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DEPARTMENT OF THE INTERIOR

M.J.

APPENDIX

TO THE

REPORT OF THE SUPERINTENDENT OF MINES

1902

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1903

APPENDIX TO THE REPORT OF THE SUPERINTENDENT OF MINES.

REPORT ON COPPER BELT AND COAL LANDS NEAR WHITE HORSE, Y.T., AND ON THE MINING CONDITIONS OF THE KLONDIKE, Y.T.

DEPARTMENT OF THE INTERIOR,
OTTAWA, December 15, 1902.

To the Hon. CLIFFORD SIFTON,
Minister of the Interior,
Ottawa.

SIR,—I left Ottawa on July 28 last for the Klondike, in accordance with your instructions, to acquaint myself with the present mining conditions of the district.

On my way to Dawson I stopped over for one day at White Horse for the purpose of visiting the copper belt, the nearest point of which is only 1½ miles from White Horse. The copper belt runs parallel to the Lewes river at an average distance of 3 miles from its western bank, has a maximum width of 4 miles, minimum width of about 2 miles, and has been found to be mineralized for a distance of some 8½ miles. The accompanying map, on a scale of one mile to one inch, shows the principal copper locations in the vicinity of White Horse. It has also an inset, showing the position of this mining district with reference to the principal places in the Territory.*

WHITE HORSE.

COPPER.

The mines visited were the Grafter, Best Chance and Copper King, where some development work had been done. A government wagon road is being constructed, leading from White Horse to this mining region, and about one-half the distance to the Grafter mine had been completed on the date of my visit. At the Grafter mine I found that a shaft of 60 feet in depth had been sunk and some drifting begun. The ore, chiefly Bornite and Copper-glance, carries gold and silver values and many of the specimens examined, taken from shaft and drift, showed free gold.

Some development work had also been done on the Best Chance claim, which joins the Grafter, lying north-east of it, by the removal of the ferruginous capping and the sinking of a shaft some 30 feet in depth. The nature of the ore appeared to be similar to that of the Grafter claim.

At the Copper King, some 3½ miles to the north-west of White Horse, also reached by government wagon road, a shaft of some 30 feet had been sunk and drifting begun. The shaft was timbered and on going down, I found the surface to drift covered with ice, preventing examination. The surface of this claim has been prospected for mineral for a distance of 900 feet by some 30 cross cuts, exposing a mineralized zone, about 200 feet in width. Not sufficient development work has yet been done to disclose the amount of ore contained.

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*For a description of the geology of the region by Mr. McConnell, see pages 49 A et seq., summary report on the operations of the Geological Survey for the year 1900. This map will only appear with the monograph form of this report.

Two hundred and ten sacks of picked ore from this mine, representing 8·757 tons net, have been sold through Pellew-Harvey, Bryant & Gilman, of Vancouver, B.C., to the Puget Sound Reduction Company, of which the following is an itemized statement of the transaction :*

Sacks		210
Net weight	pounds	17,870
Moisture	per cent	2
Dry weight	pounds	17,515
Tons, net		8,757
Assay per ton of 2,000 pounds	gold, oz.	0·10
Assay per ton of 2,000 pounds	silver, oz.	11·00
Assay	copper, per cent	46·64
Total value per ton		$98 15
Cost of treatment per ton		6 00
Net price per ton		$92 15
Amount		$807 00
Less freight		64 85
		$742 15 = $84 74 per ton.

From this value per ton must further be deducted to obtain the net value, the cost of mining, sacking and cartage from mine to railroad depot. No figures could be obtained for these items.

Although the examination of the copper belt was hurried, and, therefore, necessarily superficial, still sufficient was seen to impress me favourably regarding the mineral contents of the area. The concentration of the ore into matte and shipment of the same for further treatment to refineries will obviously be the method of commercially handling the output.

COAL.

The following statement, relating to the coal lands of the White Horse Coal Company, was made to me by Mr. Robert Lowe, of White Horse:—

'The White Horse Coal Company's lands consist of a strip ten and one-half miles long, and contain 4,000 acres, situated about eighteen miles west and south-west of the town of White Horse, Yukon Territory. There are on the property, so far as known, ten veins ranging in thickness from four feet to twenty feet and aggregating over one hundred feet in thickness and running along the foot hill a distance of about ten miles, being cut off at the east end by a limestone ridge, and on the west end by the Ibex valley, a broad valley with entirely different formations on either side.

'The coal veins dip into the mountain at an angle of about 45 degrees, and show many exposures where cross-cut by streams from the mountain. They are also cross-cut by two deep valleys where water level tunnels may be run in on the veins, and in short distances obtain depths varying from one thousand to fifteen hundred feet beneath the surface croppings. No easier or cheaper place to develop a mine could possibly be prepared by nature. The company has a tunnel eighty feet in length on one vein, showing it to contain nineteen feet of clear coal, almost entirely free from slate or foreign substances. About seven tons of this coal were taken to the White Pass and Yukon Railway and tested by them in March, 1901. This coal was taken out from a depth of about eighteen feet from the surface in mid-winter, soaked with surface water and immediately frozen on exposure to the air, thus rendering it impossible to pick out any slate, &c., and in that condition tested on the road. Herewith are attached the reports of engineer to J. P. Rogers, superintendent, and now on file in their office.

