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THE B. C. MINING EXCHANGE AND INVESTOR'S GUIDE

And Mining Tit-Bits.

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ELECTRIC MINING IN THE ROCKY MOUNTAIN REGION

BY IRVING HALE, DENVER, COLO.

The superiority of electric power for mining purposes was recognized in a general way as soon as the electric motor became a practical success, but it has required time and experience to amplify and fully develop its advantages and to overcome the minor difficulties that arose.

ADVANTAGES OF ELECTRIC POWER.

These may be considered under three heads, based on the nature of the generating power:

I. Electricity generated by water-power.

(*a*) Saving of coal, water for steam (an important item in many places), firemen, handling ashes, boiler repairs.

(*b*) Electric motors, as now made, require less attendance and repairs than steam or compressed-air engines.

(*c*) Underground wires more convenient than pipes.

(*d*) Avoidance of losses by steam-condensation underground.

(*e*) Avoidance of bad effects of steam underground—heating mine, vitiating air, rotting timbers.

(*f*) Electric motors more efficient than the small steam and compressed-air engines used on hoists, pumps, diamond drills, etc.

(*g*) Rotary motion of electric motor superior to reciprocating motion of engines, for many purposes, especially blowers and diamond-drills.

(*h*) Electric locomotives peculiarly adapted to underground haulage where steam is impracticable.

II. Electricity generated by steam at some distant point where fuel and water are cheaper.

(*a*) Saving of difference in cost of fuel and water between places where power is generated and used.

(*b*), (*c*), (*d*), (*e*), (*f*), (*g*), (*h*) same as under I.

(*i*) Superior economy of large compound and, where practicable, condensing engines, over the small, inefficient engines used on most mining machinery, proper allowance being made for losses in transforming and transmitting electric power.

III. Electricity generated by steam at place where power is used.

(*a*) Disappears.

(*b*), (*c*), (*d*), (*e*), (*f*), (*g*), (*h*), (*i*), same as under I. and II.

Most of the electric mining-plants in this district are included in Class I.

Mr. Edward G. Stoiber's Silver Lake Mines plant, described below, will be, when completed, an example of Class II., or rather a combination of I. and II., as a steam-plant of the highest possible economy will be used to reinforce the water-power, which is not sufficient throughout the year.

The Metallic Extraction Co.'s pumping plant at Florence, Colorado, is between Classes II. and III. Electricity is generated by steam in the mill and transmitted 1500 ft. (later 4500 feet) to the pump located near the river, avoiding, on the one hand, the carrying of steam that distance, and, on the other, the keeping of a man at the pumping-station.

Class III. is illustrated by the plants of the Pleasant Valley Coal Co., at Castle Gate and Scofield, Utah (hoisting and hauling); the Union Pacific Coal Co., Rock Springs, Wyoming (hauling); and the Colorado Fuel and Iron Co., Rouse, Colorado (pumping, ventilating and miscellaneous power).

COUNTER CONSIDERATIONS.

Against the advantages enumerated in the preceding section must be charged interest, insurance, taxes and depreciation on the excess of cost of water-power and electric plant over a steam-plant for doing the same work; also the greater cost of attendance, if any, due to the location of machinery at two places, although this will in many cases be more than offset by the saving in attendance on motors, as compared with steam-engines and boilers.

CONDITIONS AFFECTING THE COST OF PLANT.

The cost of an electric-transmission plant depends chiefly on three conditions:

First. Nature of water-power (assuming such power to be used) and cost of developing it.

Second. Distance of transmission.

Third. Electromotive force or voltage used.

In order to show more clearly the effect of distance and voltage on cost of plant, it may not be inappropriate to state briefly the principal electrical laws involved in the problem.

ELECTRICAL LAWS AND FORMULÆ.

(1) Electromotive force, "pressure" or voltage (symbol, E. M. F. or E.; unit. the volt) corresponds to pressure of water in pounds per square inch, or head in feet.

(2) Current (symbol, C.; unit, the ampere) corresponds to flow of water in cubic feet per second.

(3) Power (symbol, P.; unit, the watt) corresponds to the power of falling water, and is equal to the product of electromotive force and current, just as water-power is proportional to the product of pressure or head and flow.

1 Kilowatt = 1000 watts. 1 H. P. = 746 watts. 1 Kw = 1⅓ H. P. Formula, P = EC.

(4) Resistance of a conductor to the transmission of electric current (symbol, R. ; unit, the ohm) corresponds to the friction of water in a pipe. This resistance is directly proportional to the length of the conductor, and inversely proportional to its area of cross-section.

(5) The electric current is equal to the electromotive force divided by the resistance. This is also analogous to the flow of water, which increases with the pressure, and decreases as the resistance or friction increases, although the law is not exactly the same.

Formula (Ohm's law), $C = \frac{E}{R}$.

(6) Energy wasted in a conductor by being converted into heat (symbol, H. ; unit, the watt, as before) corresponds to the waste of power, also converted into heat, by the friction of water in a pipe, and is equal to the square of the current multiplied by the resistance.

Formula, $H = C^2 R$.

CONCLUSIONS.

(A) From (4) and (6) it is evident that increasing the distance, and consequently the length of wire (other things remaining the same), will proportionately increase the resistance and the loss of power ; but if the cross-section of the wire is increased in same proportion as its length, the resistance and loss will remain the same. This, however, increases the weight of the wire as the square of the distance. Hence the law : For a given power and electromotive force (which fixes the current) the cost of copper, for a specified percentage of line-loss, varies as the square of the distance.

(B) From (3) it appears that the same power is obtained from high electromotive force or voltage and small current as from low voltage and proportionately large current—another analogy to water power. But (6) shows that the loss of power varies as the square of the current, and hence inversely as the square of the voltage. If the loss ($C^2 R$) is to remain the same, R can be increased as much as C^2 is decreased, or as much as E^2 is increased, which means that the cross-section and weight of the wire will be inversely proportional to E^2. Hence the law :

For a given power and distance the cost of copper, for a specified percentage of line-loss, varies inversely as the square of the voltage.

(C) Combining (A) and (B) the following law is established : —

If the voltage is increased in proportion to the distance, the cost of wire for transmitting a given power with a specified line-loss remains constant.

The annexed table shows the cost of copper, at 14 cents per lb., per kilowatt transmitted by the 2-wire system for various distances at different voltages, with 10 per cent. waste of energy in line.

Considering the fact that the total cost of steam or water power, electric generators, switch-board and motors seldom exceeds $150 per kilowatt, it is evident that when a distance is reached that makes the cost of wire (and transformers, if used) exceed that amount, or the entire cost of the remainder of the plant, that distance may be considered to be near, if not beyond, the economical limit, unless the conditions are peculiarly favorable for electric power.

With 500 volts this condition is reached inside of three miles ; with 1000 volts, inside of six miles ; with 3000 volts, at about seventeen miles, and with 10,000 volts, at about fifty miles (allowing for transformers).

It is evident from the foregoing principles and figures that the key to long distance transmission is high voltage.

Volts.	Miles. 1.	2.	3.	4.	5.	10.	15.	20.	30.	40.	50.
500	$20.00	$80.00	$180.00	$320.00	$500.00	$2,000.00	$4,500.00	$8,000.00	$18,000.00	$32,000.00	$50,000.00
1,000	5.00	20.00	45.00	80.00	125.00	500.00	11,25.00	2.000,00	4,500.00	8.000.00	12,500.00
2,000	1.25	5.00	11.25	20.00	31.25	125.00	281.25	500,00	1,125.00	2,000.00	3.125,00
3,000	.56	2.22	5.00	8.89	13.89	55.56	125.00	222,22	500.00	888.89	1,388 89
4,000	.31	1.25	2.81	5.00	7.88	31.25	70.31	125.00	281.00	500.00	781,25
5,000	.20	.80	1.80	3.20	5.00	20.00	45.00	80.00	180.00	320.00	500.00
10,000	.05	.20	.45	.80	1.25	5.00	11.25	20.00	45.00	80.00	125.00
15,000	.02	.09	.20	.35	.56	2.22	5.00	8.89	20.00	35.56	55.56
20,000	.01	.05	.11	.20	.31	1.25	2.81	5.00	11.25	20.00	31.25
30,000	.....	.02	.05	.09	.16	.56	1.25	2.22	5.00	8.89	13.89
40,000	.....	.01	03.	.05	.08	.31	.70	1.25	2.81	5.00	7.81
50,000	.....	.....	.02	.03	.05	.20	.45	.80	1.80	3.20	5.00

SYSTEMS.

Direct Current.—Direct-current generators, suitable for power purposes, cannot be made to operate successfully at a much higher electromotive force than 1000 volts, on account of the arcing and short circuiting of the commutator and its connections required to rectify the current.

The direct current cannot be transformed to a higher voltage, except in a machine similar in construction to a generator and open to the same objections.

The expedient of connecting several generators in series, thus multiplying the voltage, has been tried in a few cases, but it is suitable only where power is to be transmitted and used in large units. It would be manifestly impracticable to connect several motors in series for small powers, and especially for such purposes as running hoists, pumps, blowers and other mining machinery.

