For cleaning wells, however, it has largely supplanted hemp cable throughout the east, as in this work it is not necessary to use such a rapid strike, and hence steel cable may be advantageously employed.

The standard well-drilling outfit with steel-wire drilling cable has been used to some extent in the Baku oil region of Russia, where it was found that only a very limited amount of rotation could be imparted to a wire rope without damaging it, because of the untwisting and kinking of the strands. To overcome this disadvantage a special kind of wire rope was employed, consisting of left-hand and right-hand strands plaited together. It is said that this rope worked satisfactorily in the hands of a skilful attendant, but it had to be disconnected from the main drum at each change of operations.

Drilling Operations—Spudding.

The term "spudding" is often misunderstood. By some people it has been thought to mean the preliminary part of drilling, without reference to the way in which the drilling is conducted; by others it has been interpreted to mean drilling in rock of unusual hardness. Properly, however, the term is applied to drilling without the aid of the walking beam — the method nearly always used in sinking the first 75 or 100 feet of a well, as the string of tools is too long to be operated from the walking beam in beginning work. It is possible to attach the tools to the drilling cable before the hole has been drilled to this depth, but owing to the short length of cable between the tools and the walking beam there is very little "spring" in the rope, and the hole must be spudded to a sufficient depth to allow a considerable length of cable to come between; otherwise the blow of the drill will be "dead" and the rope will be likely to break.

For spudding a short cable is run through the crown pulley at the top of the derrick, one end being attached to the bull-wheel shaft and the other to the rope socket, to which are usually screwed only the auger stem and spudding drill. The drill may be given an up-and-down motion in two ways: In the first method the rope is carried around the bull-wheel shaft in two or three turns, its end being left free. A man standing in front of the bull wheels grasps this free end of the rope and gives a slight pull, causing the coils to tighten and grip the revolving shaft, and by this means raising the tools; when the rope is slackened the tools fall. By alternately tightening and slacking the rope the operator may raise and drop the drill. The second method has come into use comparatively recently and is much more effective than the other. In this method, which is self-adjusting, the drill rope is wound firmly about the bull-wheel shaft and passed through the crown pulley, and from its end the tools are suspended in the drill hole. A rope called the jerk line is attached to the wrist pin of the band-wheel crank, brought inside the derrick, and attached to the part of the drilling cable which extends from the crown pulley to the bull-wheel shaft by a curved metal slide called a spudding shoe. (See fig. 8). By carefully adjusting the length of this rope each revolution of the band wheel results in a pull on the line and its subsequent release, and a corresponding rise and fall of the tools. As the hole is deepened the cable is let out by giving the bull-wheel shaft a partial revolution, and the spudding shoe is slipped farther and farther down, for this downward sliding of the spudding shoe increases the length of the pull on the drilling cable and hence the distance through which the drill drops. The sliding motion is imparted by the driller's assistant, between the jerks of the line, by means of a crooked stick long enough to reach the spudding shoe from the floor of the derrick.

Spudding is much harder on the derrick than is ordinary drilling, as the strain is brought on the top of the derrick where there is the greatest leverage. In drilling with the walking beam the weight comes on the samson post, which is not directly connected with the derrick, and the strain comes on the derrick only when raising or lowering tools or casing and when using the sand bucket or the bailer.

Drilling with the Walking Beam.

After the hole has been sunk to the depth required for the string of tools a heavier drilling bit is attached, the drill rope is suspended from the walking beam by the temper screw, and regular drilling by means of the walking beam is begun. To allow freedom of motion to the walking beam, 20 or 30 feet of the drill rope are unwound from the bull-wheel shaft and loosely coiled on the floor. The pitman of the walking beam is then

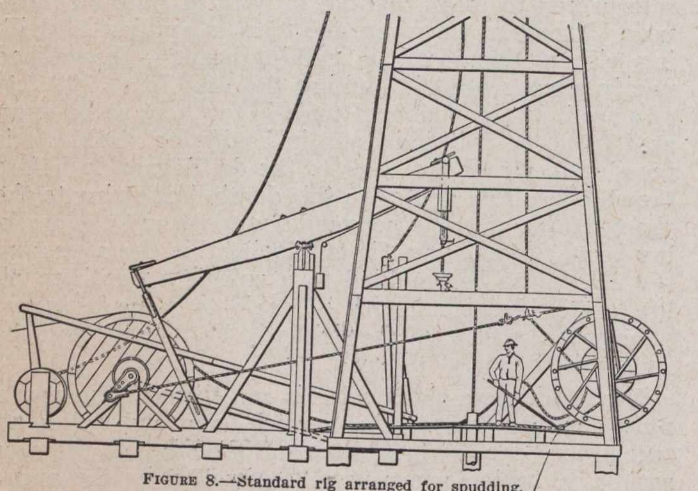


FIGURE 8.—Standard rig arranged for spudding.

fastened to the wrist of the band-wheel crank. The crank is provided with a number of holes, so that the length of strike can be adjusted to the depth of the well, a short stroke being used near the surface, as the strain would otherwise be too great for the rope to bear. The engine is then started and the walking beam begins rocking up and down, raising and dropping the tools at the rate of about 25 strokes a minute.

Until within the last few years it was the custom to revolve the drill by inserting a stick in the rings below the temper screw and slowly turning the rope first in one direction and then in the other. This was thought to insure a round hole by causing the drill to strike each time in a different place. One day a tired workman, who wondered if this operation was necessary, neglected this precaution and found that the drill still made a round hole, a fact that had often been inferred by drillers who had seen the tools revolve and bring the drill in a new position for each stroke. The drill is jerked free from the rock unevenly, and the torsion of the drilling cable under the lifting strain has the effect of rotating the tools in one direction on the upstroke and in the other on the downstroke. This action, however, takes place to a notable degree only when there is a sufficient length of rope between the tools and the walking beam; until a considerable depth is reached it is often necessary to turn the cable by hand, otherwise the drill may strike successive blows in the same place, but it is now rightly considered that after the hole is 200 or 300 feet deep it is needless to turn the rope while drilling.

The skilled workman takes hold of the rope or swivel often, for by the feel of the rope he ascertains whether the string of tools is intact and the drill is cutting the rock. When the drilling bit strikes the bottom of the well, the cable is drawn taut and conveys the vibration to the driller's hand; by this means he soon learns when to adjust the temper screw. In the same way the operator learns whether or not the jars open and shut at each blow of the drill.

The proper tension of the cable can be determined only by practice. An old cable has more spring to it than a new one; and the weight of the drilling tools, the depth of the hole, and the speed at which the machine is running must also be taken into consideration. Ordinarily the engine should be speeded up until the cable tightens slightly in advance of the stroke of the drill, not so as to retard its fall, but so that when the drill touches bottom it will be instantly lifted, with no time either to settle or stick. This careful adjustment of the stroke is absolutely necessary for rapid and skilful work. If the drill touches bottom when at rest, there is too much rope out and it should be taken up with the temper screw, for the downward stroke of the drill will stretch the rope sufficiently to let the bit strike the bottom of the hole.

The motion of the drill will be greater than that described by the walking beam, unless too much cable is let out, in which event the stroke of the drill will be less than the stroke of the walking beam, the strain on the cable will be greatly increased, and little or no progress can be made. One of the hardest things for a beginner to learn is that he can not make the drill cut faster by letting out more cable. With a hemp cable, at a depth of about 50 feet, when the drilling tools are at the lowest point in the stroke, the point of the bit should hang 2 or 3 inches above the bottom of the hole. At 100 feet it should be 4 or 5 inches; at 200 feet it should be 6 to 12 inches; and at greater distances with greater depths. An unskilled driller will sometimes allow the full weight of the tools to fall on the drill rope, the drill actually being stopped in its descent a short distance above the rock in which it is supposed to be cutting. The likelihood of such an occurrence increases with the depth of the hole, for the increasing weight of the drill rope, added to the weight of tools, often several tons in all, makes it difficult to detect by the "feel of the rope" whether or not the total weight is decreased at the end of the stroke by the weight of the tools below the jars.

As the drill cuts deeper it is necessary to let out the drill rope gradually, so that the drill will strike bottom at each stroke. This is done by loosening the yoke clamp a little, and running out the temper screw a turn or two. At the end of from half an hour to several hours the temper screw has been run out its length of several feet and the drill has advanced an equal or greater distance. The tools are then withdrawn, the waste that has accumulated since the last bailing is removed with the sand bucket, and, if necessary, a sharpened bit is substituted.

The withdrawal of the tools is accomplished by first taking up the slack cable on the bull-wheel shaft, thus transferring the weight of the tools to it through the crown pulley. The rope clamp is then loosened, the temper screw is disconnected, and the pitman is thrown off from the band-wheel crank pin, as in figure 8. By rotating the bull-wheel shaft with the engine connection, the tools may then be raised or lowered at will. This part of the work demands skill, for if the bull-wheel brake should not be applied as the tools reach the surface, the crown block and pulley would be torn loose and the tools would fall on the workmen beneath. After the tools are clear of the hole, they are swung to one side and caught in the loop of a quarter-inch rope fastened to a leg of the derrick.

The operator is now ready to bucket the drillings from the well. The sand bucket, or bailer, consists of a section of tubing 15 to 60 feet long and somewhat smaller than the well. It has an iron valve at the bottom, either of the flat pattern, or the ball and tongue pattern. (See fig. 8 9.) In some materials in which the drillings are thick and heavy and do not readily enter the bailer, a sand pump (fig. 6[10]) is used. In addition to the bottom valve this has a plunger which is worked like that of a water pump, and thus sucks the drillings into the tubing. The bucket or pump is suspended from a wire cable that is wound on the sand-line reel and carried through the sand-line pulley. The reel is operated from the derrick by a lever, which brings its friction pulley into contact with the band wheel. The sand-bucket line is thus wound up and the sand bucket is swung over the hole. The friction bearing on the band wheel is then released and the bucket is lowered into the well at any desired speed. As the drillings form a thin mud, owing to the addition of water from time to time by the driller, they rise into the sand bucket, are retained by the valve in its bottom, and are then removed. The bucket is emptied by lowering it upon an upright stake or pin beside the well, thus opening the valve.

The liquid condition of the drillings often makes it possible to drill 5 or 6 feet without bucketing; otherwise the drill would become ineffective at the end of a very short time, by striking into its own cuttings, and the necessity for frequent bailings would greatly increase the work and cost of drilling. Water is usually added to the drillings by the bucketful at the well head. Sometimes it comes into the well from water-bearing strata that have been penetrated by the drill in a quantity sufficient to soften up the drillings, and yet not great enough to interfere with the work.

In many localities water is added to the drillings by means of a barrel set at one side of the derrick, from the lower end of which a pipe extends within 2 or 3 feet of the drill hole; to this pipe is fastened, by a loose joint, another piece of pipe as long, at least, as the height of the barrel and long enough also to reach from the end of the horizontal pipe to the mouth of the drill hole. When the short length is dropped to a horizontal position water flows from the barrel down into the hole; by raising the short pipe to a vertical position the flow is shut off.

Dressing the Bit.

As the bit gradually becomes worn on the edges, its diameter is constantly reduced — that is, it loses its gauge. When the tools are withdrawn, if the bit has become noticeably worn, the screw joint connecting the bit and auger stem is "broken" by means of the wrenches and floor circle, the bit is unscrewed and removed by hand, and a freshly dressed bit is then substituted. During the first part of this operation the tools are steadied by keeping them partly in the drill hole. At this time the whole string of tools is usually examined, and each joint is "set up" in turn, as the constant and tremendous jarring to which the tools are subjected tends to loosen the different parts. Before drilling is resumed the temper screw is also screwed up or "elevated" so that it can be fed down as the drill hole deepens. The tools are then let down again and drilling is resumed.

The worn bit is heated in the forge, the circular tool gauge is slipped over while it is hot, and the edges of the drill are hammered out to fit the gauge, which has a diameter one-eighth inch greater than the required diameter of the bit, to allow for contraction due to cooling. In heating the bit it should be turned occasionally to get an even heat, and brought to a cherry red for a distance 3 or 4 inches back from the end, so that in hammering it the outer part will not tend to spall off. It is usually spread with a sledge, working from the centre to the edges, to a diameter a little larger than the gauge, and then hammered down to proper size. The edge should not be made very sharp or it will tend to drill a three-cornered hole. In tempering the end is heated until it shows bright cherry red in the shade, then placed upright in 1½ or 2 inches of water so as to cool only the part to be tempered. After a minute or two, when the edge is cool, the bit is removed until the heat flows back into the end and causes it to pass through straw, orange, and purple to a blue colour. It is then re-immersed and allowed to cool. The treatment gives the proper temper for drilling moderately hard rock. If the bit is cooled at one of the colours that appear earlier, it will be too hard and brittle to work well, and if allowed to wait longer before tempering it will be too soft. The upper (threaded) end of the drill should be thoroughly cooled before it is screwed to the stem, otherwise subsequent shrinkage may cause the joint to loosen.

As the bit becomes worn by continued drilling, the size of the hole is correspondingly decreased. In hard sandstone one-quarter to three-eighths of an inch may be worn from the width of the bit in drilling 3 or 4 feet, so that when a newly dressed bit is introduced it may find the last few feet too small, and may work hard or even stick for the first few strokes. A well-worn bit will cut a hole no larger than its shank, but a newly dressed bit provides clearance, like the teeth of a newly set saw. To prevent sticking the bit is run up and down a few times and turned constantly. It is thus prevented from forming a groove which it would tend to follow so as to direct the repeated strokes of the drill in the same place. When the rock is very hard and the bit is more rapidly worn, jars are necessary to prevent accident to the drill rope by the sticking of the drill.

Wet and Dry Drilling.

A "wet" hole is one in which water in excess of that required for the operations is present while drilling; a "dry" hole is one in which excess water is cased off during the sinking of the well. In oil fields these terms are applied in a different sense, a wet hole being a well which yields oil and a dry hole one which does not.

In a dry hole the drilling can be done faster, as the tools are not buoyed up by water; the rope lasts longer because it is not always saturated; small showings of gas and oil are more readily detected and their depths are more accurately determined; and if the tools are lost in the hole, they can be more easily recovered, as fishing tools are used to better advantage in a dry than in a wet hole. At Bartlesville, Okla., three water-bearing sands are encountered in drilling for oil. Dry drilling in that field is regarded as so much more satisfactory than wet drilling that three strings of casing are inserted to keep the water out. Two of these are withdrawn when the well is completed, the last one that is inserted being kept in service to retain the oil and prevent the well from caving.

Wet drilling is usually cheaper (there being no outlay for additional casing), no time is lost in putting in casing and replacing the tools by a smaller set; and when the well is down, the charge of nitroglycerine used in shooting the well has much greater effect, as it is tamped by the heavy column of water. The greatest disadvantage of wet drilling is that the sides of the hole are kept so wet that some of the shales are reduced to a semi-fluid mud, which frequently caves. Another disadvantage is that when tools are lost there is danger of sand and mud settling around them, even if the sides of the well do not cave.

Casing the Well—Conductor Box.

In many places the surface material consists of loose sandy clay, sand, and gravel, varying in thickness (in the Pennsylvania oil regions) from a few feet on the hills to several hundred feet in the valleys. To restrain this material, which would otherwise impede the work of drilling, a conductor box, made of plank, circular, square, or octagonal in shape, and 8 inches to 20 inches across, is sunk to the bed rock. If the rock lies only a few feet below the surface the necessary excavating is done by hand; if the soil is deep, a large drilling bit is used to spud down a hole, into which the conductor box or a section of large iron pipe may be sunk as fast as drilling proceeds.

Casing and Drive Pipe.