*Copy of assay return of Pellew-Harvey, Bryant & Gilman, Vancouver, B.C.

'The coal lands can be connected with the White Pass and Yukon Railway at a point nine miles south of White Horse, by building twelve miles of railroad up a wide level valley, without engineering difficulties whatsoever, and at a cost of about $10,000 per mile, as estimated by J. E. Beatty, engineer, who surveyed the route, or could be connected directly with White Horse and navigation by the building of about twenty miles of road, thus being entirely independent of the White Pass and Yukon Railway, and at the same time passing directly through the centre of the copper belt.

'*Coal Market.*—At the present time the White Pass and Yukon Railway use ten thousand tons of coal north of White Pass summit, all of which has to be transported over the summit from Skagway and placed in bunkers as follows:—About two thousand tons at Bennett, about two thousand tons at Caribou, and about six thousand tons at White Horse.

'The cost of this coal to the company at Skagway is $7.85 per ton. In addition to this, the company uses for its fleet of steamers thirty-five thousand cords of wood, at an average cost of $6.50 per cord. This wood is annually growing scarcer and is a spruce wood, very light and requiring almost three cords to equal one ton of our coal. The company would be glad to substitute our coal for this wood. The town of White Horse burns about five thousand cords of wood per annum at a cost of $10 per cord in stove lengths.

'The Klondike district and Dawson burnt in 1901 $3,000,000 worth of wood at prices ranging from $12.50 to $18 per cord, according to reports compiled by the wood inspectors and newspaper statisticians of Dawson. The figures for the railroad and steamboats were furnished us by Mr. E. C. Hawkins, Manager of the White Pass and Yukon Railway.

'In addition to this present existing market, the White Horse district will in the next few years develop into a great copper district, with smelters and an almost unlimited market for coal.'

FIRST TEST.

SKAGWAY, ALASKA, April 1, 1901.

Re Test of White Horse Coal.

Engineer A. MCGEE,
Shops.

DEAR SIR,—Referring to the test of coal made out of White Horse last Wednesday, I would be glad to have you answer the questions below.

Q. How much of the White Horse coal did you take out of White Horse ?
A. Forty-five sacks, or about two tons.
Q. Was your fire started with it ?
A. Yes.
Q. How much did you burn between White Horse and Skagway ?
A. Two tons run me 80 miles.
Q. How did it compare with the Comox coal for steaming purposes ?
A. Not as good.
Q. Is the percentage of ash greater or less than the coal we are now using ?
A. Greater.
Q. Did you find any slate in the coal on breaking the same up ?
A. Yes, small amount.
Q. Did the coal clinker up any more than the Comox coal ?
A. It did, but not bad for clinkers.

I would be glad to have you answer the foregoing questions as intelligently and fully as possible.

Yours truly,
(Signed) J. P. ROGERS,
Div. Supt.

I was told this coal was taken from a depth of 15 to 20 feet level. Would consider it first class for surface coal. Made very little black smoke.

(Signed) A. McGEE,
Engineer.

SECOND TEST.

SKAGWAY, ALASKA, April 10, 1901.

Re Second Test of White Horse Coal.

Engineer A. McGEE,
Shops.

DEAR SIR,—Referring to the second test of the White Horse coal, made out of White Horse station on the 6th instant, I would be glad to have you answer the questions below.

Q. How much of the White Horse coal did you take out of White Horse ?
A. Thirty-five sacks.
Q. Was your fire started with it ?
A. Yes.
Q. How much did you burn between White Horse and Skagway ?
A. Thirty-five sacks.
Q. How did it compare with the Comox coal for steaming purposes ?
A. Not so good, but makes good steam.
Q. Is the percentage of ash greater or less than the coal we are now using ?
A. Greater.
Q. Did you find any slate in the coal on breaking the same up ?
A. Small amount of slate.
Q. Did the coal clinker up any more than the Comox coal ?
A. Yes.

Yours truly,
(Signed) J. P. ROGERS,
Div. Supt.

(Copy of Analyses furnished by Mr. Lowe.)

ANALYSIS of coal, Sample No. 1, taken from tunnel at a vertical depth of about twenty-five feet from the surface.

Fixed carbon	72·90
Vol. car. matter	5·55
Ash	17·76
Water	3·79
	100·00
Sulphur	0·41

ANALYSIS of coal, Sample No. 2, taken from surface of ground on top of high hill.