Single-Phase Alternating Current.— The single-phase alternating current generator can be wound without difficulty for 3000 to 4000 volts, and considerably higher if necessary, as the current is taken off from two continuous rings without rectifying it, thus avoiding the difficulties experienced with the commutators of the direct current machine.

By the principle of induction, an alternating current of moderate voltage can be transformed into a current of smaller amperage and proportionally higher voltage, for transmission, and can be re-transformed at the other end of the line to any voltage desired for lights or power, the amperage varying inversely as the voltage. The energy remains the same, excepting a small loss in the transformation, not exceeding 2 per cent. in large transformers. As the coils of the transformers are stationary, and there are no sliding contacts, any desired amount of insulation can be used, and almost any voltage can be generated that can be controlled on the line. Many plants are in operation at 10,000 to 12,000 volts, and as high as 50,000 volts has been used experimentally with promising results.

The single-phase alternating current is widely used for lighting, but, being a simple alternating wave, is not suitable for power, as no satisfactory single-phase alternating motor of large size has yet been devised that is self starting under load and capable of speed regulation. If a motor built on the same lines as a single-phase generator is brought up to the proper speed by some extraneous power, so that the alternating impulses will act in the right direction at the right instants, and the current is then sent through the motor and the load gradually thrown on, it will run satisfactorily at constant speed. Such a machine is called a synchronous motor, because it runs syncronously, or in step with the alternations of the current. Its speed cannot be regulated; and if a sudden load causes it to slow down and lose step, it stops. It is inconvenient, and in fact impracticable, for service where frequent stops and starts are necessary, because starting it is such a tedious operation, and if it must start with a load on, it cannot be used at all.

Multiphase Alternating Current.—The successful development of the multiphase system during the past four years has solved the problem, and secured the advantages of both the direct and alternating currents. A multiphase generator has several windings, so placed as to generate several alternating currents differing in phase, *i. e.*, passing the zero and maximum points at different instants. Under the influence of these currents (which may be compared roughly to the cranks of a duplex or triplex engine—no dead centre), multiphase syncronous motors are self starting under light load, while non-syncronous or induction motors will start under full load, and are capable of speed regulation. The latter possess the good qualities of direct-current motors, and the additional advantage of having no commutator and, unless speed regulation is required, neither collecting rings nor brushes, the wires being simply connected to terminals on the field of the machine. On the other hand, the multiphase alternating current, like the single phase, retains the indispensable quality, for long distance transmission, of being transformable from low to high voltage for transmission, and from high to low for use at its destination.

HISTORY.

It may be interesting to trace briefly the development of electric mining operations in the Rocky Mountain district, and the effects of the foregoing principles and systems on this evolution.

First Application of Electricity in Mines.—In July, 1888, the first electric hoist in this region, and probably in the world, was successfully started in the Veteran tunnel, Aspen, Colo. It consists of a 7½ H. P. street car motor of one of the earliest types (just coming into use at that time), geared to a flat friction hoist, used for hauling cars into the tunnel. Later, it was arranged so that it could be thrown into gear with either this drum or another used for hoisting from an adjacent shaft. This machine has done good work continuously for eight years, and is still in service.

Development at Aspen, Colo.—To supply this and other similar hoists that soon followed it, the Roaring Fork Electric Light and Power Company, using water power from Hunter's creek, installed a 45-Kw. bi-polar 500-volt generator, and later a 100-Kw. generator of the same type. In 1892, this company developed another water power on Maroon and Castle creeks. and installed two 200-Kw. multipolar 500-volt generators. This plant was started in the Spring of 1893.

In 1892, the People's Light and Power Company, using water power on Castle creek, installed a light and power plant, the latter consisting of four 100-Kw. bi-polar 500-volt generators.

There are now in use in the mines at Aspen thirty motors, varying in size from 1 H. P. to 120 H. P., and aggregating 622 H. P., which are used for hoisting, ventilating, diamond-drilling and running mills, samplers and miscellaneous machinery.

The successful use of electric power at Aspen was rapidly followed by many other direct current 500-volt plants.

The Virginius Plant, Ouray, Colo.—In 1890 the Caroline Mining Co., operating, at great expense for fuel, the Virginius and other mines on Mt. Sneffels, at an attitude of 12,700 feet, took advantage of the new power just comming to the front, and installed an electric plant on Canyon Creek, about four miles from the mine. At this distance, wire for 500 volts would be very expensive (see table); so they boldly faced this difficulty by adopting 900 volts, a much higher pressure than had ever been used before in this kind of work. From this plant they supplied two pumps, a hoist and a blower, and ran their mills located at the mine. After the completion of the Revenue tunnel and mill, the pumps were discontinued and the mill motors were removed to the new mill and others added, and an electric haulage plant is now being put in the tunnel.

This plant is conspicious in the following respects:

High altitude and precipitous nature of country.

Severity of lightning.

High voltage for direct current.

Great saving by electricity, amounting to the cost of the plant every year or two, and permitting the profitable working of the property at times when it would not otherwise have paid expenses.

The Anaconda, Montana, Transmission Plant.—Several years ago, the Anaconda Copper Mining Co. installed a plant for transmitting power 2½ miles, to run electrolytic generators in its refinery. Eight 100-Kw. 500-volt bipolar generators were connected in two series of four each, giving 2000 volts, and at the receiving end, eight 60 Kw. 500-volt bipolar motors were similarly connected and, belted to a shaft, from which the electrolytic generators were driven. This arrangement was abandoned some time ago, because the total capacity of the water power plant was required for light and power in the town of Anaconda; and a high economy steam plant was therefore installed at the refinery.

The Telluride Plant.—In 1891 the San Miguel Consolidated Mining Co., Telluride, Colo., developed a water power at the junction of the Lake and Howard forks of the San Miguel river, for the purpose of supplying power and light to mines and mills in that district, at distances varying from two to fifteen miles. The direct current at 500 or even 1000 volts being too expensive for that distance, they turned to the alternating current; and the only alternating current available at that time being the single-phase, this was adopted. Several mills were run by syncronous motors quite successfully; but the application of power to miscellaneous purposes, requiring speed regulation and frequent stops and starts, was impracticable with this system, for the reasons heretofore explained. The plant has recently been changed to the multiphase alternating system, using two-phase generators and motors, and an arrangement of transformers to change the two-phase into three-phase current for transmission on account of the saving of 25 per cent. in copper effected by the three-phase system, as compared with the two-phase. This plant is now lighting the town of Telluride and supplying motors for running a number of mills in that vicinity.

Silver Lake Mines Plant, Silverton, Colorado.—In 1894 Mr. Edward G. Stoiber, owner of the Silver Lake Mines, installed the first multiphase plant in this part of the country, doubled its capacity in 1895, and is now still further increasing it. This plant is on the three-phase system, and runs mill, hoist, air-compressor pumps, blowers, machine shop and lights. The distance of transmission is three miles.

Of the large number of electric-mining plants installed in the Rocky Mountain district during the past eight years, the foregoing are selected in tracing the development of electric power, as they illustrate all of the systems that have been tried, namely:

Direct current, moderate voltage (500 volts or less).

Direct current, high voltage (900).

Direct current, using several generators and motors in series.

Single-phase alternating.

Two-phase alternating.

Three-phase alternating.

ELECTRIC MINING MACHINERY.

As will be seen, electricity is being applied to the operation of every kind of machinery used in mines.

Hoists.—The first application of electric power, and one of the simplest, was to hoisting; the rotary motion of the electric motor being easily adapted to this work.

Most of the earlier machines consisted of street-car motors, geared to flat friction or V-friction hoists. This type is satisfactory for small or medium sized machines, as the friction gear is an assistance to the motor-controller in smooth starting.

For large hoists a positive geared motor is more reliable; but it is desirable to interpose a friction-clutch or equivalent device at some point between armature and drum, as a safeguard in case of excessive strain on gearing, caused by the inertia of the armature when the drum is stopped by a too sudden application of the brakes. Mr. D. W. Brunton, of Aspen, has designed a slipping pinion, which is used on the electric hoists in mines under his management, and serves this purpose admirably.

The choice of the best kind of motor depends considerably on the size of the hoist, its location, and the nature of the work. For an unbalanced hoist of moderate size, especially if placed underground and exposed to dirt and water, the iron-clad series-wound street-car type is well adapted, as it is strong, well protected and designed to stand heavy work on intermittent service. In his motor, efficiency, low heating and absolute freedom from sparking are to some extent sacrificed for compactness and lightness. For large hoists, which are generally located in comparatively clean, dry places, and, if over-balanced, work almost continuously, hoisting and lowering, and in which high efficiency is more important than in small hoists, the stationary type of motor is usually preferable.