After passing through the surface material the drill enters the "live" rock. As a rule this rock is made up of alternating layers of hard and soft, of very porous and slightly porous, of water-bearing and non-water-bearing rock that is encountered after passing through the water-bearing layer. This casing is set very firmly into the hard layer and shuts out the water. In order to continue drilling it is necessary to use a smaller bit which will pass, with clearance, inside the casing. If other heavy flows of water are encountered at greater depths, each flow must be cased off by a string of casing extending from the surface to the bottom of the water-bearing layer. As each string must slip inside the preceding one, a smaller drill must consequently be used after each casing operation.

The first well lining used in this country was in the celebrated well drilled by Colonel Drake on Oil Creek, Pennsylvania. Some of the early drilled wells of small diameter were lined with pipe made of rivetted or soldered sheets of copper. Before long this was superseded by drive pipe with soldered brass screw joints, such as is still used in the salt wells of Tarentum, Pa.

Several varieties of casing are now used. Sheet-iron rivetted pipe is extensively employed in the Russian oil fields, but it is little used in oil wells in the United States. It is rather short lived, and the corners of the bit are apt to catch on it in drilling and cause breaks. Another kind of pipe used, known as oil-well casing, ranges in usual sizes from 4 to 12 inches, inside diameter, and is made in several weights. A third kind, called steam pipe, is also made in sizes up to 12 inches and in three grades—standard, extra strong, and double extra strong. Still another kind of lining is the regular drive pipe, which is made very heavy in order that it may be driven to great depths. The ends of the pipe are cut off smoothly and meet squarely in the middle of the sleeve coupling (fig. 9[1]). In this way the whole strain in driving comes not on the threads, but on the pipe; otherwise the joints would be disabled before reaching any considerable depth.

If a cheap well is desired, heavy wrought-iron pipe

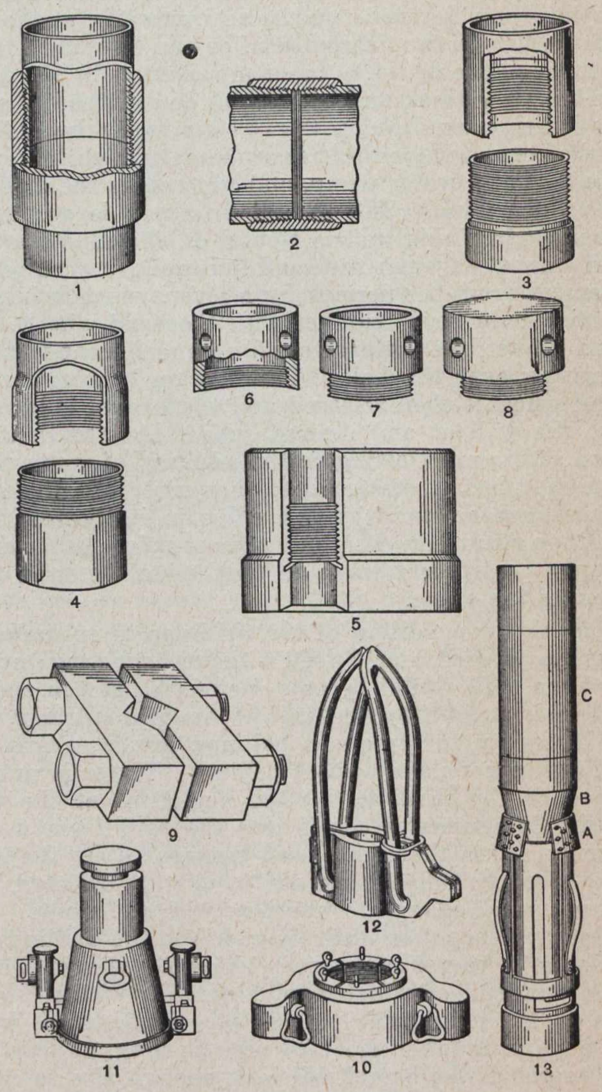


Figure 9. Couplings and casing attachments. 1, Sleeve coupling; 2, Tapered sleeve coupling; 3-4 Sleeve and inserted joint couplings; 5, Shoe; 6-7-8, Drive heads; 9, Drive clamps; 10 Pipe ring; 11 Hydraulic jack; 12, Elevator; 13, Gas packer.

is driven to rock, and the well is finished by drilling to the required depth. A casing made of sheet iron, one-sixteenth inch thick and one-half inch smaller than the drilled hole, is then used. If it is necessary to shut off sand the bottom of this pipe may be flanged outward a little. After the sheet-iron pipe has been placed in the well the heavy pipe may be pulled out and used again. If the depth to rock is not more than 50 or 75 feet and the material is all clay or earth which will not cave, the heavy pipe may not be used at all, the sheet-iron pipe serving in its stead, though its use in this way is attended by considerable risk

Casing is usually a lighter and cheaper pipe than drive pipe, as it has little outside pressure to withstand. A tapered sleeve coupling (fig. 9²) is often used with it. In this form of coupling the last thread in the tube is the weakest and most likely to break in case of accident, and the pipe is easier removed than if the whole thread remained in the tube. Flush joint and inserted joint couplings (fig. 9 ³ ⁴) are also used with casing that requires little driving. After a few wells have been sunk in a district the approximate amount of casing that will be required for a well can usually be estimated, since the depth to troublesome water-bearing formations is then roughly known.

In gas wells, where dryness is essential, all the strings of casing are usually left in the well to prevent water near the surface from sinking to the lower end of the last casing, where it would be under great head and might force its way through a weak spot at the point of juncture of the casing with the rock. As a cubic foot of water weighs about 62½ pounds, the pressure, in pounds per square inch, of the column of water in the drill hole is equal to the height of the column in feet, multiplied by 0.434. Therefore at the bottom of a well 1,500 feet deep water that enters and fills it up to the 500-foot level exerts a pressure of 434 pounds per square inch. This is the crushing stress on the pipe provided there is no internal column of liquid to counterbalance the external column, as, of course, there is not in a producing gas well.

In deep drilling, where caving material may be encountered, it is customary to sink casing, or drive pipe, as fast as drilling proceeds. For this purpose pipe heavier than the usual casing is employed, and stronger joints are made generally by heavy sleeve couplings (fig. 9¹). On the bottom of the lower joint there is screwed or shrunk a shoe of tempered steel (fig. 9⁵), which will stand heavy driving without injury, and which gives clearance for the pipe and couplings. The ordinary pipe would be greatly damaged in driving long distances if it were not protected by this shoe. To prevent the top of the pipe from being battered, a drive head (fig. 9⁶ ⁷) is screwed or placed on it. In some places the material is so loose that the tubing will follow the drill for some distance without requiring to be driven; but when driving becomes necessary drive clamps (fig. 9⁹) are bolted to the pin square of the upper end of the auger stem. The machinery is then coupled as for spudding, and 50 or 60 blows a minute are delivered by this driving clamp to the drive cap on the top of the pipe. The pipe may also be driven by a heavy wooden maul attached to the drill rope. In this case a solid drive head (fig. 9⁸) is used, and proper direction and effectiveness are insured to the blows by means of temporary guides set within the derrick.

Sometimes in drilling through a compact foundation, such as clay, the pipe becomes lodged, owing to the projection of the couplings. When this happens a cap is screwed to the drive pipe, and water is forced down it so as to come up outside of the pipe and loosen the material about the coupling.

When the pipe has been driven as far as practicable drilling is resumed. The driller endeavours to keep the hole sunk a few feet ahead of the casing, for in this way the casing is let down straight, whereas if the pipe is driven ahead of the drill, it may be deflected from its course by changes in the hardness of the material or by encountering a boulder or a layer of coarse gravel.

This method, however, can only be used where the material will stand up for some distance without the support of the pipe. Quicksand will flow around the bit and even rise in the pipe, and in this material the pipe must be driven down to the bottom of the hole and kept ahead of the drill. If the bed of quicksand is not thick, the difficulty of drilling through it will be slight, but where beds 50 or 60 feet in thickness are encountered, some of the greatest difficulties known to well engineers have to be met and overcome.

When long and difficult strings of casing or drive pipe are to be withdrawn or "pulled" from a well, as on completing or abandoning it, a pipe ring (fig. 9¹⁰) is placed over the upper end of the pipe; this ring grips the casing firmly by means of its corrugated iron wedges and is then subjected to upward pressure by specially designed hydraulic lifting jacks. (Fig. 9¹¹.) When short or easily pulled lengths are to be removed, wrought-iron elevators (fig. 9¹²) are clamped to the upper end of the last length of pipe, are caught by a hook suspended from the derrick, and are tugged upward by means of pulley sheaves.

Several machines for pulling casing are on the market. For pulling casing from abandoned wells they have the great advantage of portability, and they are cheaper and more efficient than a derrick erected over the well.

CONSOLIDATED M. & S. CO.'S RECEIPTS.

The following figures show the tonnage of ore received at the smeltery at Trail, British Columbia, of the Consolidated Mining & Smelting Company of Canada, Limited, during the expired nine months of the company's fiscal year to April 1; also the quantity of ore smelted each month, the approximate gross value of the metals contained in the same, and the percentage of gold included:

Month.	Tons. Received.	Tons Smelted.	Approximate Gross Value.	Percentage of Gold.
1910—				
July	35,641	35,138	$384,000	62.7
August	33,453	32,301	420,000	49.5
September	33,333	31,105	288,000	57.5
October	34,356	34,132	430,000	47.2
November	35,053	36,066	421,000	56.5
December	35,310	36,364	351,000	53.4
1911—				
January	34,505	32,958	349,000	57.7
February	32,323	32,315	328,000	57.8
March	35,096	34,208	365,000	54.8
Totals	309,070	304,587	$3,334,000	55.2

Of the total quantity of ore received, as above, 46,755 tons was custom ore and the remaining 262,315 tons came from the company's own mines, as under:

	Tons.
Centre Star group, Rossland	139,972
Snowshoe, Boundary	83,201
Sullivan, East Kootenay	25,362
St. Eugene, East Kootenay (concentrate)	6,129
Richmond-Eureka, Slocan	2,476
Queen Victoria, Nelson	1,984
No. 7, Boundary	1,718
Phoenix Amalgamated, Boundary	1,143
Molly Gibson, Nelson	330
Total output for nine months	262,315

The greater part of the ore from the company's mines was gold-copper, namely, 228,018 tons; the remaining 34,297 was lead-silver ore and concentrate.

SPARKS AND BRAKES

Safety in Mines.

(Reprinted from the Engineering Supplement of The Weekly Times, London.)

Among the various causes that are assigned to recent explosions in mines it is usual to include as a possibility the ignition of inflammable gases by sparks arising from mechanical friction in belts or gearing associated with the haulage plant or with the brakes used for controlling the speed of haulage. It is also suggested that with the modern tendency to speeding up the machinery used in mines this risk of ignition is increasing. The question is one for investigation rather than for dogmatic expression of opinion, and it is desirable that the evidence so far available should be examined, and that the matter should be made the subject of organized experiment.

Since Bochet in 1861 published his remarkable treatise regarding his "Recherches Experimentales sur la Frottement de Glissement" the theory of sliding friction has advanced but little. Rochet showed how tests should be made, and he indicated how results could be usefully compared by deducing certain coefficients of friction from the observations. Moreover, he determined the coefficients for various woods, leather, gutta percha, and metals, investigated the effect of moisture upon the rubbing surfaces, and generally laid the foundations of present knowledge of the subject. In the meantime a vast amount of information has accumulated regarding the energy frittered away as heat arising from friction and in regard to mechanical devices for reducing frictional losses; but we have learned very little in respect to the formation of sparks generated mechanically by abrasion. The flint and steel and its precursors have grown up with the human race, with the result that sparks are naturally regarded as fire originators. The power of the spark to cause ignition is, however, a question of degree, and what is now required is an investigation of the circumstances in which it becomes potent in causing explosions.

There is general agreement that sparks from brakes are the result of friction, but the term "friction" is often used vaguely, as though it were a constant quantity for two given surfaces, such as those between a given brake-block and a given wheel-rim. Friction is measured by the proportion which the sliding force—tending to cause relative movement between the two surfaces—bears to the pressure between those surfaces. If the sliding force and the pressure are adjusted so that the surfaces are about to move relatively upon one another, without actually moving, the proportion between them, or the "static friction," is greater than when the forces are adjusted to permit of decided movement, which corresponds with "kinetic friction." Friction, therefore, varies with the speed, and for a given pressure it is greatest at low speeds. It is usual to assume that it depends upon the total pressure, and that for most purposes it can be assumed to be independent of the area of contact. Where the heat problem is concerned, however, the question of area of contact would certainly require to be taken into account. In order to slow down a piece of mechanism the brake must rob the moving masses of energy; and with our present crude methods of retarding moving masses the whole of this stolen energy must appear as heat at the brake surfaces. The materials used for brake-blocks must therefore be such as to get rid of the heat as quickly as possible, and they must be able to withstand high temperatures. Again, it has to be remembered that with band-brake devices the friction may differ considerably at different points throughout the length of the band, owing to different radial pressures, and that heating may consequently be of a local character.

Temperature and Ignition.

The process of abrasion may be pictured as a set of impacts distributed over the surfaces in frictional contact, and succeeding one another with a degree of rapidity depending upon the rate at which the rubbing surfaces move with reference to one another. At any selected small area of the surface, these impacts —which are for the most part tangential—may be regarded as a succession of glancing blows struck by a hammer upon an anvil. The energy of the blow is resolved into (1) the energy required to shear off the abraded material; (2) the energy that heats the hammer and the anvil; and (3) the energy that heats the abraded particles. It is thus seen that the initial temperature of the particles is due to the hammer and anvil process. The subsequent temperature of the particle may arise from rapid oxidation at its new surfaces, assisted by the initial heating. Thus it is probable that the temperature of the particle at the spark stage depends upon the magnitude of the impact, the specific heat, the thermal conductivity, the tenacity constants and the coefficients of friction of the substances in contact, and the nature of the surrounding air or gas. These temperatures, in the case of such a material as iron, might be roughly estimated in certain cases from the colour and brightness of the sparks. It has been stated that the temperature of ignition of coal dust is 180 deg. C.; and one observer who heated coal dust in an air bath succeeded in igniting it at 140 deg. C. Consequently, as the tem-
which nevertheless ignite those gases because of the extremely high temperature of their flames. Again, a spark is certainly not a detonator, and the investigation would have to be extended to examine the na-
perature of a spark struck off an iron wheel may be
ture of the ignition, if any, that it produces in respect
anything up to about 1,000 deg. C., there is a clear prima facie case against sparks—provided that temperature at a single point and apart altogether from considerations of time and heat capacity is alone taken into account.

It is well known, however, that the temperature of ignition in the case of explosive mixtures is a complex function of the time and possibly of the volume. The exploding process is chemical as well as physical, and the initiation and propagation of the chemical action is not necessarily instantaneous. This principle is the basis of the theory of the so-called "safety" explosives for shot-firing in mines. In the ignition of gunpowder, for example, the flame and the gases surrounding the flame are held for a comparatively long time in contact, with consequent great danger of explosion of mine gases; and for this reason the use of gunpowder for blasting purposes in mines has had to be abandoned. It must be remembered, however, that at the other end of the scale there are explosives which, when detonated, provide very short contact between their flame and the surrounding gases, and to the rate of combustion of the gases in the immediate vicinity.

Absence of Positive Evidence.

In the more recent Home Office reports upon mining disasters resulting from explosions and fire there seems little positive evidence to support the spark theory of ignition. The Hamstead Colliery fire, which occurred in March, 1908, happened while the winding engine had broken down, leaving 250 men below ground, who had to be drawn up slowly. In the words of the report, "the pit was laid off actual coal-producing work, and was in this condition at the time of the accident." As, in addition, the evidence is definite that lighted candles were used in the mine, it is entirely unnecessary to consider the effect of mechanical friction in this instance.