The speed controller is one of the most important feature of an electric hoist. On many of the earlier hoists the commutated field, thrown into various combinations of different resistances by a cylinder switch, was employed; this form of control being at that time widely used in street-car service. This controller gave quite satisfactory results when assisted by friction gearing; but with positive gearing it would not give sufficiently gradual start. On most hoists a variable resistance in armature circuit is employed; and by making this resistance sufficiently high, a perfectly smooth start may be obtained, even with slack rope. The most satisfactory rheostatic controllor, especially for heavy work, is one in which the resistance is cut in and out by a cylindrical switch with magnetic blow-out, which avoids the troublesome effect of arcing at contacts, when the current is broken.

In some cases it is practicable to use a double motor equipment, with series parallel controller, such as is now employed almost exclusively in street car work.

By overbalancing a hoist, making the counter-weight equal to the dead load plus about half the live load, the work in hoisting and lowering can be made approximately equal, and the maximum current and size of motor can be reduced to considerably less than half of what would be required for doing the same work with unbalanced hoist. This principle is used in the electric hoists at Free Silver, Alta Argent and Della S. mines at Aspen, and the Silver Lake mines at Silverton, and will doubtless be employed more generally in the future than in the past.

The Alta Argent hoist, in addition to being over-balanced, is arranged in a novel manner. The hoist, with its motor, is placed on a substantial platform above the head of the incline, and is out of the way of the operator, who is located, with the controlling levers, just below the hoist and on the level where the cars run off. This gives more room for handling the cars as they are raised, and enables the hoist operator to do this work.

(To be continued.)

THE ECONOMY OF ELECTRICITY IN MINING.

Economy is one of the main essentials to the successful working of the mine, and should be practiced in every department. There is none in which more care should be used than in that of the power used in operating.

There are few camps in British Columbia where water for power is not abundant, and the supply ample throughout the year. In many cases, naturally, this power is at considerable distance from individual mines, and the question of transmission of the same has become a factor of great importance. The country is, generally speaking, exceedingly rough, and impracticable for laying pipe lines for transmission of compressed air, also the loss is great in long distances, consequently many mines are being worked without compressor plants. Timber for hoists, etc., has in many cases to be brought up from lower levels, either by tram lines or over rough trails, and the ore transported by the same means to the concentrators and mills below.

Modern improvements in electricity have now done much to reduce the cost of these operations, through the efficiency and cheapness of transmission, and the great range of its possible and practical uses, in fact it has to-day, become the main factor in the economic working of mines, and not alone in this but in the saving and reduction of ores.

Few mines in B. C. outside of the coal mines as yet operate independent electric power plants, though there are numerous cases where they could easily do so, at an immense saving and comparatively small initial cost.

In districts where good properties are numerous and only one or two efficient water-powers exist, companies will, of necessity, have to be organized to work them and distribute the power to the mines individually, as has been done at Bonnington Falls, on the Kootenay River, by the Kootenay Power and Light Company, Limited. This company was organized in 1897, and has now in operation the most complete and efficient electric power transmission plant on the Pacific slope, distributing power for a distance of over forty miles to the various mines.

We cannot do better, in describing this wonderful piece of engineering, than by quoting from "Uses of Electricity in Mining," by Mr. Geo. P. Low, Editor of the "Journal of Electricity," published in the Mining and Metalurgical Journal," in September last:—

Among these further features may be briefly enumerated the extraordinary thoroughness and reliability of the water power development, the difficulties which attended the building of the pole line over a rugged route wherein could be found but a few miles of practically level line out of the entire distance, and where, in its length of 32 miles the altitude of the line varies at different points by over 2,200 feet. A novelty in the line of construction consists in the use of roofed poles and cross arms, and the Columbia River is crossed with a single span 1,500 feet in length without the use of supporting cable. The plant was built essentially for power purposes and of its present load only about twelve per cent. is in lighting, the remainder being in both syncronous and induction motors in mining duty for the operation of compressors, hoists, rock breakers, roasters, bricquetting, machine shops, and other equipments used in and about mining and smelting work.

The general view of the Bonnington Falls, upper and lower, and the country about the power house is given in the accompanying engraving. Here the Selkirk Mountains rise to an elevation of over 1,300 feet above the river, or to an elevation of about 3,500 feet above sea level, and the beautifully snow-capped peaks of the rugged range, together with the grandeur of the chain of the falls, forms a charming and picturesque scene. At low water the falls, both upper and lower, are capable of delivering 267,000 horse power, but the West Kootenay company has thus far attempted to utilize only a portion of the lower falls, which under the 40-foot head available at extreme low water, are capable of delivering 100,000 horse-power. The Kootenay river is 400 feet wide at the lower falls and in developing a portion of its water power, the West Kootenay company constructed a canal 650 feet in length and some 26 feet in width, all through the hard country rock. Towards its lower end the canal widens out into a forebay 54 feet in width, the forebay being closed in by a solid concrete dam 32 feet high and 26 feet in width at the bottom, tapering to six feet in width at the top. Between two high bluffs at a point in the head race, 250 feet above the concrete dam has been constructed a wooden dam sloping at an angle of 42 degrees up stream and having a vertical heighth of 44 feet. The sills and timbers of this dam are spaced five feet apart, and all of the timber, including sills, are of 12 x 12 material solidly bolted to the rock, the whole being then planked by a double layer of four-inch planking. In the bottom of this dam are five sluice ways and its object is to break the impact of water flowing into the head race from the canal during high water, or, in general, to insure the control of the water entering the forebay at all times.

Lower Bonnington Falls have an extreme difference of 32 feet, which measures the head of water available at the power house. The main concrete dam is provided with three feeders, two of nine feet each and one of ten feet. The upper ends of the feeders are closed by gates which measure respectively 12 feet by 13, 12 feet by 13, and 13 feet by 14. These gates are of wood, and consist of a framing of 12 x 12 timber to which is solidly bolted eight-inch planking. The two outside frames extended upward of 38 feet and to the walls of each pit are bolted racks for raising and lowering the gates. The gates are further provided each with a small iron flood-gate, 12 inches by 12 inches in size, and the main gates are raised and lowered by mean of headgate irons rigidly bolted to the top of the dam. The winch controlling the headgate irons are operated by one man, these and other features are admirably shown in the drawing which will accompany this article showing the end elevation of the dam, power house and tail race. The three steel penstocks, each nine feet in diameter by 20 feet in length, run through the concrete dam into the hydraulic section of the power house near the base of the dam. The back of the dam practically forms one side of the power house and tail race, the latter extending at right angles to it and consisting of a pit approximately 30 feet in depth by 20 feet in width, extending nearly the lenth of the power house, which is 66 feet. In the clear water the tail race is flanked by built masonry and concrete retaining walls, which vary from 4 to 6 ft. in thickness, and extend upward to approximately the level of the power house floor. The floor plan of the power house shows the arrangement of the turbines and their mode of connection to the generators. Bolted to the lower end of each penstock is a 13-foot casting, containing one pair 39 inch horizontal cylinder gate turbines, To these castings or wheel housings,

are bolted the draft tubes, which are 22 feet in length and ten feet in diameter at the lower end. The housing is supported on each end by the retaining walls of the tail race and are further carried by I beams. The turbines for driving the exciters are supplied with water taken from the main turbine housings in the manner shown on the ground plan of the power house.

To be more explicit, the three 40-kilowatt, 125-volt multipolar exciters are direct-driven from independent horizontal, 12-inch registered gate turbines which are contained in the cast iron flumes, the latter in turn supported by transverse beams of the large wheels, while bolted to the cast iron flumes are the draft tubes and feeders. The latter are connected to the shafting of the large wheels from which they derive their water supply. The portion of the power house containing the generators and switchboards together with the transformer house built thereon as an L, is bedded on the solid granite rock, which, after being suitably dressed and surfaced with concrete, gave most perfect foundations for the heavy machinery to be placed therein. A single roof covers the entire structure with the exception of the transformer house which is independently roofed. The building is fireproof, with walls of brick and roof of wood, covered with galvanized iron. The inside dimensions of the turbine house are 25 feet by 64 feet; those of the generator room are 31½ feet by 66 feet; while the transformer house measures 17½ feet by 28 feet. A flight of nine stairs takes one from the floor of the generator room to that of the transformer house, the difference in elevation of the two floors furnishing space for the blowers of the air blast transformers and ducts, as will be described hereafter. The height of the building from floor to the ridge of the roof is 40 ft. and ample room is thus provided for substantial framing on which to carry the tension leads.

(*To be continued.*)

The conception and commencement of the work on the remarkably interesting transmission of the West Kootenay Power and Light Company, Limited are largely due to the efforts of Sir Charles Ross, Bart., and Mr. Oliver Durant. The charter was obtained in the name of Mr. Patric A. Largey, president of the Center Star Mining and Smelting Co., Oliver Durant, manager, and C. R. Hosmer, manager of the Canadian PacificRailway Co.'s telegraphs, and it was afterwards transferred to the West Kootenay Power and Light Company. Preliminary surveys were made early in 1897, but it was in July of that year that the location of the plant was definitely settled and actual construction begun. The plans of the company contemplate the ultimate utilization of the entire three falls.