In the case of the explosion in the workings of the West Stanley Colliery in February, 1909, the evidence was so conflicting that it was difficult to arrive at any conclusion regarding the cause. The official report is to the effect that at first it seemed as though the place of origin was in or about the hauling engine-house, and that to some investigators it appeared possible that it might have occurred in the engine-house itself. Finally it was considered more probable that it originated at a point in the workings where there was a heavy fall, burying beneath it the cable leading to the motor which drove the hauling drums. There was some doubt whether the set of tubs was in motion in the shaft or not at the time of the explosion, but there was agreement that dust was present, and that a full set of tubs had been hauled out against the intake air current. Among the possible means of ignition were considered open lights, shot-firing, electricity, and sparking from mechanical friction. The report concludes with a confession that it was impossible to say which of these causes initiated the explosion; but the mechanical friction theory was accounted to be untenable in view of the experiments carried out by a sub-committee of the French Firedamp Commission, who failed to ignite marsh gas and firedamp by the sparks from a mechanical drill working against hard stone, or by a dazzling and continuous shower of sparks formed by pressing a bar of steel against a rapidly revolving emery wheel.

The cause of the Wellington Pit fire which occurred in May of last year is not absolutely determined in the Home Office Report, but the conclusion is that "although there is every probability that it is attributable to a safety lamp—which may have been either in perfect or defective condition—there is not sufficient evidence available to enable any one safety lamp to be indicated." In an appendix, Mr. J. B. Atkinson states his opinion definitely that fire-damp was ignited by the flame of one of the safety lamps, and Professor Galloway says with equal certainty of expression that the fire-damp was ignited at a damaged or defective safety lamp. If the opinions of these experts are accepted the theory of ignition by friction-gear must in this case also be abandoned; but, nevertheless, the evidence and the plans that accompany the Report deserve examination by all who may study the problem of ignition in mines, for in this instance the mechanical haulage plant is described, and the position of the friction gear is shown. The fact that fire occurred in certain regions of the mine and not in others cannot, of course, be attributed to anything relating to the plant. This distribution was no doubt the result of the corresponding local chemical constitution of the mine gases, and the explanation is to be found in the Home Office Report of 1896 upon the causes of death in colliery explosions and underground fires, where it is pointed out that in most fire-damp explosions there must be, in parts of the explosion, insufficient oxygen for complete combustion.

Lines of Progress.

Thus on the whole the friction-gear theory of ignition lacks positive support, and all that can be said is that there is enough possibility of danger to justify reasonable restrictions against the use of imperfect brake mechanism. The systematic testing of metallic brake shoes for train wheels has been in operation for several years, and elaborate and powerful machines have been installed for testing at peripheral speeds up to 80 m.p.h. These machines are fitted with self-recording apparatus for giving diagrams of pressure and speed, and account is taken of the wear of the wheels and shoes in each test. Advance has also been made in the direction of providing materials which reduce sparking and dust, and it is claimed that some of the new brake-blocks possess these characteristics in a marked degree.

If a research should be undertaken regarding this question of ignition by mechanical sparks the investigators would probably find some help from analogies with what has already been achieved in respect to electric spark ignition, and at certain points the two sets of phenomena may converge. The relationship between electric spark potential and sparking distance with change of air pressure, the effect of slight impurities on the minimum sparking distance, and the change in the electric field caused by the spark itself are all suggestive of lines of research with mechanical sparking. Lastly, attention may be directed to the significant words of Bichel that "all explosives require some initial impulse in order to explode," and to the effect of detonation in accelerating combustion.

OBITUARY.

Mr. N. F. McNaught, who had been identified with mining in the Slocan district of British Columbia for eighteen or nineteen years, died at Silverton, Slocan Lake, British Columbia, on May 12. He arrived at Ainsworth, B.C., in 1892, and the following year removed to Silverton, where he had resided ever since, up to the time of his death. He was part owner of several well-known mining properties, including the Alpha, about Four-mile Creek; the Hampton, on Springer Creek, and the Kilo, on Lemon Creek, all in the vicinity of Slocan Lake. In his numerous mining activities he was energetic, and in several successful. One of his characteristics was the erection of substantial mine buildings in his several mining camps. His body was interred at Everett, Puget Sound, Washington.

The total exports from South Africa amounted in 1909 to £51,151,463. Of this total, the mineral industry contributed 80.8 per cent.

SUMMARY OF PRINCIPLES IN THE SEPARATION OF ASBSETOS

Extract from Monograph "Chrysotile Asbestos," by Fritz Cirkel, M.E.

Although the method applied in asbestos separation is practically the same in every mill, no two mills are built alike. The serpentine in the different localities varies in hardness and toughness; one quarry extracts Nos. I. and II. grade by hand; another only No. I. grade; while others have abolished hand cobbing entirely, and send the whole output of the quarry through the mill. In some mills two qualities are produced; in others four or sometimes five. These factors, combined with other minor considerations, dictate to a certain extent the course of the treatment which has to be followed, and the kind of apparatus to be employed.

In order to illustrate the working of the serpentine method generally adopted, a description of a typical mill is given, which, by reason of its simple construction, will, it is hoped, facilitate the study of the principles involved.

A plan showing the arrangement of this mill is given in Fig. 36. No. I. and No. II. crude are hand-cobbed, and the balance of the asbestos material is sent to the mill for treatment. The serpentine used is massive, and of the usual hardness as found in the Black Lake and Thetford districts. Two qualities are made in the mill, with an additional grade out of the tailings of the shaking screens.

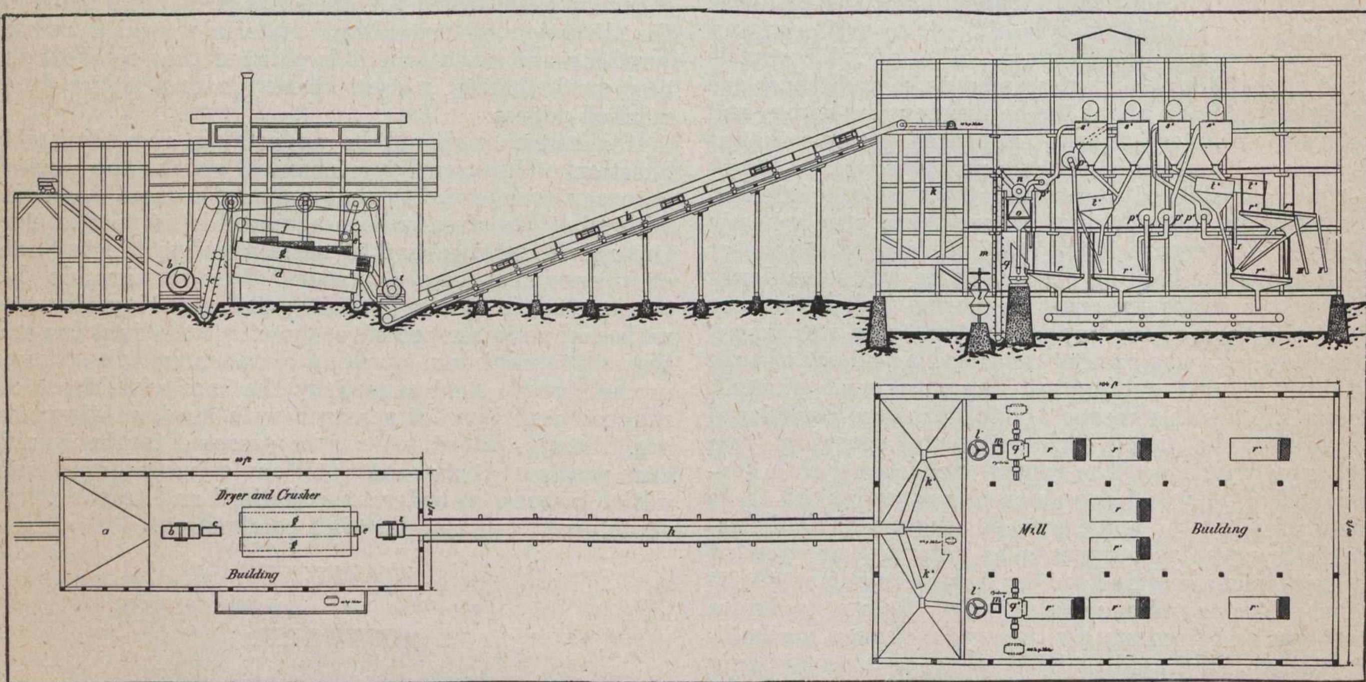


Fig: 36. **Modern Asbestos Separation Plant.**

FIRST PART OF SEPARATION.

All the asbestos rock and fines produced at the mines are dumped into ore bin (a), then crushed in jaw breaker (b), raised by means of bucket elevator (c) to a chute, which empties into rotary dryer (d). A bucket elevator (e) raises the material to a belt conveyer (f), transporting it back to the other side of the dryer and delivering it to the second dryer (g). The end of the latter is perforated, and effects a division of the rock into "medium" and "rough." The "rough" is again crushed in a second jaw breaker, while the "medium" or undersize falls directly upon the belt conveyer (h), which also takes up all the crushed material from the breaker. The belt conveyer then delivers all the crushed material to two ore bins (k^1) and (k^2), which discharge through an automatic feeder to the Butterworth and Low crusher (1). A bucket conveyer (m) discharges the rock into a fiberizer (n), and after thorough diminution the material falls on a screen (o), where a fan (p^1) takes up all the liberated fibre and deposits the same into collector (s^1). The residue from screen (o) is delivered to cyclones (q); the discharge of the latter is thrown on screens (r^1); here two separations of sand and fibre are effected, the fibre being taken up by fan (p^2) and deposited into collector (s^2), the sand disappearing under the screens into a hopper, which empties on the sand conveyer (u).

SECOND PART OF SEPARATION.

All fibre extracted from the rock is now placed in collectors (s^1) and (s^2). From here, it passes through a grading screen (t^1), having arms within, moving in opposite directions. In this screen two grades are made: long fibre thrown on screen (r^2), and short fibre (or undersize) thrown on screen (r^3). These screens effect a partial separation of the sand from the fibre; the former falling on the sand conveyer (u) and the latter being sucked up and placed into collectors (s^3) and (s^4). From collector (s^3) the fibre is again screened in revolving screen (t^2), the oversize constituting now fibre

No. I., and the undersize being again treated on an oscillating screen (r^4) in order to get rid of the sand. Whatever fibre remains on this screen is taken up by fan (p^5) and is deposited in collector (s^3).

The No. II. fibre which is in collector (s^4) goes through the same process of clearing as the No. I. fibre, described above, and the final results are a Nos. II. and III. grade, in addition to the No. I. grade referred to.

The following chart, No. I., represents in graphic form a summary of the foregoing descriptive outline of the various stages through which the longer fibre has to pass before it is ready for the market.

There are various other combinations, as will be seen from the mill schemes laid out in charts II., III., IV., and V., and, furthermore, new combinations may suggest themselves.

practically possible. We learn also that many combinations of the crushing machinery are used; but the jaw crusher always forms the initial step, followed by a rotary or Gates crusher; while the last stages of the process are practically the same in all the mills, with very few deviations.

In mill IV. a picking table is inserted between duplex crusher and elevator. These picking tables consist of an endless rubber belt of a width varying between 18 in. and 24 in.; and turning on a wide cone or pulley, with a length of from 12 to 18 feet. Boys are stationed along the belt, picking up the dead rock, long asbestos fibre, and pieces of iron, or rubbish which may have fallen accidentally into the ore. In mines which produce much crude, this arrangement is very important, as the long fibre which was hidden in the rock before breaking can be removed and saved as crude. It is also of equal im-

CHART I

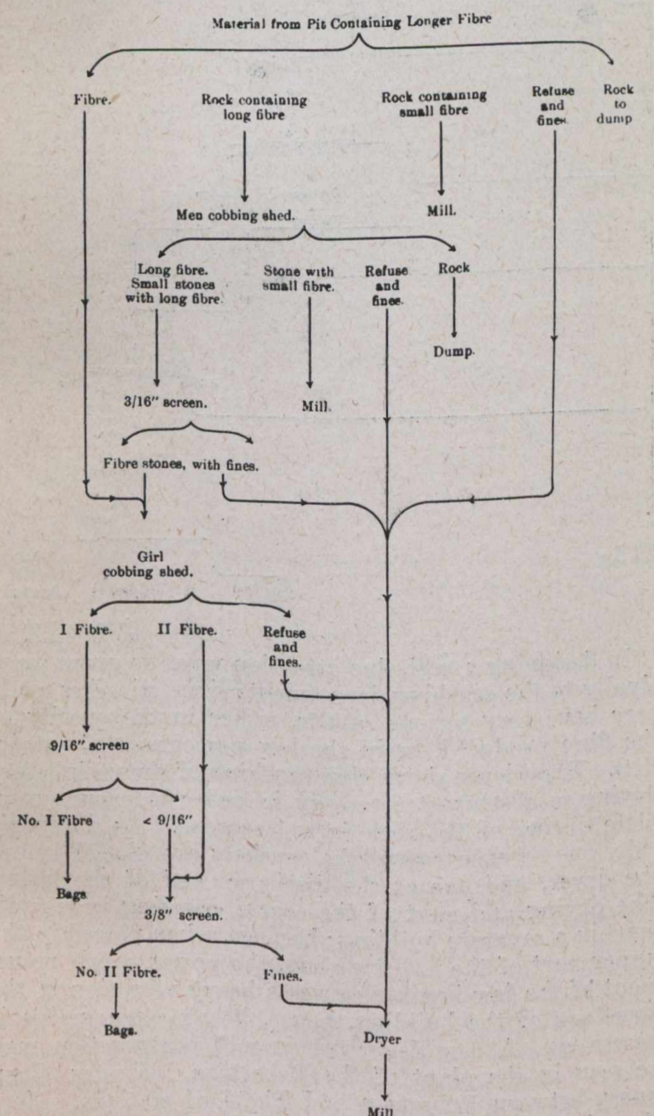
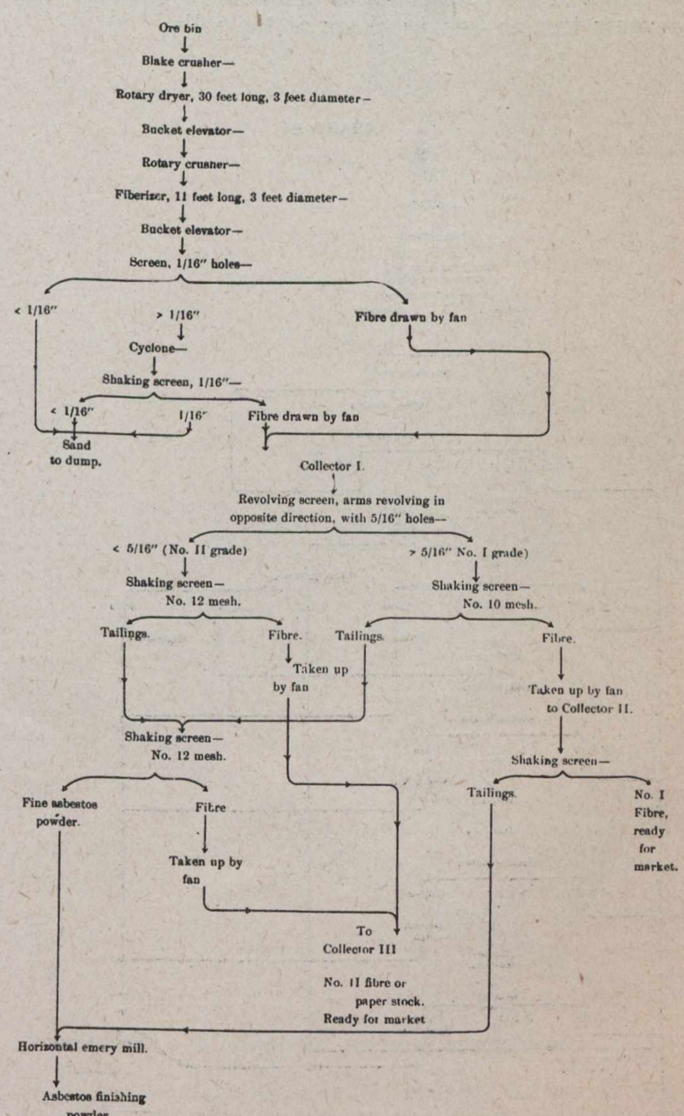


CHART II.



Theoretically, the principles introduced would allow a perfect separation of all the asbestos from the rock, and of the different grades; but practically this is very difficult to accomplish, and is rarely attained.

In looking over the above-mentioned charts, we find that the principal object in the first stages of the process is to eliminate the sand through the shaking screens, and to have as much fibre taken up by the fans as is

portance that all the rock which contains no fibre be taken out, to relieve the subsequent operations from unnecessary work.

In the extraction of pieces of steel and iron from the ore powerful magnets are employed. An effective design for this purpose is in use in some of the Montana mines[1], and its adoption in the asbestos mills of Quebec will not meet with any difficulty. The magnet can either be placed over the conveyer belt, or over the shaking screens. The metal to be removed consists of pieces of steel, bolts, track spikes, and castings from the machine drills; in fact, any iron that may get into the ore on its way from the stope to the mill.

The magnet used consists of a cast-iron part (a) 4 in. thick, 20 in. high, and 20 in. wide. It is wound with 19 layers of No. 10 double cotton-covered copper wire (c), with 2,300 turns on each pole. The current used is 5 amperes, at 125 volts. The pole faces (b) are 2 in. x 6 in. x 24 in., and are spaced 6 in. apart. The magnet is suspended from a carriage (e) and supported on a track (d) at right angles to the belt. When a number of pieces of iron are collected on the magnet, the entire apparatus is moved to one side, the current cut off, and all the iron is dropped to the floor. The magnet is suspended 6 in. to 8 in. above the belt, and is adjustable by the means of turnbuckles (f). This magnet will pick up pieces of steel weighing as much as 10 pounds; this prevents trouble and breakage at the rolls.

CHART III

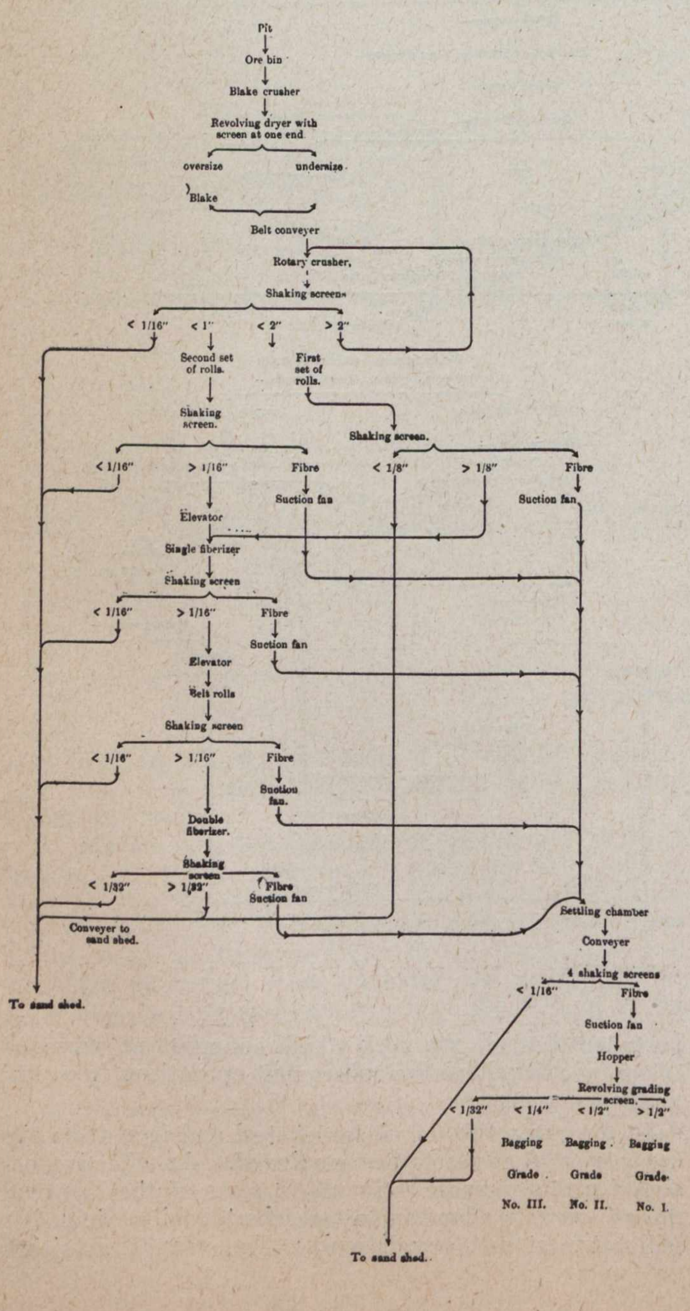
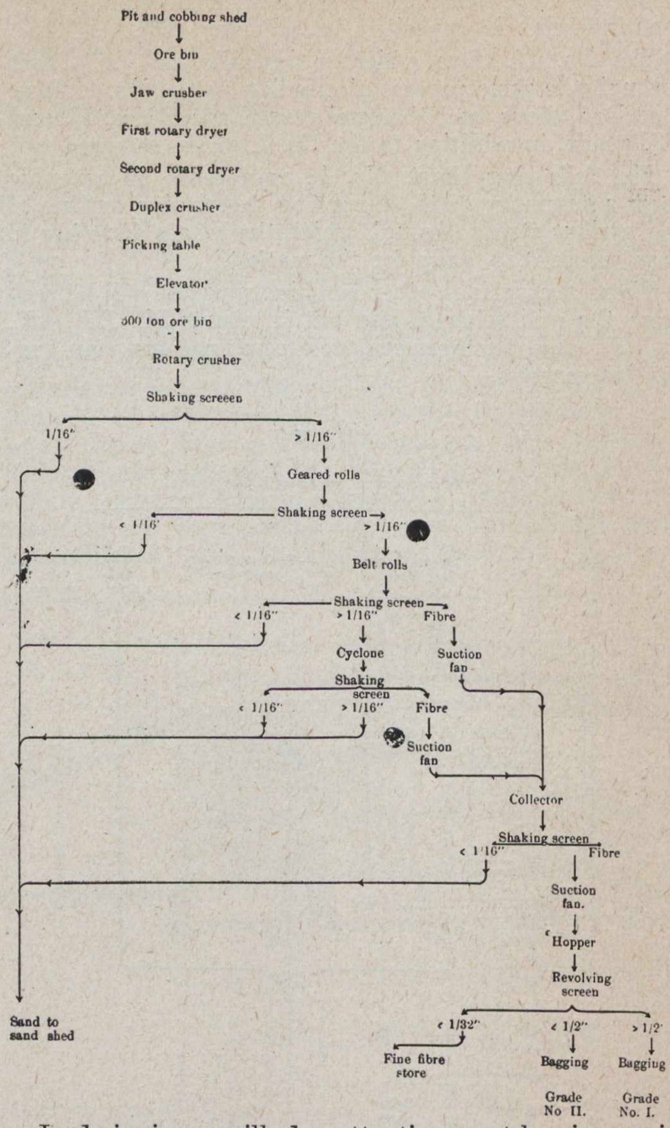


CHART IV.

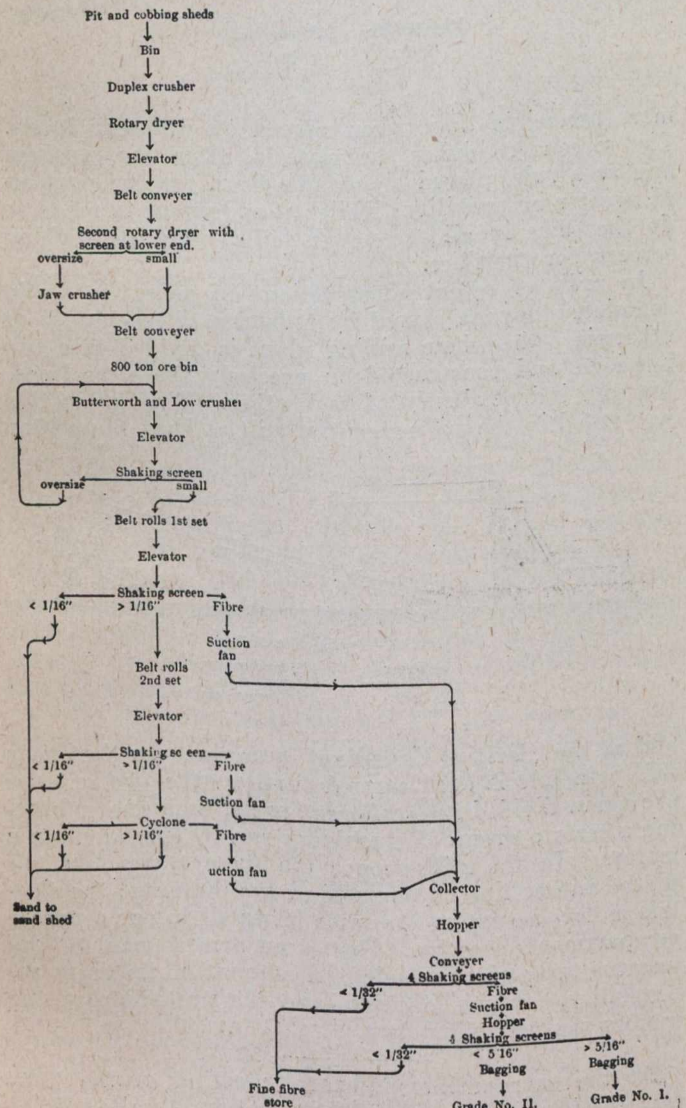


In designing a mill, due attention must be given principally to the crushing department; since mistakes made here have very serious results, either in the quality of the fibre produced, or in the low percentage of extraction. Experience shows that crushing of the rock before drying is absolutely necessary in order to ensure complete drying of the rock in wet seasons. As a general rule, one or even two Blake crushers are placed before the dryer, and one at the discharge end of the latter. The drying and most of the coarse crushing is now all done in a separate building; because, when placed in the upper part of the mill building, the power toggle movement of the jaw breaker causes a heavy vibration in the structure of the building, hence, heavy construction is necessary. A new departure in mill construction may be seen in the plant of the Robertson Asbestos Company, between Robertson and Thetford stations. Here the whole plant is divided into three parts: the dryer and crusher building; the re-crusher; and the cyclone building. This is the first time that this division in three separate departments has been made.

There are other new noticeable features in this mill. The rock coming from the dryer passes through two gyratory and one rotary crusher, having shaking screens between, for the purpose of abstracting, by means of suction, whatever fibre there has been liberated through crushing. We notice that the rock passes through not less than five different crushing apparatus before it enters the cyclone; and three in nearly all other mills; it is only exceptionally that four crushing machines are used for the same purpose. It is urged in support of this innovation that the cyclone, which receives only ore of uniform size—smaller than a walnut—will treat a far higher tonnage of ore, doing at the same time, better and more uniform work.

There can be no question that through the employment of the designs indicated above, the efficiency of a mill is increased; while much breakage in the different pieces of apparatus—especially in fast revolving machines like the cyclone—is prevented.[1]

CHART V.



Of the fiberizing machines the cyclone appears to be the most extensively used in the mills. In some of the newer mills other machinery has been introduced to take the place of the cyclone. This is shown on chart for mill No. III., where the fine crushing is represented as being done by two pairs of belt rolls, in connection with single, and double cylindrical, fiberizing apparatus. In another mill the material passes twice in succession through a set of rotary crushers and a beater of recent design; the construction of which is kept a secret. It is claimed for this new departure that the fibre is not torn up so much, and that the repairs are less, and not so costly as those in the cyclone machines.

The different grades of fibre are, as a rule, made in most of the mills at the end of the process, by sizing in shaking screens, or in revolving screens, with arms moving in opposite directions. A new departure in the extraction of the fibre from the screen, and the elimination of the sand, was made several years ago in a mill of new construction. The experiment failed; but for the novelty of the idea, and for the purpose of calling attention to the mistakes involved in its application, the device is again described and illustrated. The material after being crushed successively in a jaw and rotary crusher,

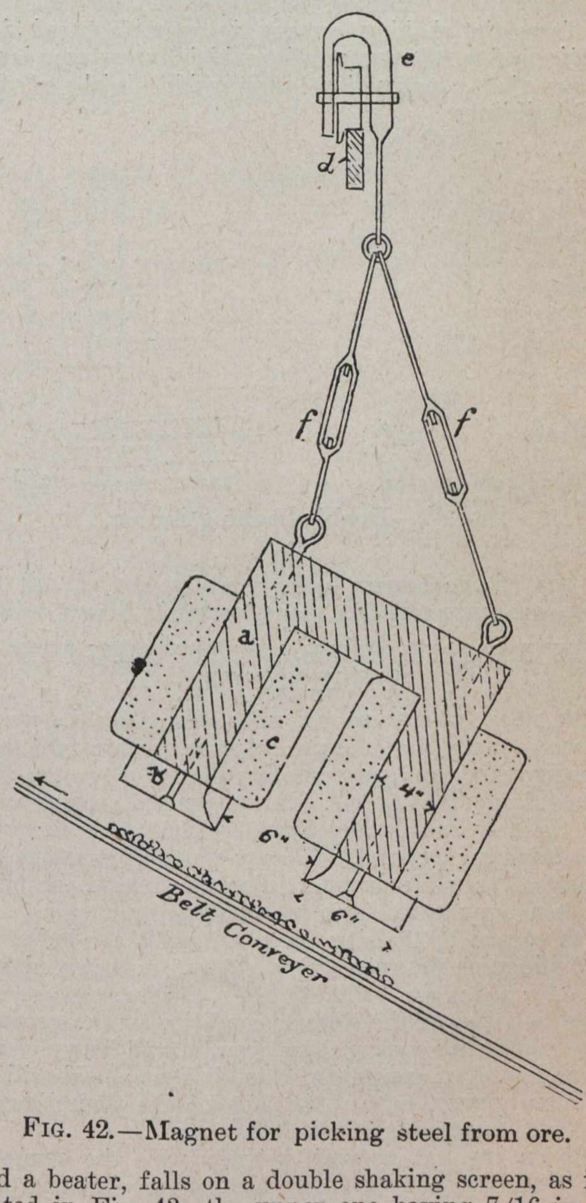


FIG. 42.—Magnet for picking steel from ore.

and a beater, falls on a double shaking screen, as illustrated in Fig. 43: the upper one having 7/16 in. and the lower one 1/16 in. mesh, allowing the sand to pass away. The fibre is graded in this way into No. I. and No. II. Each grade is taken up at the end of each screen by suction fans, and deposited in separate collectors. The overflow from both screens passes again through a rotary crusher and beater and a double screen as before; while the two grades of fibre, so produced, are taken up and deposited in collectors. The principal trouble in this device was the difficulty of

[1]Since writing the above several changes in this mill have been made, and at the same time the capacity increased from 2 to 6 cyclones.

gaining access to the lower screen: it was blocked so frequently that its usefulness soon vanished.

The sand from all the shaking screens falls generally into a long hopper, having a rubber belt conveyer at the bottom, which transports all material to the outside. Where the dumping ground is not on the same level with the mill, the sand is carried by conveyers into elevated sand-sheds or large reservoirs, from which cars are loaded and sent to the dump.

At the British Canadian quarries the sand is transported through a 658 ft. rubber conveyer to the dump; from thence it is carried away through sluicing; a turbine pump actuated by a 75 horse-power electric motor placed at the river bank furnishing the necessary water through a 6 in. main 1,000 feet long, to the top of the dump.