The present Board of Directors of the West Kootenay Company are: Sir Charles Ross, Bart., Balnagown, Scotland, President; Mr. W. M. Doull, Montreal, Vice President; Mr. J. M. Smith, Rossland, Secretary and Treasurer; Mr. L. A. Campbell, General Manager, and Messrs. Oliver Durant, Rossland, C. R. Hosmer and Frank Paul, Montreal, and T. G. Blackstock, Rossland. The entire plant is under the personal management of Mr. L. R. Campbell, to whom great credit is also due for the able adminstration of the position of electrical engineer, which he has filled in addition to his duties as general manager. The line was erected under the supervision of Mr. B. O. Boswell, so well known in California as superintendent of construction of the lines of the Folsom-Sacramento, Fresno, and other transmissions.

MINERAL DETERMINATION AND MINERAL TERMS.

COMPILED BY T. R. HARDIMAN.

The number of elements composing $\frac{99}{100}$ of the earth's crust is something less than 16, with their chemical and physical compounds.

The primary is an element and cannot be made by uniting different things nor separated into matter different to itself. A compound is composed of two or more elements. A chemical compound usually is one wherein the things composing it are so altered as not to be recognized by one or more of the senses of sight, touch, taste or smell.

A physical compound usually is one wherein the substances composing it are unchanged, or so slightly as to be observed immediately. As an illustration: water is the chemical union of oxygen and hydrogen, invisible gases; common salt is a white substance composed chemically of a green gas (chlorine) and a silvery metal (sodium). These are chemical compounds.

To illustrate a physical compound, mix salt and iron filings together thoroughly; you can easily detect the iron. Again, dissolve sugar in some water and the sense of taste will locate the sugar.

Some seventy elements are recognized by chemists of which we quote thirty-six.

Non-Metalic Elements—Gases: oxygen, hydrogen, nitrogen, chlorine and fluorine. Liquid: bromine. Solids: silicon, carbon, sulphur, phosphorus, iodine, boron.

Metals and Metalloids—Gold, silver, copper, mercury (quicksilver), lead, tin, zinc, nickel, iron, aluminum, antimony, arsenic, barium, bismuth, cadmium, calcium, chromium, cobalt, magnesium, manganese, platinum, potassium, sodium, stronium.

Few elements are found pure; nearly all occur as compounds.

Oxygen is the great compounder. Oxygen 1-5th, nitrogen 4-5ths make the air we breathe. It chemically unites with every known element except fluorine. It forms one-half the earth's crust, 8-9ths of water, 4-5ths of vegetable (by weight), and 3-4th of animal (by weight).

Oxygen, united with non-metallic elements, forms acids; for example— sulphuric acid, nitric acid. With the other elements it forms bases. Acids and bases united form most of the minerals. Chemical composition is indicated by the use of the terminations, *ide* and *ate*; "ide" indicating the union of two elements, "ate" at least three elements, one of which is oxygen and indicates a compound of an acid with a base.

Sodium chloride (salt) is a union of sodium and chlorine; silver sulphide, sulphur and silver; copper oxide, copper and oxygen. Iron sulphate (green vitrol) shows that oxygen is united with iron and sulphur. Calcium carbonate (limestone) is composed of calcium, carbon and oxygen, that is of lime and carbonic acid.

Hydrogen forms 1-9th part of water. This gas is the lightest known, it burns freely with a bluish flame.

Nitrogen makes 80 per cent. of the atmosphere, yet by itself destroys animal life.

Chlorine is 2½ times as heavy as air, and united with sodium forms common salt.

Fluorine forms with calcium fluorspar, and with hydrogen hydrofluoric (fluorhydric) acid, used to etch on glass.

Silicon combined with oxygen forms silica or quartz.

Carbon, pure, is a solid, and forms the principal part of coal; plumbago and bitumen; charcoal is almost pure carbon. The diamond is pure carbon crystalized. United with oxygen it forms carbonic acid and this acid, in combination, forms a class of minerals called carbonates; limestone is carbonate of lime.

Sulphur is a yellow, brittle solid. It is most abundant in volcanic regions. Combined with metals it forms a class of sulphurets or sulphides.

Phosphorus is a white, waxy substance. It is quite abundant in nature in combination with lime and oxygen, it forms the phosphates of lime.

Aluminum is found only in compounds with oxygen. It forms alumina, of which the gems ruby and sapphire are pure specimens. It largely constitutes clay and feldspar.

Potassium is one of the lightest of metals. With oxygen it makes potassa or potash.

Sodium with oxygen is soda.

Calcium with oxygen makes lime.

Magnesium with oxygen forms magnesia, an abundant substance in the composition of many rocks.

MINERALS AND ROCK DEFINED.

A mineral is an element, or two or more elements chemically united naturally. Water is a mineral. A rock generally lacks definite chemical composition and usually consists of two or more minerals united or mixed as found in nature. Scientists usually distinguish minerals from rocks in their names. Thus, the names of minerals usually end in *ite*, the names of rock in *yte*. Halite is the mineral common salt; trachyte is a common rock in mining regions; diorite, phonolyte, doleryte are rocks; the well-known gran*ite* maintains its old spelling.

There are some seven hundred well-known minerals. Of these 20 are *ides*, 200 are sillicates, and 300 are other *ates*, sulphates, etc.

(To be continued.)

THE RIGHT SORT.

"A scrimmage in a border station,
A canter down some dark defile,
Two thousand pounds of education
Drops to a bally Boer rifle,
The Crammer's boast, the Squadron's pride,
Shot like a rabbit in a ride."

Kipling's lines are wonderfully appropo to the Boer warfare.

Canada has shown her loyalty in a time of supreme difficulty and danger to the Empire, and has contributed both brawn and money in response to the Imperial request for support.

British Columbia and the Territories have sent the right sort of stuff to the front, men inured to the dangers and difficulties of pioneering in a mountainous country, thus having all the requisites, both in physique and ability, to cope with the tactics of Boer warfare—good shots, good horsemen, good soldiers all round. We regret that in the face of the actual need of such men—plenty more being forthcoming—such indispensable material cannot be secured to form a neuclus of another contingent. We know numbers who would volunteer, and have regretted that the Imperial authorities have not established a method of enlisting specials which would give such men a chance and the service a factor which needs as much support as possible. The exigencies of the position demand foresight and delays are dangerous in respect to strength of the right sort. The luxury of this war is costing England some $10,000,000 per week.

BRITISH COLUMBIA STATESMANSHIP.

We have been treated for some time past to an exhibition of statesmanship (save the mark) in our local Legislature which, if it were not so extremely damaging, would be superlatively ludicrous. The time is past when we can continue to play the game of statesmen, or put up with those who do so, to the utter demoralization of the principal interests of the Province—for such we consider our mining industries to be; and, further, we maintain that our greatest enemies in respect to mining development are in our own camp and amongst the representatives of the people. When, at the present stage of British Columbia, an Alien Bill, amongst other drawbacks, is carried by our exponents of political economy against the very people who we have to thank principally for promoting our growth. Why, it is time to recommend our statesmen to take a few lessons in municipal government from some rural aldermen in the Old Country, who could give them some pointers on self government and political economy as practised by progressive people, ere they play with the destinies of people in the legislative chambers.

Mr. Clifford, the member for Cassiar, introduced a motion to repeal the Alien Bill, without success, and the few who supported it should be remembered by every true friend of the Province. The Government had also received memorials from all the principal mining corporations, praying that the eight-hour law may be repealed. We shall follow the Government action, or want of it, in this matter, this also being a subject which should be thoroughly investigated in the interest of mine owners.

ELECTRIC POWER IN MINING.

There are about forty mines in British Columbia using electricity in one way and another, in connection with their workings. Out of this number there are thirty-five in the Kootenay, thirteen of these being supplied by the Kootenay Power and Light Company. The remainder are independent plants, mostly for the purpose of lighting.

As the distance of transmission from Bonnington Falls is somewhat over 40 miles, the mines are supplied from a sub-station, 39 miles from the power plant, and as there is no re-transformer plant at this point, the only class of power used in the mines is the alternating system, (single phase and multiphase). The direct current system cannot be used on long distance circuits, except by re-transformation from the alternating.

In the case of the War Eagle hoist, over which there is being considerable trouble just at present, and in connection with which several law suits are now pending, there can be no doubt that a direct current plant would have been more efficient. The company was advised of this by the Candian Electric Company when estimating for the plant, but the installing a transformer for this plant alone would have more than

doubled the cost of their plant, and so it was decided to use the three-phase system. The Canadian General Electric Company who had then supplied most of the mines, and the Bonnington Falls machinery, estimated for the plant to be used for hoist, but the War Eagle Company, not being satisfied with the opinions of those who had heretofore made a complete success of their installation, employed Mr. Mills, a consulting engineer from New York, who caused them to alter their plans, and they ordered their plant on his advice.