In the mills at Danville the bulk of the sand and tailings from the shaking screens is manufactured into *asbestic*: a fine asbestos powder which enters now largely into the construction and inside finish of fireproof buildings.

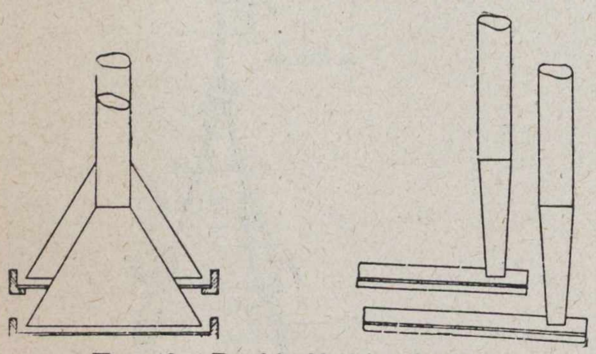


FIG. 43.—Double Shaking Screen.

In one of the largest mills recently erected, all the tailings are pulverized in giant, vertical, Emery mills.

GENERAL FEATURES OF THE MILLS IN THE DISTRICT.

With a few exceptions, the mills visited by the writer are located near the quarries: that is, within 500 feet; indicating that the transportation of the ore to the mill is a most important factor. In the general arrangement of all the newer mills due consideration has been given to the dumping ground, with a view to preventing the covering of valuable ground. For this reason the mills have been built away from the quarries.

With regard to the sites on which mills are built, we may distinguish between (1) a sloping or terraced site (Fig. 44); a flat site (Fig. 45). In the former case advantage is taken of the sloping condition of the ground, all material being conveyed by gravity, and heavy elevators are few. An example of this kind is the old mill of the Union quarry, now of the Black Lake Consolidated Asbestos Company at Black Lake.

Mills on the flat ground, however, are the common rule. The disadvantages are, that more elevators are required; which wear out rapidly; causing stoppages of the mill on account of breakage, and annoying the mill man.

An asbestos separation plant is usually designed in the form of a three or four-storey building. The ore is received in a large ore bin, placed in the upper part of the building, or in an annex: allowing the ore to pass through the crushing machinery by gravity; elevators being used between the apparatus for middlings and for recrushing. In the majority of cases, however, the ore passes on straight without recrushing in the same apparatus. Sometimes all the fine crushing apparatus and fiberizers are placed in one line and on one floor, as at the mill of the Johnson Asbestos Company at Black Lake. Small elevators convey the material from one apparatus to another; and it is claimed for this arrangement that the machinery can be watched better, and is

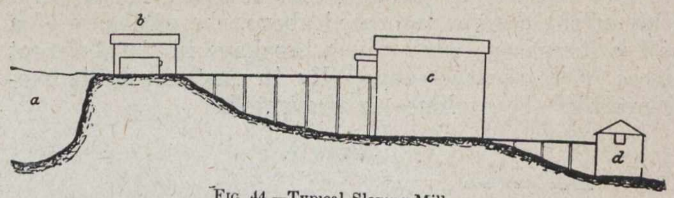


FIG. 44.—Typical Sloping Mill.
(a) Pit. (c) Mill
(b) Dryer (d) Storehouse.

more accessible than when placed on different levels. The screens receiving the material from the crushers are, as a rule, placed all on one floor, for the purpose of greater accessibility; while an endeavour is made to do the same in all the newer mills, with the shaking screens for the fibre.

In mills of recent construction—in order to avoid complete stoppage caused by breakage of machinery or otherwise—the whole milling plant is divided into two portions, and constructed on precisely the same lines; but run independently of each other. This innovation was noted in the mills recently built at East Broughton

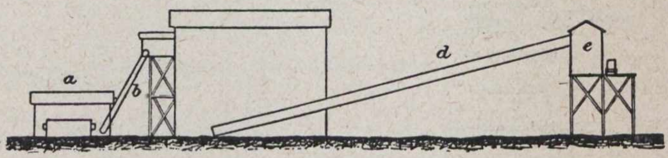


FIG. 45.—Typical Flat Mill
(a) Dryer (d) Sand conveyer
(b) Elevator. (e) Sand shed.
(c) Mill. (f) Elevated track

and at the "British Canadian" quarries. In the latter this principle is even carried further: the two sections are again divided into different parts, each one embracing a certain group of machinery run by special electric motors. In the mill proper the six cyclones are all placed in one line on one side of the building; the electric motors actuating the same being all in one separate compartment close by. This is an arrangement of apparatus to be recommended on account of its great accessibility, uniform division, and the protection of the motors against flying dust.

At the extraordinary general meeting of the Central Mining & Investment Corporation, Limited, held at No. 1 London Wall buildings early in June, the capital of the company was increased to £5,100,000 sterling. The agreement between the Central Mining & Investment Corporation, Limited, and Messrs. Werhner Beit & Company, and Messrs. W. Eckstein & Company, which provided for the purchase of several of the assets of these two well known mining firms, and which had previously been unanimously confirmed, was brought to completion. The committee appointed to value the assets taken over were Messrs. R. T. Bayliss, Otto Beit and G. Rouliot, and the values made by them were accepted. Three representatives of the French shareholders were elected to the board.

New Dominion Copper Company, Ltd.

The new Dominion Copper Company, Ltd., owns several groups of mineral claims, situated in the Boundary District of British Columbia. A controlling interest in the company's capital stock is held by the British Columbia Copper Company, so its mines are operated under the same local management as those of the latter company. Mr. J. E. McAllister, of New York, formerly general manager, is now consulting engineer, and Mr. E. G. Warren, of Greenwood, is acting general manager. The particulars that follow have been taken from the company's second annual report:

Report of Directors.

Under date New York, June 5, Mr. Newman Erb, vice-president, reported to the shareholders as follows:

"During the fiscal year ended March 31, 1911, the activities of your company were directed principally to the development of the Rawhide and Athelstan mines. Incidental thereto, there was extracted 90,000 tons of ore, of which more than 30,000 tons consisted mostly of waste left in the mines during former operations and about an equal tonnage in very low-grade ores, all necessary to be removed as part of the development work. These mines have, with the end of the fiscal year, just reached the stage for normal operation, when reasonably profitable results may be henceforth expected.

"The net expenditure during the fiscal year was $106,472.59, which is within the estimate originally submitted by the company's engineer before the development work was begun. Beside, this amount includes administration, office, legal, and other expense.

"On January 2nd last a fire destroyed the office, machine and repair shops, supply building and contents at the Rawhide mine, entailing a loss of $26,546.97, covered by insurance to the amount of $25,000, which has since been collected.

"The company acquired $16,150 par value of its bonds, which are now in its treasury. While no income was available for the payment of bond interest during the year, your directors believe that the operations for the coming year, under normal conditions, will result in sufficient income to provide for its payment.

"It is intended now to diamond drill and thoroughly explore the Montezuma and Sunset mines in the expectation that they will develop as substantial producing properties.

"The past year has been extremely unfavourable to the copper industry the world over. These conditions appear to be approaching a marked change for the better, and, with the expected improvement in the market value of the metal, substantial gains in operating results will naturally follow. While conditions have been discouraging, we are now justified in considering them as more hopeful.

"The executive is indebted to the general manager and the operating force for their intelligent co-operation, zeal, and fidelity."

Balance Sheet, March 31, 1911.

ASSETS.

Properties—mines, smelter, etc.— Cost-adjusted book value		$1,016,267.14
Permanent improvements and equipment—		
As at March 31, 1910	$306,546.56	
Additions	684.30	
	$307,230.86	
Less sales	10,772.02	
	$296,458.84	
Add transfer from supplies a/c	13,187.81	
Material overvalued or non-existent at March 31, 1910		309,646.65
Rawhide Mine construction		10,780.30
Rawhide spur—		
Book value at date of acquisition	$23,211.26	
Additions	5,678.50	
	$28,889.76	
Less refunds on shipments at $1 per car	2,344.00	
		26,545.76
Bonds purchased—$16,150 par value		8,075.00
Store inventory		22,290.63
Ore in transit		1,814.02
Office furniture at Boundary Falls— Book value at date of acquisition		500.00
Expenditure a/c claims against Dominion Copper Co., Ltd.		24,599.58
Payments a/c reorganization creditors		1,010.27
Treasury stock, as contra—par value		71,880.00
Income and expenditure a/c— Net balance March 31, 1910	$30,818.81	
Add excess expenditure for year	106,472.59	
		137,291.40
Deferred charges		420.47
Sundry debtors		18,527.69
Cash in bank and in hand		188,448.86
Contingent asset— Deposit, pending result litigation	$10,030 62	
		$1,838,097.77

LIABILITIES.

Capital stock— Authorized—350,000 shares at $5 each	$1,750,000.00	
Issued and outstanding— Issued as fully paid for property and assets of the company, 249,993 shares at $5 each	$1,249,965.00	
Subscribed in cash, 7 shares at $5	35.00	
250,000 shares at $5	$1,250,000.00	
Issued for conversion of bonds, 40 shares at $5.	200.00	
		$1,250,200.00
Ten-year 6 per cent. convertible income gold bonds issued	$500,000.00	
Converted into stock at par	200.00	
		499,800.00

Surplus—par value of 14,377 shares at $5, received from Organization Committee..	$71,885.00	
Less one share issued since	5.00	
		71,880.00
Accounts payable		13,873.18
Reserve for outstanding liabilities—		
Employers' liability	$ 924.10	
Wage claims, Dominion Copper Co., Ltd.	1,413.28	
Unclaimed wages	7.21	
		2,344.59
Contingent liability, as contra, $10,030.82		
		$1,838,097.77

Income and Expenditure A/c March 31, 1911.

Cr.

Proceeds ore smelted, as Schedule A	$55,621.80	
Add transfer Rawhide expense account	3,045.49	
		$ 58,667.29
Interest on bank balances, etc.		7,602.23
Rent of cottages		658.65
Balance		106,472.59
		$173,400.76

Dr.

Expenses at mines—		
At Rawhide, as Schedule B..$147,468.37		
" Athelstan	7,220.11	
" Brooklyn	367.98	
" Sunset	315.53	
" Idaho	256.59	
" Mountain Rose (3/4 interest)	184.49	
" Stemwinder	170.93	
On various claims	804.18	
		$156,788.18
Smelter plant expense		2,990.95
Administration and office do.		4,626.34
New York office do.		4,883.93
Legal do.		4,111.36
		$173,400.76

Schedule A—Ore Treated, Etc.

Statement showing ore treated at smeltery and proceeds of same for year ended March 31, 1911:—

Ore shipped—		
Gross tons 90,858		
Dry tons 88,613.5		
Gross value of metals		$287,527.02
Gold, 3,828.1696 oz. at $20...	$ 76,563.39	
Silver, 22,430.17 oz. at av. 54c.	12,120.53	
Copper, 1,311,880 lbs, at av. 12.25c.	198,843.70	
Less deductions		209,632.33
Off gold, 5 per cent.	$ 3,828.17	
" silver, 5 per cent.	606.02	
" copper, 2¾c per lb.	44,326.72	
Sampling cost	3,995.25	
Treatment cost	156,157.34	
Handling loss, 0.25 per cent..	718.83	
Net value		$ 77,895.29
Less freight		22,722.71
		$ 55,172.58
Proceeds of 3/4 interest in ore shipped from Mountain Rose mine		449.22
		$ 55,621.80

Schedule B—Rawhide Mine Expense.

Analysis of Rawhide mine expense for year ended March 31, 1911:—

Preliminary development		$ 10,639.35
Mining expense		58,459.39
Development—		
Drifts and cross-cuts	$14,045.92	
Raises and winzes	17,586.67	
		31,632.59
General underground		26,837.09
Tramming and bins		2,159.57
General surface		11,139.78
Construction		962.16
Addition to stable	$253.07	
Addition to blacksmith shop..	174.23	
Dry house	84.90	
Carpenter shop	190.01	
Transformer building	208.86	
Miscellaneous	51.09	
Deficit on preliminary shipments ore		3,045.49
		$144,875.42
Less ore in transit March 31		1,814.02
		$143,061.40
Net loss on supplies destroyed by fire		1,546.97
Taxes accrued due		2,860.00
..		$147,468.37

MINERAL PRODUCTION IN ONTARIO, FIRST QUARTER OF 1911.

Returns to the Bureau of Mines show the following production from the metalliferous mines and works of Ontario for the three months ending 31st March, 1910:

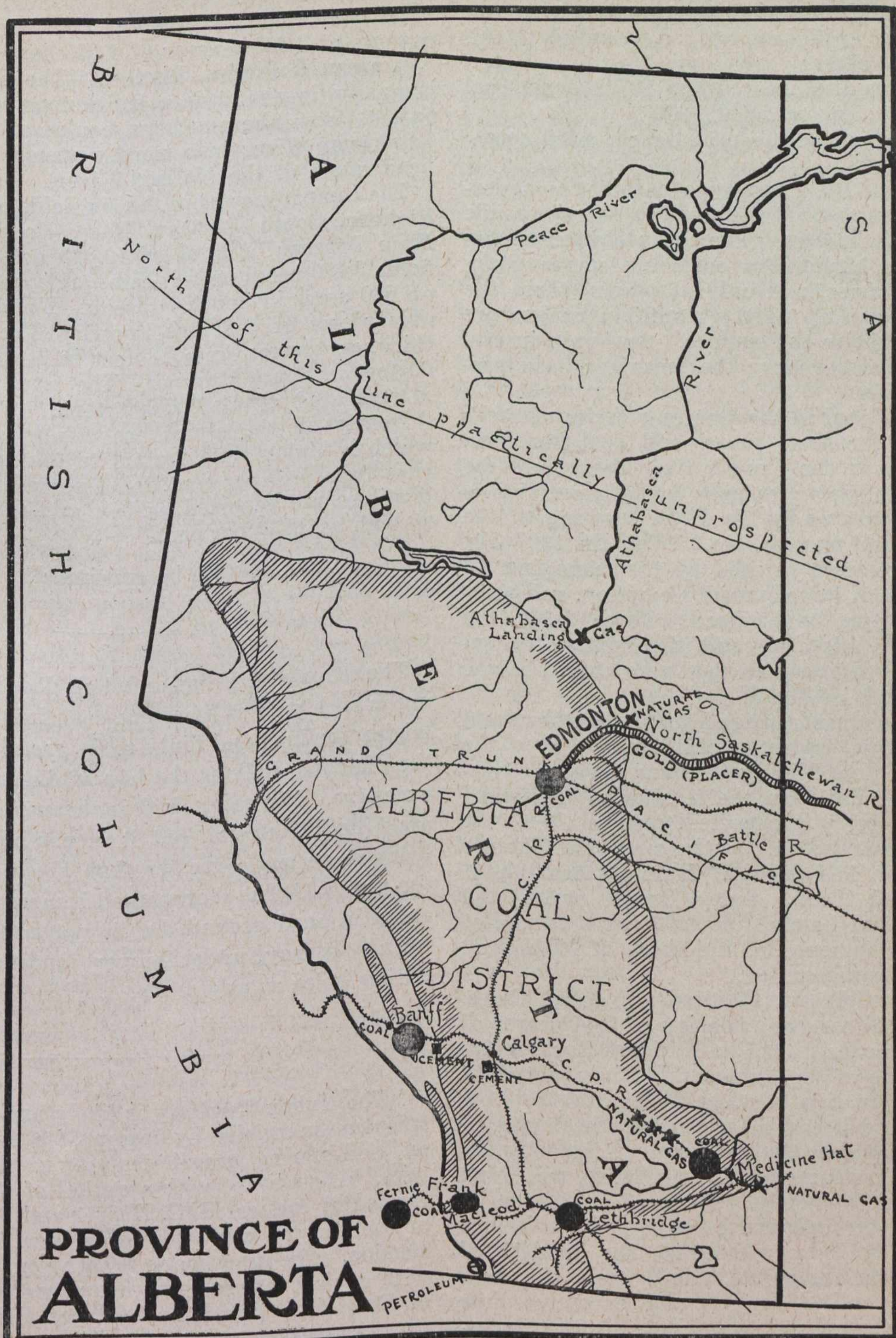
		Quantity.	Value.
Gold	ounces	1,813	$ 33,990
Silver	ounces	7,530,487	3,708,544
Copper	tons	2,121	303,240
Nickel	tons	4,124	884,992
Iron ore	tons	11,621	24,404
Pig iron	tons	115,454	1,823,717
Cobalt and nickel oxides	lbs.	107,846	29,882

As compared with the first three months of 1910 there is a decrease in copper and nickel from $357,074 and $1,131,024 respectively, and an increase in iron ore from $15,034, pig iron from $1,750,396, and in silver from 6,399,927 ounces, valued at $3,041,158.