During the past year this plant has not been working satisfactorily, and as a consequence, it is claimed, the mine has been at a considerable loss. It remains to be seen whether this is the case. It does not seem to us that it is very likely, or if so, the fault of the plant or the power company, as the plant has not been treated in a proper manner. The plant was designed for a 2000 ft. hoist, and has been mostly used at 300 ft., thereby placing an immense strain on the resistance and a consequent burning out of parts.

We beg to differ from the British Columbia Review when they say : "A mine hoist requires the sudden movement of a very heavy mass, and practical experience has apparently demonstrated that steam is the only reliable form of power for this purpose . . . . . Electric hoists seem always to be out of order and the wear and tear of the machinery is tremendous. Science has much to learn yet regarding the control of electric power."

There can be no doubt, that science has much to learn of electric power, but we will say, that from statistics acquired from various parts of the American Continent, both in the United States and Canada, we find electricity in its application to hoisting in mines, to be the most efficient and economic power so far brought into use.

The offices, assay office, and other effects of the British Columbia Agency, have been sold on a judgement for debt, and have been purchased by the Britiannia Copper Mining Co. The latter is a company which has been formed of Rossland and Montana men to acquire a group of properties on Howe Sound, within thirty miles of Vancouver, where a large body of medium grade copper ore has been discovered and somewhat exploited. We hear, curious to say, that the B. C. Agency themselves had at one time an interest in these same properties, but like everything else that was any good and that they had anything to do with, they allowed them to slip out of their hands.

Towards the end of the month there has been considerable improvement in British Columbia affairs in London. British Americas have put on 1s. ; Le Rois were much stronger, having put on 3-16 ; Alasca Goldfields 1-8 ; and Ymirs the same.

At a general meeting of the Van Anda Company, held in Seattle, on Tuesday last, a resolution was passed authorizing a further issue of $250,000 of six per cent. debentures, redeemable at or before ten years. These together with outstanding debentures, amounting to $750,000, will be secured by a first mortgage over the entire assets of the company.

Athabasca clean-np for December, 1899, was 344 tons, yielding $10,400, being an increase of 35 per cent. over any previous clean-up. One hundred and thirty men are now employed at the mine.

BARKERVILLE, B. C.

(FROM OUR REGULAR CORRESPONDENT.)

At present I can send no more important mining news than to give a concise statement of what we agree upon as essential for our law makers to do and undo. First, We demand the repeal of that piece of stupidity commonly known as the Alien Act. All classes denounce it: investors, promoters, mine-owners, miners, merchants, laborers, all are affected by this blunder and are unanimous in its condemnation. The intent was to shut out the American prospector, and allow the foreign capitalist to come in, and in accomplishing the former the law has distinctly tended to exclude the latter. I mean no disrespect to the representative of the Crown, in saying that the foreign investor does not want his rights dependent on the Lieutenant-Governor in Council ; he wants, and should have, his rights clearly defined by law.

This matter is of immediate importance on account of the South African war, which will tighten British purse-strings while it lasts, and, when the war is concluded the Transvaal will be the favorite for British investment. In the mean-time we shall be side tracked.

Look at a map of the Province and see why we favor the admission of alien prospectors ; see what a vast area lies north of Quesnelle and Barkerville. Much of it is not only unprospected, but unexplored ; most of it is absolutely worthless except for the mineral it may contain ; all of it is useless without development. We believe it to be rich in gold, but men and money are required to prove this—not money alone, mind you, but men, hardy, persevering, adventurous prospectors—the one indispensable factor in the development of every mining country, a factor we cannot supply on account of our sparse population.

Second, a strong and growing sentiment exists here in favor of Crown grants for placer holdings. The Placer Act seems to be framed with the idea that placer mining is an easy, inexpensive business, while the fact is there are very few spots in the Province where a paying placer can be developed without a large outlay in cash. The same is true of quartz mining anywhere, and we see no reason why the placer investor should have less security of title than the investor in quartz. We favor an enactment providing that the holder of placer ground may secure a Crown grant when a certain reasonable sum shall have been expended in development work.

To prevent ground being tied up in Crown grants by men financially unable to develop mines, to discourage idleness, and encourage development, let the annual tax be the same as the annual rental now paid for placer leaseholds of equal area, if during the year a certain minimum sum shall have been expended in development ; but if the owner performs no work, increase the tax 50 per cent., when the owner fails to pay his tax the ground reverts and is sold by the Gold Commissioner to the highest bidder

A law such as outlined would increase the revenue of the Province, put placers on a stable foundation, encourage the investor, benefit the miner and prospector, and help Cariboo regain her old time renown as a gold producer.

The Cariboo Consolidated, Ltd., has three shifts at work in a tunnel on the Ah Quay hydraulic opposite Stanley. Next season the gravel will be washed through this tunnel which will be about 500 feet in length, most of it in rock.

At the Slough Creek mine of the Cariboo Consolidated, Ltd., work will soon begin on the bedrock shaft, which will be 5 by 15 feet, three compartments and 352 feet deep. From the bottom of the shaft a tunnel will be run 1060 feet in rock to where the bottom of the deep channel has been found by boring. John Hopp is superintendent.

After a shut down caused by a broken hoist, deep ground prospecting has been resumed by the Colonial Mines Development Co., Ltd., on Summit Creek. This company will have six monitors piping on Summit Creek benches and at Eight Mile Lake next season. F. T. Hamshaw is manager.

F. C. Laird has returned from Chicago and is making another attempt to get into the deep ground of Willow River.

A bedrock shaft is being sunk on Lightning Creek, miles below Stanley, by the Lightning Creek Gold Gravel, and Drainage Co. As the company has abandoned its drain tunnel, the "drainage" part of the name is a misnomer. It is extremely probable that the quantity of gold in the gravel at that point will also make the "Gold Gravels" part of the name a misnomer. This enterprise hails from Baltimore, Maryland, and C. H. Unverzagt, was prominent in its flotation.

L. A. Bonner, late manager Cariboo Gold Fields, Limited, has bonded the Snowden, near Stanley, for $10,000. There is more prospecting by individual miners this winter than in any winter for many years. Lightning, Devil's Canyon, Cunningham, Summit, Coffee and Stewart are the creeks on which most of the prospectors are working.

The B. C. Mining Exchange and Investor's Guide.

Is published monthly as a Guide to Investors generally, to whose interests it devotes itself.

MANAGING EDITOR . . . T. R. HARDIMAN.
SUB-EDITOR . . . . . C. R. GRAVES, M.E.

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DAKE'S AGENCY, San Francisco, Cal.

ADVERTISING RATES on application to Business Manager, 612 Cordova Street, Vancouver, B. C.

Commissioner Ogilvie wires from the Yukon that the royalty returns from November were $14.757. He places the estimated revenue at $1,400,000, against an expenditure of $11,188.

Copper is slowly falling in price, Lake being now quoted at 16½ cents per pound as against 18½ cents a few weeks ago. This lower figure is, however, several cents ahead of the prices that have ruled for years past, and the late quarterly dividend of the Calumet and Helca, $2,000,000, making $9,000,000 paid out in dividends this year goes to prove that the industry is still a remarkably profitable one.

A gentleman, lately returned fro Sydney, Cape Breton, informs us that the Dominion Steel Company have some 2,000 men at work preparing for the erection of their proposed furnaces and mills, and that vessels with material are almost daily arriving from the United States. The old town, he says, seems hardly to know itself, so great is the long-unkown activity, and even real estate, which has practically remained in the same families for the past hundred years, is changing hands.

Mining men are always interested in a new explosive, and a new one, known as "Kalstair's Explosive," has come to the front, the invention of an Englishman named Jno. Kalstairs. It is said to be the most wonderful yet invented. It is less dangerous than dynamite, of greater energy, and can be fired from any gun without erosive effects common to cordite and other smokless powders. A number of foreign governments are now experimenting with the new exlposive.

THE BOERS' ENCOURAGEMENT OF MINING.

As some one has put it, it was the irony of fate that finally, after all the toil, danger, and abnegation, the Boers should have been led to the region most alluring to the cupidity of the Uitlander. The realisation of this did not come at once and as a shock, but by degrees. It was not until 1885 that gold-bearing conglomerate beds of Witwatersrand, in the Transvaal, were discovered, and it was not until later that the most fabulous richness of the region were fully appreciated. At first, restrictive and prohibitory laws were enforced against prospecting for and mining gold. Then, when it seemed hopeless to stave off the inevitable, a reversal of policy ensued. The Transvaal Government saw the opportunity to replenish its empty treasury by means of taxing gold mining, directly and indirectly, and even went so far as to offer a bonus for the discovery of paying gold deposits. In Mr. Hammond's opinion this latter move acted as an immediate incentive to prospectors, and was an efficient factor in the rapid growth, not only of the revenue, but of the mining and its allied industries. Sooner or later discoveries were bound to come; but it is worthy of note that the Transvaal Government itself encouraged them, and thereby tacitly but impliedly entered upon obligations which no amount of argument can disguise. This feature is neither admitted nor recognised generally—certainly not by the Boers themselves.—Albert Williams, jun., in "The Engineering Magazine" for December.

TO THE POINT.

We clip the following paragraph from the Toronto Economist Mining Gazette:—

"A year or two ago the newspapers were flooded with the advertisments of mining brokers who posed as experts in the business, and advocated the purchase of this and that stock without any enquiry as to its probable value, the object being solely commission. Now many of them having by fake work "killed the goose that laid the golden egg," are going out of business, leaving behind them a trail of disappointed prospective millionares. We cannot say we view their departure with regret and trust that those remaining will be more careful in the future than they have been in the past, to the nature of the stocks they attempt to place with the speculative public."

A NOTABLE ENGINEERING FEAT.

The Great Northern Co. expects to complete its tunnel through the Cascade Mountains in Washington in the year 1900. It will be 13,228 feet long, or over two miles and a half, and will be the longest tunnel in the United States, with the possible exception of the Hoosac tunnel in Massachusetts, which, if we remember rightly, is five and three-fourths miles long. The west portal is 3,125 feet above sea level, and the tunnel slopes down eastward so that the east portal has an elevation of only 1,375 feet. The railroad now runs over the tunnel by a switchback, which climbs up to a heigth of 4,027 feet. The Hoosac tunnel was pierced from both ends and from the middle at the same time, the centre work being done from a shaft sunk in a depression in the mountain-top, but the work on the Cascade tunnel must all be done from the ends.

A LONG TELEPHONE SYSTEM.

The Pacific Coast system of telephone wires is the longest in the world, the circuit extending from Livingston, Mont., to San Diego, Cal. It costs $18 to talk between the two points five minutes The total lengtht of the circuit is 2,161 miles, or 551 miles longer than the circuit between Kansas City and Boston.

A RICH CASCADE CAVE.

On a mountain side in the Cascade Range in Washington, and not far from the Great Northern Railway track, a Swede named Anderson has found a natural cave which is seventy feet deep and has an arched overhanging wall forty feet in height from the floor of the cavern.

Back in the innermost portion of the cave, it is said, is a decomposed ledge of rich gold ore twenty-three feet wide. It is so rotten that it can be crumbled in a mortar and the gold washed out. Seventy assays have already been made, and the poorest showing made so far is $48 to the ton, other assays running up to $200.

A JAP MATRIMONIAL ADVERTISEMENT.

Hosuijoshi seeks a husband. She describes herself thus :—"I am a beautiful woman, 'with cloud-like hair, flowery face, willow like waist, and crescent eyebrows.' I have enough property to walk through life hand in hand, gazing at flowers in the day, and the moon at night. If there is a gentleman who is clever, learned, handsome, and of good taste, I will join with him for life, and share the pleasure of being buried in the same grave."

Mining Matters.

KAMLOOPS.

The Pot Hook is installing a very considerable plant, and will shortly resume work; a concentrator is to be erected, and we very soon expect to see the mine amongst the shippers.

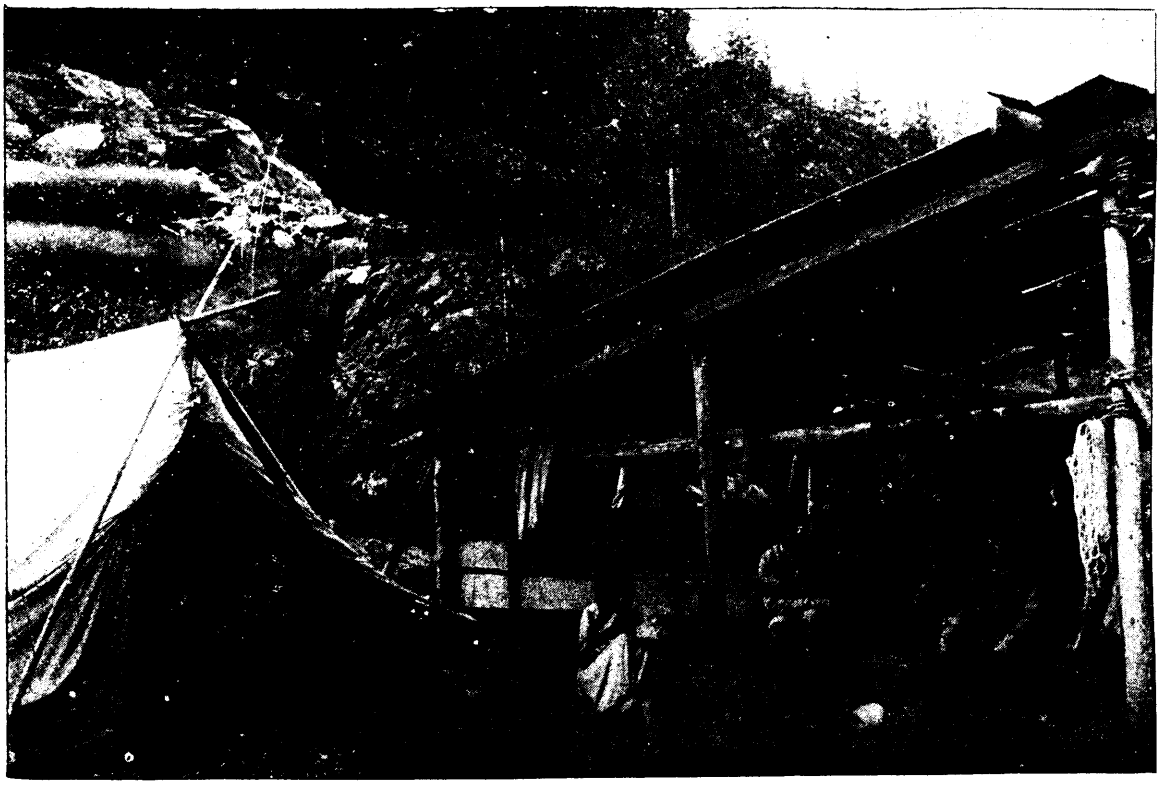
REVELSTOKE.

In the Big Bend, on Carnes Creek, the Carnes Creek Consolidated Mines Co. have driven another 215 feet, in No 2 drift. The ore continued about the same until the last few feet, then it widened out; a lense of copper ore came in on the foot-wall, and near the hanging-wall the rich arsenical iron appeared again. They are still working in this drift, but the tunnel is not wide enough to take in both walls. The shistose matter seems to be disappearing from the vein, and the iron and quartz becoming more solid. The lower lime dyke has come up close under the footwall, and appears to be mostly calcite, with some pyrites and galena, and shows evidence of having been broken and twisted considerably. The wall itself, however, is still regular, the graphitic gouge being always of the same dip and trend. The copper ore referred to, is in quartz, with chalcopyrite, some tetrahedrite and a small quantity af galena. is running from 5 to 20 per cent copper; 10 oz. to 40 oz, silver, but so far, carries only a little values in gold; some of the arsenical and sulphide iron ore from this level, however, runs as high as $56 00 in gold, and it is expected soon to strike the rich chute, which was struck at 130 feet in the upper drift; this should be reached in about 75 to 80 feet. There is no trace of copper mixed with the iron. Winter cabins. ore sheds, track and ore-car, have been put in, and work will be carried on continuously throughout the winter.

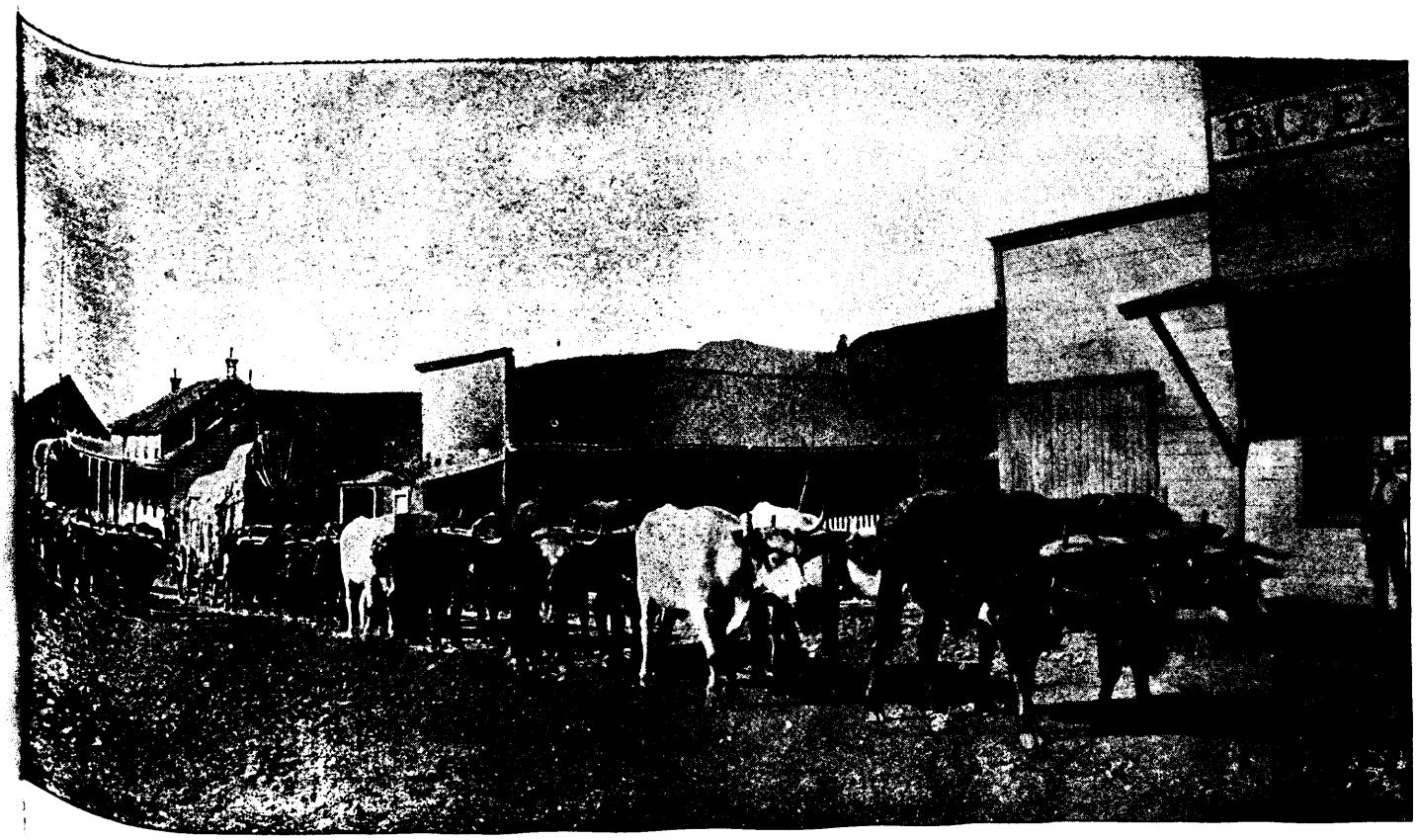
CARIBOO TRANSPORTATION AS IT IS—SOON TO BE SUPERCEDED BY AUTOMOBILES.