The somewhat serious shortage of electric power at Cobalt during the quarter might have been expected to lead to a reduction of the silver output, and although power is now again plentiful the effects may perhaps be seen when the returns for the second quarter of the year are received. Gowganda and Elk Lake produced 132.900 ounces of silver during the quarter, and South Lorrain 66,795 ounces. The total shipments from Cobalt were: ore, 3,786 tons; concentrates, 1,974 tons; bullion, 2,004 pounds.

The Rocky Mountain Collieries, Brazeau Collieries, and Sixth Meridian Coal Lands.

Notes from the privately circulated Report of Chas. L. Hower, M.E.



EDITOR'S NOTE.—Through the courtesy of one of the directors of the above companies the CANADIAN MINING JOURNAL is permitted to give the following notes from Mr. Chas. L. Hower's excellent report. For some years Mr. Hower has been working in the coalfields of Alberta. His report is singularly careful and accurate.

The three groups of coal lands mentioned above are owned conjointly by Mackenzie & Mann and the German Development Co., Ltd.

Most of the property is held outright, the coal purchased, and the mining rights perpetual. Some of it is held on approved leases, with the title still pending.

All areas owned were purchased from the Government. The rights are perpetual. Ten cents per ton will be payable to the Government on all coal mined.

The leased properties are in the National Park, where special regulations are in force, or in territory acquired under the new mining regulations. These properties are held on twenty-year leases at a cost of one dollar per acre per year and a five-cent per ton royalty for coal mined.

The ultimate divisions are as follows:—

Rocky Mountain Collieries, Ltd., Kananaskis Field, coal leased, 5,440 acres.

Brazeau Collieries, Ltd., coal owned 10,320 acres, coal leased, 5,480 acres; surface, 640[1], 200[2].

Sixth Meridian Coal Lands, coal leased, 4,480 acres; surface, 6,400[3] acres.

History.—Most of the Province of Alberta is underlaid with coal; but east of the Rockies the accessible deposits are recent lignites. The Cretaceous measures carrying the true bituminous coals are under many thousand feet of cover, and only at points where the measures are thrown up in the mountain ranges are the deposits brought to the surface. And only in certain protected localities have the measures been preserved from erosion.

The existence of coal in the Kootanie series of rocks has been known for some years, and coal has been mined extensively in the Crow's Nest Pass and near Banff. Coal in the same measures in the mountains to the north was discovered by Mr. D. B. Dowling, of the Dominion Geological Survey in 1906. In 1907 Mr. Dowling's services were secured by the managing director of the German Development Company, and prospecting and staking commenced. Three fields, the Saskatchewan, the Bighorn, and the South Brazeau were staked. The Kananaskis field was staked in the National Park south of Banff.

In 1908 Mr. Dowling returned to the Survey, and Mr. James McEvoy, formerly chief engineer to the Crow's Nest Pass Coal Mining Co., was engaged. Under Mr. McEvoy's direction the territories mentioned above were thoroughly prospected, and, in 1909, the Race Creek field was staked. At the same time Thomas Russell staked the McLeod and Main Brazeau fields for Mackenzie and Mann. Later, Russell staked the Sixth Meridian Coal Lands. In 1909 the holdings of the German Development Co. and those of Mackenzie and Mann were amalgamated.

. **Rocky Mountain Collieries, Limited**—As noted above, the property of this company consists of 5,440 acres of leased coal lands in the Canadian National Park, mainly on the west side of the Kananaskis River, about 12 miles above the junction of that river with the Bow River. Sections of the coal measures have been opened at three points, first near the southern end, second near the middle of the property on Ribbon Creek, and third near the northern boundary. The coal is known to run continuously through the property, but sufficient work has not been done to establish the identity of the seams at the various points. Neither are the seam intervals uniform. The various and excessive dips are difficult to measure and to project. Basing an estimate on the coal in sight, the property contains 415,800,000 tons, figuring the workable thickness of the various seams at 50 feet. The analyses indicate a semi-bituminous coal, rather high in ash owing no doubt to the surface dirt in the samples taken near the crop.

The following proximate analyses show the character of the coal sampled on seams Nos. 5, 7, 8, and 9:

	5	7	8	9
Moisture	0.72	1.50	2.82	0.85
Volatile	16.34	11.79	19.33	12.50
Fixed carbon	71.89	69.66	65.70	73.73
Ash	11.05	17.05	12.15	12.92
Sulphur	0.87	0.79	....	0.45

Mr. Hower's estimates of production costs range from $1.37 to $1.56, depending upon whether daily outputs of 3,000 tons or of 1,000 tons be aimed at.

Brazeau Collieries, Limited.—The six areas of this company lie almost in a continuous straight line and extend from the southern banks of the North Saskatchewan River in a northwesterly direction to the headwaters of the McLeod River.

The company owns in the six fields of Saskatchewan, Bighorn, South Brazeau, Race Creek, McLeod, and Main Brazeau, a total of 10,320 acres of coal lands, holds 5,480 acres under lease, and owns surface rights on 560 acres in South Brazeau. From 17 to 21 workable seams of coal are known. The total workable thickness ranges from 13 feet in Main Brazeau up to 60 feet in South Brazeau. The total quantity of coal is estimated at 612,000,000 tons.

Nearly all the seams are coking coal. The ash, which is higher than normal to the unweathered coal, runs from 8.43 per cent. to 14 per cent. Volatile combustibles are reported as low as 22.29 per cent., and as high as 32.30 per cent.

(To be continued).

The scope of the diamond drill does not include drilling in such rock as limestone containing chirty nodules. Highly inclined and flinty rocks are also dangerous for the diamond drill, as the loss of diamonds is apt to be excessive. The calyx drill is cheaper in soft or moderately hard material, but it is not adapted to boring holes at an angle greater than about 25 degrees from the vertical. The shot method is more efficient than the calyx in hard ground, but is not adapted to soft material. It may, under proper conditions, be used for boring holes at any angle.

"The Yukon Territory is likely again to become conspicuous financially by reason of a new venture based on gold-bearing gravel deposits in the Klondike district. A syndicate, with a capital of £200,000, has been formed by Messrs. H. C. Hoover and A. C. Beatty, half of the amount being placed in New York and half in London. The intention is to bring out a company later, with a view to exploiting a number of claims situated on Dominion, Quartz, Last Chance, Eldorado, and other famous creeks near Dawson. The vendor is Mr. A. N. C. Treadgold, well known in connection with the Yukon Gold Co., an enterprise controlled by the Guggenheims. The money now raised is, we understand, to be loaned to Mr. Treadgold, who, in return, gives the syndicate the call on his rights, with a view to an issue, when it is deemed expedient. The property has been examined by Mr. W. E. Thorne, who has submitted a favourable report."—From the Mining Magazine, London.

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[1] Owned. [2] Leased. [3] Pending.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

Dominion Coal Output.

The outputs for the first half of June were very satisfactory. Although the output capacity of the mines is not quite as large as it was in 1908, the production is gratifying by reason of its steady uniformity, and the fact that it is all obtained on single-shift working. For the first twelve days of the month the output averaged well over 14,000 tons per day, which it at the rate of 370,000 tons monthly. During the latter half of the month there will be some reduction owing to the provincial elections on the 14th, and the effect of Coronation Day. Shipments were also unusually rapid. During six days over 70,000 tons were shipped over the International Piers at Sydney for St. Lawrence ports.

Colliery Wash-Houses.

The subject of the miner's bath has given rise to a large amount of discussion in the British Isles of late. It has always been a matter of surprise to mining men from the Continent of Europe to find that British miners are in the habit of returning to their homes from the pit without washing or changing their clothes. The person who suffers most from this custom is the miner's wife, more particularly as the arrangements for taking a tub in the majority of miner's houses in Great Britain are not of the best. It is certain that very little opposition will be forthcoming from the female relatives of the miner to more adequate provision at the pithead for washing and changing of clothes. The writer was for many years employed at a colliery in England at which one of the first "wash-houses" at an English colliery was erected. The wash-house was designed after the German pattern, with shower-baths and clothes lockers, and it was welcomed by the younger miners. Among the older generation of miners, however, there lingers an idea that too much washing is weakening, and in one district of England at least it is regarded as distinctly unwise to wash the backbone. One old collier that the writer remembers, while scrupulously clean in every other respect, would not allow any water to be applied over his spine, but had that portion scrubbed clean with a dry cloth.

In Nova Scotia it has been the custom for many years to provide wash-houses fitted with clothes-lockers and facilities for cleansing the upper part of the body, and they are used by practically all the underground workmen. To see the miners' bath in perfection, however, one has to travel to Germany, although "Engineering & Mining" had recently an account of a fine wash-house on the German plan which has been provided at the Marianna mine in Pennsylvania.

In many of the German collieries the miner coming from the pit, heated and perspiring, can walk directly from the pit mouth into the wash-house through a covered gangway, and is not exposed to the outside air. After his shower-bath with hot or warm water he can finish off with a cold shower, thus lessening the risk of catching cold. No one seeing the German miner on the street can tell, except by the dinner-can he carries, whether he is on his way to or from work, or whether he is merely out for a stroll. This is just as it should be.

The Coal Mines Regulation Act in Nova Scotia calls for the provision of a suitable house for changing and drying clothes at every mine employing more than 12 persons, and this is generally interpreted to mean also the provision of washing-bowls and running water. The last wash-house erected by the Dominion Coal Company at the Lingan Mines is a great improvement on its predecessors, and it is certain that so far as Nova Scotia is concerned, the colliery wash-house is not only a permanent institution, but one which will be improved as time goes on.

The following paragraph from the "Engineering & Mining Journal" of New York of June 10th may interest Nova Scotian and New Brunswick readers:

"At auction in New York, June 1, a lot including 950 shares Northern Coal Company, Ltd., of New Brunswick; 39,936 shares Kent Coal Company, Ltd., of Maine; 44,875 shares Crown Coal Company, Ltd., of Maine; 24,950 shares Great Northern Coal Company, Ltd., of Nova Scotia; 41,201 shares Great Northern Coal Company, of Maine; 960 shares North Shore Railway Company, of New Brunswick, and claim to title in 49,950 shares Maritime Coal Company, Ltd., of Nova Scotia, brought $10,500 for the lot."

This is the aftermath of the wonderful prospectuses of Dr. Hugo von Hagan, to which reference has been made at various times in this correspondence and the columns of the "Journal." It is more than probable that the person who spent $10,500 on the shares just mentioned paid all they were worth.

ONTARIO.

Cobalt, Gowganda, and South Lorrain.

While there has been a considerable falling off in the tonnage from the Cobalt camp, the first quarter's figures as published by the Government show that the silver ounces are higher than for the first portion of 1910. It is a striking illustration of the fact that tonnage plays little part now as an index of the prosperity of the camp. While there is no likelihood that any more mills will be built this year when that of the City of Cobalt is completed, the Crown Reserve and the Kerr Lake have signed contracts with the Nova Scotia and in a few months all their low grade tonnage will leave the camp by express and will not add one single pound to the ore freight carried by the T. & N. O. Railway. In addition the Nipissing is now reducing to bullion most of its high grade ore, and in a few months will have so completed its plant as to be able to handle all its high grade ore in this way. Cyanidation has increased at four mills, and the local sampling plant is every week turning out many bars for other mines.

It may now be said that the process devised by Mr. Butters for the Nipissing high grade ore is a commercial success, though it is by no means out of the experimental stage yet. The high grade ore is now being treated at the mill and reduced to bullion at a substantial profit above what would have been received had the ore been sent direct to the smelters. Mr. Butters is now endeavouring to discover a process whereby the low grade ore can be treated chemically with a high extraction and at a low cost per ton.

There is to-day more chance that Gowganda will have a railroad than at any time in the history of the Montreal River. It is hinted that the Porcupine branch will be extended south to tap some good farming land that has been located, and it is understood that it may be extended through Gowganda to connect with the Canadian Northern lines.

The recent development at the Millerett renders it likely that that property will be running with profit for its owners for many years. In their diabase area they now have an ore body 75 feet long on the 150-foot level which gives promise of a large quantity of milling ore. A vein about two inches wide, carrying 2,000-ounce ore, has just yielded a shipment of 30 tons of high grade ore. Outside this, in the country rock there is on either side of the vein a foot of good milling rock. The ten-stamp mill is now running and treating about 30 tons of ore per day. At the Miller Lake-O'Brien recent development at the 200-foot level has revealed an ore body which for richness and tonnage has not been equalled in the mine so far. All ore shipped out this summer has to be handled six times before it reaches the cars at Latchford, and nothing but the highest of high grade can be shipped at a profit.

At the Wettlaufer mine, now under the management of the Mines Finance Company of New York, it has been decided to erect a mill of about ten stamps to treat the large amount of low grade ore which has been accumulating since operations commenced. Good ore has been discovered at the 120-foot level of the Bellellen mines in the same camp. The vein, very spectacular on the surface, was lost when the shaft had been sunk a few feet on it. There is every prospect that when the gold excitement has subsided a little that considerable attention will again be paid to this now neglected silver camp.

The Buffalo annual report for the year ending April 30 shows that a little more than a million and a half ounces of silver were produced, that there is now a cash surplus of $41,000 after paying dividends of $370,000, and that the ore reserves now stand at approximately what they did a year ago, namely, 4,000,000 ounces. The president reports that but for the shortage of power there would have been a considerable increase in the production of the mine.

The Beaver Consolidated has declared a second dividend of 3 per cent., or $60,000. The company has now paid $110,000 in dividends. It is expressly stated that this dividend is not a regular quarterly, but hope is expressed that later in the year the directorate may declare a regular rate. An additional force of fifty men has been employed to push development work and a new bunk-house has been built for their accommodation. The quarterly report of the Beaver for the three months ending May 31 shows that there was then on hand $96,241, out of which the dividend of $60,000 has to be paid in August.

The St. Lawrence Mining Company has recommenced work on the Sasaginaga Lake property. A crosscut is now being run from the 100-foot level to intercept the calcite vein which dipped out of the shaft.

The Silver Leaf shaft is now being put steadily down till the Keewatin, which has been productive on the adjoining Lawson, is reached. It has now reached a depth of 465 feet.

The Temiskaming Mining Company has declared another 3 per cent. quarterly, payable July 12th. When this distribution has been made the company will have paid 38 per cent., or $924,156. Exploration at the 575-foot level has so far failed to discover any tonnage of high grade ore, though several rich streaks have been drifted through.

Porcupine, Swastika, and Cripple Creek.