DEPARTURE OF STAGE.

ARRIVAL OF STAGE AT ASHCROFT.



CHINESE CAMP ON FRASER RIVER.



CARIBOO OX-TEAM.

SMILKAMEEN.

In the Sunset mine, on Copper Mountain, careful examination and assaying have developed the fact that the dump shows an average of 18 per cent. copper per ton. The shaft is down 100 feet, and is all in ore. The ore body is estimated to vary from 150 feet to 500 feet in thickness. It is the intention of the company to cross-cut this at the 100-foot level, and at the same time to continue sinking to the 200-foot level.

Other properties on Copper Mountain are being steadily developed, notably the Lost Horse, Canadian Bell and Violet group, all of which are showing up well. The camp shows undoubtedly great promise.

SLOCAN.

SILVERTON.

On the Vancouver group, development work is being pushed with good results, and rich ore has been struck at a depth of 250 feet on No. 2 vein, the ore being similar to that found in the Vancouver vein, on the same property, and averaging 30 per cent. lead, over 200 ounces of silver and a little zinc.

SLOCAN.

Work has been started on the Lone Star group, good ore having been discovered. Options have been obtained on several properties by M. Weyl, of Paris. A company will be formed in France to develop the same.

YMIR.

The shaft on the Ymir Bell is down 67 feet. The Big Horn tunnel is into the 100-foot station. On the Ymir mine a tunnel is being started to run in 3,000 feet from the mill. This will form the main outlet of the mine, and all the ore will be brought out through it directly to the mill, thereby superseding the aerial tramway now used.

EAST KOOTENAY.

WINDERMERE DISTRICT.

Late advices are very encouraging. The Paradise group is coming to the fore. This property was bonded a short while since by W. G. Mitchel-Innes, and contains a very extensive deposit of sand carbonates, which are very rich.

The Paystone group, on Horsethief Creek, is looking well under development.

The Red Line, which is under bond to Chicago capitalists, has been developing all winter. The rawhide trail to the Columbia is completed, and ore will be shipped out to be transported when the river opens for navigation.

The Delphine, which has the honor to be the first mine in this district to ship ore, is looking well, and considerable ore is now ready for shipment.

The Swansea, under the management of Mr. Charles Parker, of Rossland, has 1,000 sacks of high-grade ore ready for shipment.

BOUNDARY DISTRICT.

CAMP M'KINNEY.

The drift on No. 1 level of the Waterloo is in over 200 feet, and shows, all through, ore of good grade.

THE BOSTON & B. C. COPPER MINING & SMELTING COMPANY.

This corporation is now registered in B. C., and has an absolute title to the properties in the Standard Basin. Acting upon the recommendation of Mr. Leo Von Rosenberg, of 35 Broadway, New York City, the corporation has put a large force of men to work, with a view to running twenty-five hundred feet of tunnel, and drifts with the intention of thoroughly opening up the property, and putting it on a shipping basis. The work will be continued during the winter. The Company fully intends building a smelting plant at Revelstoke, believing that it is a good point to handle the business from, and that plenty of ore can be had from the Slocan, Lardeau, Windermere and Big Bend Districts. They expect to put the property on a shipping basis by next fall, and, as it is a tunnelling proposition, with an efficient force of men this can be accomplished. With this end in view, it is their intention to put a steamboat on the river north of Revelstoke. Several other properties in the district. are pushing development, with a view to shipping as soon as this work is accomplished.

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GOLD TRUST COMPANY.

As the proceedings of the above Company appear to be somewhat out of order and having come to a conclusion and from the number of applications we have received from shareholders both here and abroad, we think it advisable to publish certain information which has been furnished us by good authority.

The properties which were acquired in the Company's name on the West Coast of Vancouver Island, we understand are of great promise.

In 1898 the Company called a meeting at which only three directors were present. The minutes of this meeting did not become the property of the shareholders or public and we cannot now ascertain what they were. On Oct. 12th of the same year, during the absence of one of the directors (Dr. Carroll), an informal meeting was held and it was voted to borrow $8000 at 7 per cent. This matter was kept secret and the note several times renewed. The matter was forced out at an extraordinary meeting of the company, called on December 14th, 1899. Dr. Carroll being asked to allow a motion to pass ratifying all previous acts of the directors and to pass the accounts as per the Company's books, no statement of same having been produced; this Dr. Carroll refused to do. The motion was carried in spite of his protests and his dissent to this was with held from the shareholders. The chairman represents by proxy five directors and the solicitor votes by proxy for the company's secretary during his absence. On the 15th of December a notice was sent out to the shareholders of a meeting called for the 26th, this being the annual meeting of the company. This was unaccompanied by any statement of the accounts, thereby causing a breach of Article 142 of the Incorporation. At this meeting were present: Adolphus Williams, J. McQuillan, Barclay Bonthrone, Dr. Carroll, Dalziel Gordon Smith, G. H. Cowan and Jonathan Miller. Discussion raised caused an adjournment to Jan. 22nd to allow a statement to be made to the shareholders, and to enable them to criticize the same on the understanding that, if considered advisable, a further audit of the books be made other than that made by Mr. Griffiths, who was for a time acting secretary for the company and therefore audited his own entries. It was suggested that Messrs. Cross and Hallowell should make this audit. Before the meeting adjourned Dr. Carroll informed those present that it was not his intention to seek re-election, owing to the unbusinesslike manner in which the company's affairs were being transacted, and on account of the secrecy which had been maintained with regard to the loan of $8,000 and renewal of notes without his consent.

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GOLD MINING AT GREAT DEPTHS.

The wonderful deposits of gold in the Transvaal which have been worked so successfully and profitably for about a dozen years, are now nearly exhausted. Unless steps are taken to reach a continuation of the reef which is believed to exist at a much greater depth, production will soon cease, although at the present time it is almost, or quite, equal to that of the mines of the United States. The Witwatertrand reef is a series of thin, almost vertical veins in which ore of great richness has been found. The mines have been worked to a depth of about 5,000 feet; but if a push is made for the remaining treasure it will be necessary to penetrate through at least 5,000 feet more of worthless rock before reaching gold again. Whether it would be practicable to carry on mining operations 10,000 or 12,000 feet below the surface is then, a question which confronts the Transvaal miner.

In a paper read before a convention of South African mining engineers last summer, John Yates discussed this matter very fully. On this occasion he concluded that owing to the increase of temperature with depth, 12,000 feet marks the limit at which man can work. In trying to conduct mining operations at that level Mr. Yates proposes a series of inclined shafts, up which to haul the ore. Reviewing his paper recently, The Engineering and Mining Journal takes a more hopeful view than Mr. Yates but suggests certain modifications of the scheme.

In the first place, it is pointed out that while Mr. Yate's estimates of the temperature under ground are based on borings in South Africa, the rate of increase with depth there is greater than in the famous copper mines of Michigan. Allowance has not been made, apparenaly, for the cooling effect of opening workings at these depths. Moreover, The Engineering and Mining Journal belives that a judicious use of liquid air would artificially cool the mines sufficiently to make mining feasible even 15,000 feet below the surface.

The periodical just mentioned doubts the wisdom of bringing the ore up inclines instead of hoisting vertically. To be sure the limit for such work with a steel rope is about 6,000 feet; but if that means is employed, there could be transfers at two intermediate stages. But it is not incredible that an electric hoist might be devised—some application of the motor to the car itself—which would render feasible one continuous trip. That plan would possess numerous advantages in point of time and labour. So far as engineering difficulties are involved, therefore, there seems to be little reason for hesitating about the venture.

The vital question, in the opinion of The Engineering and Mining Journal, is whether it would pay. Driving a shaft down through unremunerative rock for nearly or quite a mile would take several years, and

a lot of money. And "unless the reefs at these depths should be richer than they have yet been found to be—and we do not know that there is any indication of such improvement—it will require a very close, careful limitation of costs and close working to return an adequate profit to the investor."

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DAWSON, YUKON TERRITORY.

In our Dawson, N. W. T., article Dec. issue, it was stated that Dawson had a population of between twenty and thirty thousand. This should have read: Now it has a population in the town and on the creeks a population of between twenty and thirty thousand."

We herewith, for the benefit of our readers, cite the "Act to provide for the Government of the Yukon District," which was assented to on the 13th of June, 1898:—

"1. This Act may be cited as 'The Yukon Territory Act.'

"2. The Yukon Judicial District, as constituted by the proclamation of the Goveror in Council bearing date the sixteenth day of August, one thousand eight hundred and ninety-seven, and contained in the schedule to the Act, is hereby constituted and declared to be a separate territory under the name of the Yukon Territory, *and the same shall no longer form part of the North-west Territory.*"

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Lord Strathcona's patriotic offer to equip 500 rough riders for service against the Boers, has struck the right chord, which together, with the patriotism expressed in so tangible a form throughout the length and breadth of Canada will do much to promote the future welfare of the Dominion.

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Finance.

LONDON, Dec. 30, 1899.

The tone of the Stock Exchange after the Christmas holidays was of a more cheering character. The House was in good form. Easier money occasioned by a good influx of gold from abroad helped, and a small boom appeared in the Kaffir Circus. This was, however, speedily extinguished. The only very weak descriptions were theatrical and lighting stocks in the industrial market. Coal and cotton were excellent—the latter being benefited by the recent 20 per cent. advance in wholesale thread prices.

In 1899 gold movements have been on a much smaller scale than in most previous years. Imports are about fifty-seven million dollars below those of 1898—some ten millions of this being accounted for by the cessation of supply from South Africa during the last two months. Exports of gold show many heavy decreases. America has taken forty-five millions less; Germany, forty millions; and Japan, fifteen millions. To go a little way towards restoring the balance, South Africa has taken twenty million dollars in British sovereigns, and South America has increared her usual import by seven and a half million dollars.

A return recently published shows that of all classes of new joint stock adventures, an investor should avoid, or anyhow most carefully inspect, the enterprises floated to exploit patents of which the commercial utility is undemonstrated, are the worst. Thirty-three such institutions were organized in 1896, and only three of them have now any market quotation. One of these has paid a dividend. The nominal capital of the unlucky thirty-three was $17,885,000 of which $13,000,000 was offered for public subscription.

The net profits of Harmsworth Bros., for the twelve months recently concluded amount to nine hundred thousand dollars. This is produced wholly by the scrap journals of the "Answers" type that this young and enterprising firm issues. The "Evening News" and the "Daily Mail"—the other properties owned by the Harmsworths—do not come under the control of the above limited company, put are held privately. The total profits raised by the publishing genius of this family must be colossal. The war has sent up the circulation of the "Daily Mail" to nearly a million copies daily.

LOCAL STOCK MARKET.

	PAR VALUE.	PRICE
Alberni Con	1 00	5½
Alberni Mountain Rose	1 00	5½
Athabasca	1 00	29
Big Three	1 00	06
Cariboo Hydraulic	5 00	78
Cariboo McKinney	1 00	1. 55
Canadian Goldfields	—	6½
Crow's Nest Coal	25 00	60 00
Dardanelles	1 00	8½
Deer Park	1 00	2
Evening Star	1 00	9
Grand Forks of Bonanza	50	50
Hall Mines	1 00	—
Iron Colt	1 00	10
Iron Horse	1 00	8½
Iron Mask	1 00	45
Knob Hill	1 00	65
Le Roi	£5	£6⅜
Mineral Hill	1 00	05
Minnehaha	1 00	12½
Monte Christo	1 00	5½
Montreal Goldfields	1 00	7½
Morrison	—	15
Noble Five	1 00	8
Novelty	1 00	03
Old Ironsides	1 00	85
Payne	1 00	1 05
Rambler Cariboo	1 00	50
Rathmullen	1 00	05¼
Slocan Star	50	1 25
St. Elmo	1 00	4
Van Anda	1 00	3½
Victory-Triumph	1 00	02½
Virginia	1 00	03½
Waterloo	10	10
War Eagle	1 00	2 65
White Bear	1 00	3
Winnipeg	1 00	20
King	1 00	19

B. C. AND KLONDIKE QUOTATIONS.

Alaska Goldfields, 1.
Athabaska ⅝.
Bennett Lake and Klondike Nav. 28. 6d.
British America Corporation, 19s. 6d.
B. C. Development Assoct. 1¾
B. C. and New Find Goldfields, ⅝
Dominion Mining Development and Agency ¾.
Duncan Mines, 1 and ⅛
Hall Mines, 5s.
Klondike Bonanza, ¾
LeKlondike Mining, Trading, &c. ⅜
Le Roi 5 and ⅞.
Lillooet, Fraser R. & Cariboo 6s.
London and B. C. Goldfields, 1¾.
McDonald's Bonanza, 1.
New Goldfields of B. C., 1 and ⅛.
Queen Bess Proprietary, 1.
Vancouver and B. C., Gen. Ex. 12s. 6d.
Velvet, 1⅛
Whitewater Mines, ⅝
Yukon Goldfields, 1 and ½.
Ymir Gold Mines. 1 and 7-16

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The Metal Market.

Copper, dull, brokers 16.50, exchange 16.50.
Lead, steady, brokers 4.45, exchange 4.75.
Tin, firm, straits 27.30 to 28, plates firm.
Spelter, steady, domestic 4.45 to 4.55.

The following are the Silver, Copper, and Lead qnotations for the last two weeks:—

		SILVER.	COPPER.	LEAD.
Jan.	1	—	—	—
"	2	58⅞	16 50	4 75
"	3	59	16 50	4 70
"	4	59	16 50	4 70
"	5	59⅛	16 50	4 70
"	6	59	16 50	4 70
"	8	59	16 50	4 70
"	9	59	16 50	4 70
"	10	58½	16 50	4 75
"	11	58½	16 50	4 75
"	12	58½	16 50	4 75
"	13	58½	16 50	4 70
"	14	58½	16 50	4 70

SILVER.—The market has been steady and dull, showing only small fractional changes during the week and closing at 26¼d, in London.

COPPER.—Prices remain unchanged from those quoted last week. Lake copper, 18½c. Electrolytic in cakes, wirebars and ingots, 17 @ 17½c. Cathode, 16¼ @ 16⅝d. Casting copper, 17c. nominal. The foreign market is still dominated by the difficulties between England and Transvaal. London is quoted, English tough, £78 15s. @ £79 5s. Best selected, £80 5s. @ £80 15s. India sheets, £83 @ £83 10s.

LEAD continues in good demand and no change in prices. New York being quoted at 4.55c. @ 4.60c. The foreign market has been irregular but the tendency is upwards. Spot is quoted at £15 17s. 6d. @ 16l. 2s. 6d. for Spanish. and £16 5s. @ 16l. 7s. 6d. for English, while futures are at a discount of 5s. to 10s.

SPELTER.—The disquieting news from the ore-fields stirred up consumers and a good business has resulted at stiffening prices. New York is quoted at 5.45 @ 5.50. The foreign market is also firmer, and again higher good ordinaries being quoted at 22l. 12s. 6d, Specials 22l. 17s. 6d.

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Answers to Correspondents.

SAMSON.—(1) We reiterate again, that it's useless to invest in mining expecting big returns right off. Expect nothing and don't invest unless you are in a position to stand the loss. (2) The probability is in your favor.

I.F.M.—(1) Yes; we believe it a sound concern. (2) Stock manipuiation you can not control and your shares are governed by market prices. We advise you lock them up. (3) The war has slumped things generally.

NELSON.—Your best market would be Rossland or Toronto.

TORONTONIAN.—(1) Will look the matter up. (2) The Company, as far as ascertained, is not working; in fact, we hear they contemplate accepting an offer for their property which has been made them by an American syndicate.

V. B. C.—Yes; they have dropped considerably. Will pay you to hold.

MINER.—We treat the parties you refer too as mice, not men. Such apologies for men excite the risibilities of outsiders thats all.

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The illustrations in connection with our articles on electricity have been unavoidably delayed, but will be produced in our next with the continuation of the subject.