It is now possible to buy a ticket into Porcupine from Kelso though until next month no passenger trains will be put on and no time schedule is published. Excellent progress is being made with the railway and steel is now laid to South Porcupine, while the right of way is being cut towards the Hollinger mines. The Timmins-McMartin and Dunlap syndicate is financing the building of the extra four or five miles, the Government refusing to make the extension without some cash assistance. The Commission will get $175,000 from the mining syndicate to build the line, will guarantee 5 per cent. of the bonds, and will pay back the amount in gross freight receipts over the extension, handing over 70 per cent. until the loan is wiped off. The power line from Sandy Falls has been completed and electricity can now be supplied to any of the properties desiring it. The Timmins-McMartin and Dunlap syndicate is going to establish a townsite on the Campbell veteran claim adjoining the Hollinger. A certain portion will be retained for the homes of the employees and the remainder sold to the public. The syndicate will bring water from the Mattagami River for the mill and the town, and as the settlement will be on a sand plain, sanitation presents no great problem.

The damage done by the fire at the Hollinger will cause a delay in arriving at the producing stage of at least eight months. Everything was damaged almost beyond repair with the exception of the compressor, the two boilers, and a storehouse. So fierce was the blaze that the men, from the superintendent downward, lost nearly all their personal effects. Until the railroad is completed or the winter roads open, it will be almost impracticable to bring in the heavy mill machinery over the present road from South Porcupine, and the attempt will not be made. In the meantime the veins laid bare by the fire are being thoroughly sampled and a reconstruction of the plant carefully mapped out. Instead of 40 stamps, at first planned before the fire, 60 will now be installed.

Excellent progress is being made with the 40-stamp mill at the Dome. It is now announced that the stamps will be dropping by the middle of October. The 12-drill compressor is now running and furnishing all the power needed both for the construction of the mill and underground. Here two shafts are being sunk in the big ore body 250 feet apart. They will be sunk at once to the 500-foot level and are both down to the 125-foot already. The Dome also had to fight fire for the whole of one day, but the force of 200 men was well organized and nothing was lost.

In the vicinity of Pearl Lake excellent discoveries have been made on the Pearl Lake Gold Mines, the Jupiter property under option to the Drummonds, and the Armstrong Booth. The Pearl Lake has a large number of showings of visible gold in small quartz stringers in the schist. On assay it has been shown in some cases that the schist carries good values.

The Jupiter, which is on the same series of veins, has a most spectacular surface showing in a quartz lead about five feet wide. Down the shaft, which is being sunk by contract, too, the free gold persists, and the assays are very encouraging. The Drummonds, of Montreal, have an option on the control of the stock, and the property is being vigorously worked. At least one of the Jupiter veins has been traced and laid bare across on to the Armstrong-Booth, and here both surface assays and diamond drill cores are very encouraging. At the end of

End of Steel early in June

Pearl Lake the Bewick Moreing and Company engineers have made their headquarters. Many of their 50 claims are being carefully trenched upon and sampled.

Sinking between a series of quartz stringers bearing free gold on the surface, the Preston East Dome struck into a four or five feet wide ore body at a depth of 40 feet. A small compressor is running and a small stamp mill is on the ground for use whenever it is required.

A good discovery has been made on the property of the Scottish Ontario syndicate, in Whitney. A shaft was sunk on a small vein and about twenty feet down the vein widened and became enriched.

Some spectacular samples from Bristol Township, west of the Cripple Creek camp, have caused a stampede into that section. It is stated that some months ago the original discovery was made and is now under option to an American syndicate at a long price. So far Cripple Creek, while yielding some remarkably good assays, has been able to show very little free gold.

Several good discoveries have been made on the Swastika camp in the last two or three weeks, and the competition for claims is growing. West of the Swastika mine some six miles the report of a big silver find precipitated a crazy stampede, but nothing but diabase has been discovered so far. The Swastika Company has definitely ordered its large plant, but will not increase the size of its mill until further exploration work has revealed adequate reserves of ore.

BRITISH COLUMBIA.

The Board of Conciliation and Investigation appointed to investigate matters in connection with the failure of the Western Coal Operators' Association and the officers of District No. 18, United Mine Workers of America, to agree as to terms and conditions under which the miners and other employees will return to work in the coal mines and at the coke ovens of Alberta and southeastern British Columbia, resumed its sittings on June 7th after having been in recess about a month. Little progress toward a settlement of the several points in dispute between the operators and the representatives of the miners seemed to have been made by the middle of June. The Operators' Association has lately been joined by the McGillivray Creek and Canada West Companies, both operating in Alberta, the former near Coleman, and the latter at Taber.

Apropos of this labour difficulty, Mines and Minerals, of Scranton, Pennsylvania, published in its June number the following, under the caption of "British Columbia Labour Troubles." "At this writing the labour troubles in the Northwest are unsettled and operators are preparing for a period of idleness. The railroads are contracting for coal in the United States. Large shipments will be made over the Great Lakes into Canada. The Great Northern Railway Company is seeking to place contracts for coal in the States of the Northwest. Under these circumstances it will not be long before the operators and miners settle their differences by arbitration." Unfortunately, though, this long-distance guess does not at present seem likely to prove a correct one.

Cariboo.—A press despatch from Barkerville, Cariboo, states that a London syndicate, represented locally, has secured an option on the hydraulic placer gold claims held by the Guggenheims, and formerly the property of the Consolidated Cariboo Hydraulic Gold Mining Company, of which Mr. John B. Hobson was manager. The property is situated at Bullion, in the vicinity of Quesnel Forks. When the Guggenheims bought out the interests of the Consolidated Cariboo Company they planned to make ample provision for a much enlarged supply of water for gravel-washing. Construction work was carried on until a comparatively large sum of money—stated at about $200,000—had been expended with the object of bringing in much more water, when operations were stopped, and afterwards the big hydraulicking plant and a large quantity of material on the property were sold. Understanding that the hydraulic leases had been forfeited, Mr. Hobson, who still has confidence that with sufficient water available the enterprise can be made a profitable one, made application for some of the ground and commenced work on it with the small quantity of water then obtainable. The Guggenheims, however, paid up the arrears of rent, etc., due to the Provincial Government, and successfully made application to the court for an injunction against Mr. Hobson's working the property. Since then it has been idle, and Mr. Hobson has turned his attention to another hydraulic property in the same neighbourhood.

Sheep Creek.—The Hon. Thomas Taylor, Minister of Public Works for British Columbia, recently visited Sheep Creek camp, in the Nelson mining division. The journey was made from Nelson to Salmo by train, and thence to the camp by auto stage, the run from Salmo to the first mine visited having occupied an hour and a quarter. Upon his return the Minister said, when interviewed by a representative of the Nelson Daily News: "This is the first occasion for some years upon which I have visited a mining camp such as Sheep Creek camp is, and it reminded me of the old-time boom days. As we sped along the road to the camp we passed many teams conveying supplies to the mines, and we saw a large number of men in the hills and at the mines. I was told that there are at present at least 400 men in the camp. Sheep Creek camp is certainly making remarkable progress and seems destined to have a great future. It is a real pleasure to me to see the waggon road the Provincial Government has constructed being made so much use of. Obviously it is proving of great benefit to mine owners and prospectors."

Mining in Sheep Creek camp is being proceeded with actively. The owners of the Queen are developing that mine at greater depth than in the past. The Mother Lode, owned by Mr. John McMartin and associates, is being provided with a mill and other gold-saving facilities. The Nugget is to have a 20-stamp mill in place of the 4-stamp mill it has heretofore used. The Kootenay Belle will also be in a position before long to mill its ore. A majority interest in the Summit has been sold to Eastern men, and several other claims are being developed with encouraging results.

Kaslo.—A local syndicate has purchased from the Great Northern Railway Company the Kaslo & Slocan Railway, which was much damaged by forest fire last summer along its length from Sproules to McGuigan, thus depriving the Whitewater group, Lucky Jim, Rambler-Cariboo, and other mines on the divide between Kootenay and Slocan lakes of convenient transportation facilities. During the interval between last summer and the recent negotiations for the purchase of the K. & S. Railway, the Canadian Pacific Railway Company had been urged to construct a spur from its Sandon-Nakusp branch at Three Forks up Seaton Creek towards the summit of the divide, so that ore might be shipped in considerable quantity from the Rambler-Cariboo and Lucky Jim mines, both of which had been practically deprived of income by the destruction of the railway that had long transported their ores to Kaslo for shipment thence to the smeltery. It is understood that arrangements had been entered into and the C.P.R. was arranging preliminaries, so that construction could be pushed during the summer and autumn. Now the new owners of the K. & S. are appealing to the C.P.R. Company to hold its hand and not proceed with the construction of the promised spur, for if this be built it will take away the chief freight traffic the K. & S. would otherwise obtain, and so prevent the operation of the line under its new owners. It is stated to be probable that the C.P.R. will postpone construction of the extension from Three Forks, and thus leave this small field for the support of the K. & S. Railway, upon the continuous working of which Kaslo will have to depend for much of its general trade and commercial support.

Boundary.—As the first half of the year draws to its close it is regarded as probable the total output of ore for this period will reach an aggregate of about 750,000 tons, and this notwithstanding that the Granby Company's mines will have missed nearly a month's output, and that the Consolidated M. & S. Company has not latterly shipped any considerable quantity of ore from its district mines.

The British Columbia Copper Company continues to draw its chief supply of ore from the Mother Lode and Rawhide mines, with much smaller quantities from the Wellington and Athelstan mines, both in British Columbia, and the Lone Star and Napoleon mines, situated just south of the international boundary line. This company is about to commence development work at the McKinley mine, in Franklin camp, about 50 miles above Grand Forks. The Geological Survey has a field party at work in Franklin camp, obtaining data for the preparation of a map of this part of the Boundary district.

Provincial newspapers have lately stated that the British Columbia Copper Company's dividend, payable on June 1, was at the rate of 2½ per cent. and totalled $62,875. The Engineering and Mining Journal shows the dividend distribution to have been at the rate of 12½ cents per share on the company's

591,709 issued shares, making a total for this dividend of $73,-963.63. Dividends previously paid by this company were: one at the rate of 40 cents per share in September, 1907, on 503,000 issued shares, total $201,200, and one of 12½ cents per share on March 1, 1911, on 591,709 shares, total $73,963.63. These three dividends give a total of $349,127.26. It may be explained that during its fiscal year, ended November 30, 1909, the company issued 88,709 shares of its treasury stock in part payment for the controlling interest it then acquired in the New Dominion Copper Company.

Coast.—Announcement has been made of the intention of the Vancouver company which last year acquired the Ikeda mine, on Moresby Island of the Queen Charlotte group, to do more development work on this property. Prospecting the coal measures occurring on Graham Island, of the same group, is in progress on several properties.

Coal mining on Vancouver Island is on a gradually increasing scale. Both the larger companies, namely, the Canadian Collieries (Dunsmuir), Limited, and the Western Fuel Company, are extending their development operations, with the object of opening new coal-producing areas in their respective large holdings of coal lands.

Copper mining in the southern part of the Coast district is being continued on Texada Island—at the Cornell mine, by the Tyee Copper Company, and at the Marble Bay mine, by the Tacoma Steel Company—and at the Britannia Mining and Smelting Company's Britannia mines, on Howe Sound. The last-mentioned company is showing persistent enterprise in continuing the extensive exploration of its large group of mineral claims. While no official information has been made public, it is freely reported that results lately have been encouraging.

COMPANY NOTES

DOMINION COAL COMPANY, LIMITED.

Report of the Board of Directors.

Presented to the shareholders at the annual meeting on 19th May, 1911.

Your directors submit herewith a statement of the affairs of the company as at 31st March, 1911, and of the earnings for the fifteen months then closed.

Change in Financial Year—In order that the annual meetings of the shareholders of the Dominion Steel Corporation, Limited, and of its subsidiary companies may be held at the same time, your directors have changed the financial year so that it ends on 31st March instead of 31st December. The report now presented covers the period from 1st January, 1910, to 31st March, 1911.

Business of the Year—The strike which was in existence at the date of our last annual meeting was abandoned by those concerned at the end of April, 1910, and as soon as possible thereafter full operations were resumed at the collieries.

The output was as follows:

For the 12 months ending 31st December, 1910, 3,526,754 tons.

For the 15 months ending 31st March, 1911, 4,412,639 tons.

The output in the preceding year, January to December, 1909, was 2,734,774 tons, and in 1908 3,555,068 tons.

Earnings—In considering the statement of earnings your directors would remind you that the period covered by the report includes four months in which the strike existed, that even when ended it was many months before the disorganization which it caused ceased to be felt, and that an extra winter period—December, 1910, to March, 1911, is included, during which earnings are necessarily small. The net result, under these conditions, is in your directors' opinion reasonably satisfactory.

Property and Plant—The capital expenditure on the company's property during the 15 months amounted to $784,366.92, chiefly for work on the new collieries in the Lingan district, and for additional railway equipment. It has been thought well to transfer $500,000 from profit and loss account as a general appropriation in reduction of the property account.

The company's plant is in very good condition, and your directors look for an increased production in the current financial year.

Cumberland Railway and Coal Company—During the year the Dominion Steel Corporation, Limited, came under agreement to purchase the entire capital stock of the Cumberland Railway and Coal Company, and an agreement for the lease of its property to this company was entered into, under which its collieries are now being operated as collieries of the Dominion Coal Company, Limited. Their output is not included in the tonnage reported above.

The Cumberland Company owns large and valuable coal areas in Cumberland County and in Cape Breton; it has two collieries at Springhill, a well-equipped standard gauge railway from Springhill Junction to Parrsboro, 32 miles in length, a large area of timber lands, and other property.

A strike has been in existence amongst its employees for some time, but your directors hope that the reasonable attitude of the executive, coupled with the refusal of your directors to recognize in Cape Breton the United Mine Workers Association of America, of which it is sought to enforce recognition in Springhill, will shortly lead the men to take more reasonable views.

Changes in the Board—Mr. James Crathern, who was a director of the company for some years, died in June last, much regretted by his colleagues on the board and by his many friends elsewhere. The vacancy caused by his death was not filled. The vacancies caused by the death of the Honourable L. J. Forget and Mr. H. F. Dimock, elsewhere referred to, were filled by the election of the Honourable Senator Dandurand and Sir William Mackenzie.

Staff—Your directors again desire to record their high appreciation of the services rendered to the company by its officers and employees.

On behalf of the Board of Directors,

J. H. PLUMMER, President.

Montreal, 9th May, 1911.

Profit and Loss Account for the fifteen months ending 31st March, 1911.

Net earnings from operations after payment of all expenses and current repairs		$2,118,686.65
Appropriation for depreciation and renewals		500,000.00
		$1,618,686.65
Interest on Bonds	$386,682.10	
Interest on Loans	51,151.71	
		437,833.81
		$1,180,852.84
Balance from previous year, viz.:		
Amount shown at credit of profit and loss account 1st January, 1910	$394,419.42	

Received from Steel Company for adjusted price of coal, November and December, 1909	26,758.73	421,178.15
		$1,602,030.99
Less:		
Dividends on preferred stock, 2 half-yearly payments of 3½ per cent. each	$210,000.00	
Dividend on common stock, 1 per cent. paid 1st April, 1910	150,000.00	
Payments to capital fund of Miners' Relief Society	21,000.00	
Reserved for preferred stock dividend	52,500.00	
Written off property account	500,000.00	933,500.00
Balance carried forward		$668,530.99

Balance Sheet, 31st March, 1911.

ASSETS.

Properties and investments		$24,359,132.29
Current Assets:		
Inventories	$1,035,183.83	
Accounts Receivable	699,542.44	
Cash on hand and at credit	10,600.56	1,745,326.83
Deferred Charges to Operations:		
Insurance, taxes, and steamship hire paid in advance		113,043.72
		$26,217,502.84

LIABILITIES.

First mortgage 5 per cent. Bond: Total issued		$6,300,000.00
Cape Breton real estate debentures:		
Total issue	$480,000.00	
Less matured and paid	392,113.30	87,886.70
Dominion rolling stock debentures:		
Total issue	$380,000.00	
Less matured and paid	331,470.75	48,529.25
Mortgages		50,000.00
Total bonds and mortgages		6,486,415.95
Current Liabilities:		
Accounts payable, royalty on coal, etc.	$688,609.09	
Bond interest accrued	131,250.00	819,859.09
Reserve Accounts:		
Accrued dividend on preferred stock	$ 35,000.00	
Sundry reserves	207,696.81	242,696.81
		$7,548,971.85
Capital Stock:		
150,000 shares of common stock $100 each	$15,000,000.00	
30,000 shares of 7 per cent. preferred stock, $100 each	3,000,000.00	18,000,000.00
Profit and loss account		668,530.99
		$26,217,502.84

Certified correct,

R. GORDON, Comptroller.

JUPITER MINES.

The reorganized board of directors of Jupiter Mines, Limited, is as follows: H. J. Hamilton, A. W. McDougald, C. A. Masten, K.C., John Wood, and James Pearson, the latter selected by minority interests to succeed Major Murray and Mr. O'Kelly. All details in connection with the completion of the Drummond Syndicate purchase of 900,000 shares of treasury stock have been sanctioned by the shareholders.

BUFFALO MINES ANNUAL REPORT.

The annual report of the Buffalo mines will show a production of 1,500,000 ounces, while the ore reserves are still maintained at practically what they were last year, 4,000,000 ounces. The mill treated 41,000 tons of rock during the year, and produced 1,250,000 ounces of silver, giving an average of about thirty ounces per ton milled. The company has paid a regular 8 per cent. per quarter through the year, and has now distributed among shareholders considerably over a hundred per cent. on capitalization.

BUFFALO MINES DIVIDEND.

Buffalo Mines Company has declared a regular quarterly dividend of 5 per cent. and 3 per cent. extra, the former payable July 1, and the latter August 15.

CROWN RESERVE DIVIDEND.

Crown Reserve declared a dividend of 2 per cent., with the usual bonus of 3 per cent., payable July 15 to shareholders of record June 30.

DIVIDEND NUMBER ONE.

Notice is given that a dividend of one per cent. upon the capital stock of the Dominion Steel Corporation, Limited, has been declared, payable on and after 3rd July, 1911, to shareholders of record at the close of business on Tuesday, 20th June instant.

STATISTICS AND RETURNS

COBALT ORE SHIPMENTS.

Following are the shipments from the Cobalt Camp for the week ending June 16, and those from Jan. 1, 1911, to date:

	June 16, Ore in lbs.	Since Jan. 1. Ore in lbs.
Badger	....	55,200
Bailey	....	40,000
Barber	....	6,000
Beaver	....	716,708
Buffalo	61,690	1,349,700
Chambers-Ferland	64,000	639,000
City of Cobalt	....	493,780
Cobalt Lake	249,840	2,055,090
Cobalt Townsite	....	480,700

Colonial	46,000	88,000
Coniagas	63,160	1,936,680
Crown Reserve	....	1,208,220
Hargraves	60,000	161,100
Hudson Bay	64,210	502,660
Kerr Lake	60,010	1,322,040
King Edward	....	40,000
La Rose	85,460	2,850,330
McKinley-Darr-Sav.	121,040	2,808,330
Nipissing	245,350	2,960,260
O'Brien	65,250	673,040
Peterson Lake (Little Nip.)	....	58,430
Provincial	....	40,510
Right of Way	60,100	579,560
Silver Cliff	....	106,680
Standard	....	102,813
Temiskaming	85,550	860,852
Trethewey	....	672,380
Wettlaufer	....	117,232

The shipments for the week were 1,328,660 pounds, or 664 tons.

The shipments from Jan. 1 to June 16 were 22,825,295 lbs.

NIPISSING IN MAY.

During the month of May the Nipissing Mines mined ore of an estimated net value of $221,584, and shipped ore of an estimated net value of $219,898, according to the report of Manager Watson to the directors.

In part he says: "With the return of satisfactory air pressure operations underground were resumed at all points and the production was again normal."

B. C. ORE SHIPMENTS.

The weekly mine and smelter returns record the second week of the Granby shut-down. Both mine and smelter are expected to resume the latter end of this week.

The following are the returns of the ore production and movement for the week ending June 10th, and for the year to date:—

Boundary Shipments.

Mother Lode	5,670	150,355
Rawhide	4,940	89,063
Jack Pot	556	14,776
Athelstan	227	2,169
Napoleon	555	3,192
Lone Star	413	2,456
Unnamed	127	127
Other mines		489,317
Total	12,488	751,455

Rossland Shipments.

Centre Star	4,289	89,130
Le Roi No. 2	507	12,214
Le Roi No. 2, milled	300	6,900
Le Roi	283	5,609
Other mines		421
Total	5,379	114,274

Slocan-Kootenay Shipments.

Sullivan	538	15,052
Richmond-Eureka	54	1,143
Silver Cup (at Ferguson)	19	240
Rambler-Cariboo	60	830
Enterprise	29	97
Society Girl	26	301
Knob Hill	113	1,499
Sweetgrass	21	32
Molly Gibson	137	386
Middleton	23	23
St. Eugene, milled	420	14,316
Queen, milled	420	9,450
Granite-Poorman, milled	250	5,750
Nugget, milled	110	2,530
Wilcox, milled	75	1,725
Van Roi, milled	800	9,049
Other mines		4,543
Total	3,095	66,966

The total shipments for the week, including the estimated milling, were 20,962 tons, and for the year to date, 932,695 tons.

B. C. Copper Co.'s Receipts.
Greenwood, B.C.

Mother Lode	5,670	150,355
Rawhide	4,940	89,063
Jack Pot	556	14,776
Athelstan	227	2,169
Napoleon	555	3,192
Lone Star	413	2,456
Unnamed	127	127
Other mines		568
Total	12,488	262,706

Granby Smelter Receipts.
Grand Forks, B. C.

Granby		458,982

Consolidated Co.'s Receipts.
Trail, B.C.

Centre Star	4,289	89,130
Sullivan	538	15,052
Le Roi No. 2	507	12,214
Le Roi	283	5,609
St. Eugene	129	3,067
Silver Cup (at Ferguson)	19	240
Rambler-Cariboo	60	830
Enterprise	29	97
Society Girl	26	301
Richmond-Eureka	54	1,143
Queen	37	690
Granite-Poorman	36	173
Knob Hill	113	1,499
Sweetgrass	21	32
Molly Gibson	137	386
Middleton	23	23
Other mines		35,844
Total	6,301	166,300

The total receipts at the smelters for the week, including concentrates, were 18,789 tons, and for the year to date 888,018 tons.

GRANBY ORE RECEIPTS.

During the month of May the ore receipts at the Granby smelter totalled 58,388 tons, 53,489 from the Granby mines at Phoenix, and 4,899 tons from American properties, as follows:

Snowstorm, Idaho	1,580
Insurgent, Republic	839
Quilp, Republic	271
Knob Hill, Republic	196
North San Poil, Republic	106
United Copper, Republic	38
Surprise, Republic	24
Liberty	27
Lone Pine	360
Belcher	1,447
Silver Lead	3
Total	4,899

B. C. ORE SHIPMENTS.

The shipments for the week ended June 17 were 16,184 tons, and the smelter receipts were 14,071 tons, and for the year to date 903,089 tons. The detailed figures are as follows:

Rossland Shipments.

Centre Star	3,625	92,755
Le Roi No. 2	555	12,769
Le Roi No. 2, milled	300	7,200
Le Roi	593	6,202
Other mines		421
Total	5,073	119,347

Boundary Shipments.

Insurgent	140	468
Mother Lode	5,880	157,235
Jack Pot	724	15,500
Rawhide	422	89,485
Athleston	404	2,573
Lone Star	321	2,777
Napoleon	125	3,317
Other mines		489,116
Total	8,016	759,471

Slocan-Kootenay Shipments.

Sullivan	664	15,716
Richmond-Eureka	55	1,198
Silver Cup (at Ferguson)	19	259
Ruth	31	266
Knob Hill	197	1,698
Number 1	24	51
Vancouver	30	56
St. Eugene, milled	420	14,736
Queen, milled	420	9,870
Granite-Poorman, milled	250	6,000
Nugget, milled	110	2,640
Wilcox, milled	75	1,800
Van Roi, milled	800	9,849
Other mines		5,924
Total	3,095	70,061

Consolidated Co.'s Receipts.
Trail, B. C.

Centre Star	3,625	92,755
Sullivan	664	15,716
Le Roi No. 2	555	12,769
Le Roi	593	6,202
Richmond-Eureka	55	1,198
St. Eugene	196	3,263
Silver Cup (at Ferguson)	19	259
Ruth	31	266
Queen	35	725
Knob Hill	197	1,698
Number 1	24	51
Vancouver	30	56
Van Roi	31	328
Other mines		37,101
Total	6,055	172,385

B. C. Copper Co.'s Receipts.
Greenwood, B.C.

Mother Lode	5,880	157,235
Rawhide	422	89,485
Jack Pot	724	15,500
Athleston	404	2,573
Lone Star	321	2,777
Napoleon	125	3,317
Insurgent	140	468
Other mines		367
Total	8,016	271,722

Granby Smelter Receipts.
Grand Forks, B.C.

Granby		458,982

COBALT ORE SHIPMENTS.

Following are the shipments from the Cobalt camp for the week ending June 23, and those from Jan. 1, 1911, to date:

	June 23 Ore in lbs.	Since Jan. 1. Ore in lbs.
Badger	....	55,200
Bailey	....	40,000
Barber	....	6,000
Beaver	....	716,708
Buffalo	56,160	1,405,860
Chambers-Ferland	....	639,000
City of Cobalt	64,200	557,980
Cobalt Lake	68,600	2,123,690
Cobalt Townsite	....	480,700
Colonial	....	88,000
Coniagas	117,500	2,054,180
Crown Reserve	67,200	1,275,420
Hargraves	....	161,100
Hudson Bay	63,300	565,960
Kerr Lake	....	1,322,040
King Edward	....	40,000
La Rose	203,900	3,054,230
McKinley-Dar.-Savage	180,700	2,989,080
Nipissing	63,600	3,023,860
O'Brien	....	673,040
Peterson Lake (Little Nip.)	....	58,430
Provincial	....	40,510
Right of Way	....	579,560
Silver Cliff	....	106,680
Standard	....	102,813
Temiskaming	85,550	860,852
Trethewey	....	672,380
Wettlaufer	....	117,232

The shipments for the week were 1,885,160, or 942 tons.

The shipments from Jan. 1 to June 23 were 23,710,455, or 11,855 tons.

TORONTO MARKETS.

June 24.—(Quotations from Canada Metal Co., Toronto).
Spelter, 5.65 cents per lb.
Lead, 3.65 cents per lb.
Antimony, 8 to 9 cents per lb.
Tin, 46 cents per lb.
Copper, casting, 12.80 cents per lb.
Electrolytic, 12¾ cents per lb.
Ingot brass, 8 to 12 cents per lb.

June 24.—Pig Iron (Quotations from Drummond, McCall Co., Toronto):

Summerlee No. 1, $22.50 (f.o.b. Toronto).
Summerlee No. 2, $22.00 (f.o.b. Toronto).
Midland No. 1, $19.00 (fo.b. Toronto).
Midland No. 2, $19.00 (f.o.b. Toronto).
Hamilton No. 1, $18.00 (f.o.b. Hamilton).
Hamilton No. 2, $17.50 (f.o.b. Hamilton).
Clarence, $19.00 (f.o.b. Toronto).
Cleveland, $19.00 (f.o.b. Toronto).

GENERAL MARKETS.

Coal, anthracite, $5.50 to $6.75.
Coal, bituminous, $3.50 to $4.50 for 1¼-inch lump.
June 23.—Tin, Straits, 45.25 cents.
Copper, Prime Lake, 12.75 cents.
Electrolytic Copper, 12.75 cents.
Copper wire, 13.75 cents.
Lead, 4.50 cents.
Spelter, 5.85 cents.
Sheet zinc (f.o.b. smelter), 7.50 cents.
Antimony, Cookson's, 8.50 cents.
Aluminium, 19.75 to 20.25 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, ordinary, $42.50 per ounce.
Platinum, hard, $44.50 per ounce.
Bismuth, $1.80 to $2.00 per lb.
Quicksilver, $44.00 per 75-lb. flask.

Silver Prices.

	New York cents.	London pence.
June 10	53	24½
" 12	53⅛	24 9/16
" 13	53⅛	24½
" 14	53⅛	24½
" 15	53⅛	24½
" 16	53⅛	24½
" 17	53¼	24 9/16
" 19	53	24½
" 20	53	24½
" 21	52⅞	24 7/16
" 22	52⅞	Holiday
" 23	52⅞	Holiday

SHARE MARKET.

(Courtesy of Warren, Gzowski & Co.)

Miscellaneous

June 24, 1911

	Bid.	Ask.
Dominion Steel Corporation	...	58½
Nova Scotia Steel	100	....
Crow's Nest Pass	.	68
Granby	42	42½
Consolidated Mining & Smelting	40	45
Amalgamated Asbestos	...	12½
Black Lake Asbestos	09½	10¼

Cobalt Stocks.

Bailey	.04½	.05
Beaver Consolidated	.47½	.48
Buffalo	1.60	2.00
Chambers-Ferland	.13	.14½
City of Cobalt	.14	.16
Cobalt Central	.02	.06
Cobalt Lake	.21	.22
Coniagas	6.95	7.00
Crown Reserve	3.40	3.55
Foster	.04½	.06
Gifford	.02½	.04
Great Northern	.16¾	.17¾
Green Meehan	.02¾	.03⅛
Hargraves	.14½	.16
Hudson Bay	85.00	105.00
Kerr Lake	4.75	5.25
La Rose	4.15	4.30
Little Nipissing	.03¾	.04
McKinley	1.68	1.70
Nancy Helen	.02	.03
Nipissing	10.25	10.65
Nova Scotia	.11½	.12½
Ophir	.11½	.15
Otisse	¾	.01½
Peterson Lake	.09	.10½
Right of Way	.09	.10
Rochester	.04⅝	.04⅞
Silver Leaf	.03	.03½
Silver Bar	..	..
Silver Queen	.03	.07
Temiskaming	.53¼	.53½
Trethewey	.94	1.00
Watts	..	..
Wettlaufer	1.05	1.10

Porcupine Stocks.

Foley	1.56	1.60
Detroit	.50	.51
Porc. Northern	.70	.72
Rea	5.74	5.85
Apex	.15½	.20
Porc. Can.	1.11	1.15
Central	.86	.88
Dobie	2.85	3.00
Dome Ext.	.84½	.85
Hollinger	15.30	15.40
Monita	.21	.25
Preston	.45	.45¾
Gold Reef	.27	.30
Pearl Lake	.62½	.63
Imperial	.14	.19
Tisdale	.10¾	.12
Swastika	.67	.67⅛
United	.05½	.06
Porc. Gold	.66	.66¾
Standard	.12	.20
West Dome	2.10	2.25
Am. Gold Fields	1.30	1.35
Northern Exploration	7.50	7.65

New York Curb.

Brit. Col. Copper	5	5¼
Butte Coalition	19⅜	19⅞
Chino Copper	23¾	24
Davis-Daly Copper	1	1⅛
Ely Consolidated	7/16	½
Giroux Mining	6⅞	7
Goldfield Consolidated	5⅞	6⅛
Greene Canadian	6¾	6⅞
Inspiration Copper	8¾	8⅞
Miami Copper	22⅜	22⅝
New Baltic Copper	5	7
Nevada Con. Copper	20	20¼
Ohio Copper	1 5/16	1¾
Rawhide Coalition	.4	.6
Ray Central	1 11/16	1¾
Ray Consolidated	17¾	18
Union Mines	⅜	7/16
Yukon Gold	3 15/16	4 1/16