Fixed carbon	57·97
Vol. car. matter	10·18
Ash	26·06
Water	5·79
	100·00
Sulphur	0·69

Both samples anthracite.

Unfortunately the authority for these analyses is not stated and Dr. Bell, Acting Director of the Geological Survey, has had the kindness to have check assays made for me of specimens collected for me by Mr. Norris. These specimens were taken: the one marked A from top of the mountain, four feet from surface and about 1½ miles from the tunnel; the one marked B was taken from the tunnel, 63 feet from its mouth, 45 feet from surface and 800 feet below the level from which A was obtained.

The results of the assays, by fast coking, reported by Dr. G. C. Hoffmann, are as follows:—

Specimen A.

Hygroscopic water	3·83
Volatile combustible matter	15·84
Fixed carbon	47·81
Ash (light purplish-brown)	32·52
	100·00

Specimen B.

Hygroscopic water	1·76
Volatile combustible matter	5·69
Fixed carbon	68·59
Ash (light reddish-white)	23·96
	100·00

They are both non-caking.

THE KLONDIKE.

On my arrival at Dawson on August 4, preparation was made to visit the more important creeks to study the methods and mining conditions of the region. A democrat wagon with a span of horses, in charge of a member of the North-west Mounted Police, was for that purpose kindly placed at my disposal by Acting Commissioner Major Wood, and in company with Mr. Beaudette, mining engineer to the department, the following creeks were visited:—Bonanza, Eldorado, Gold Run, Upper and Lower Dominion, Hunker and Last Chance. Quartz and Sulphur creeks were not visited, since nothing new in the way of mining was to be learned by such visit.

The following is the result of my observations along the creeks:—

MINING METHODS.

The methods at present employed in the Klondike in reaching the 'pay-streak,' which underlies the muck and barren gravel of the gold-bearing areas, depend, aside from the requisite supply of water, mainly upon two conditions: The inclination of the ground to be worked, and the depth at which the 'pay' is found.

If the overburden of muck and barren gravel is inconsiderable, the claim is worked by the 'open-cut method.' The pay-gravel is laid bare by the removal of the overburden by 'stripping' the entire area to be worked. If the ground is more or less level, the stripping is effected by the use of scrapers, operated by horses or steam power, steam points for thawing being employed when necessary. If the inclination of the ground permits and the available supply of water is sufficient for the purpose, the overburden is removed by 'ground-sluicing,' *i.e.*, washing away the muck and barren gravel by means of a jet of water under pressure. The pay-gravel is by these methods exposed to the aetion of the sun, which thaws the gravel, permitting its removal to the sluice-

box by pick, shovel and barrow, or the operation of a steam shovel or 'ground sluicing' into sumps and subsequent elevation by machinery. Illustrations of these methods with particulars will be given later.

Where the overburden is very heavy and the fall of the creek bottom insufficient for ground-sluicing, as at Gold Run, the cost of removal of barren material by above described method is prohibitive and the 'pay-streak' must be reached by shafts and drifts. The breaking down of the frozen gravel in drifting is accomplished either by steam-thawing or ground-sluicing; the latter process being employed where the gravel is coarse and interspersed with large boulders, preventing the entrance to any depth of the steam points, or where steam-thawing would bring down too large a quantity of gravel at a time or result in the premature caving in of the roof or walls of the drift.

If the ground to be worked has sufficient inclination and water of sufficient quantity and under sufficient pressure is available, hydraulicking is the method employed in removing the barren material and extracting the gold from the underlying 'pay-streak,' A powerful stream of water washes away the overburden, disintegrates the barren and paying gravel, which, with the exception of large boulders, is carried by the force of the water along improvised channels into the sluice-box.*

MACHINERY AND APPLIANCES USED IN THE WORKING BY THE OPEN-CUT METHOD.

Steam-shovel plant of Dougherty and Stiles, in operation on Claim 134, below Lower Discovery, on Dominion Creek.

The claim which is being worked by this interesting plant has been stripped by 'ground-sluicing.' The amount of water used for that purpose ranged from 100 to 200 miners' inches. The overburden averaged only 5 feet, the depth of gravel to be worked, 10 feet. The bed-rock had not been reached when I inspected the plant. Very few boulders were encountered, and the gravel was not frozen.

The operations are conducted with two machines; one being the steam-shovel proper, the other the gravel-dressing plant. The steam-shovel is built on the plan of a common dredge, the contents of bucket-shovel being dumped by releasing the catch which holds the swing-bottom in place when being filled, elevated and swung over to be emptied. The release is operated by the engineer operating the shovel. To enable the shovel to tear up the bed-rock, when reached, the lip of the bucket-shovel is armed with three strong prongs of steel. The bucket-shovel is capable of effectively excavating gravel 10 feet below the level of the machine. The bucket-shovel holds about three-fourths of a cubic yard, and the machine has a capacity of 800 cubic yards in two shifts of 10 hours each.

The gravel-dressing machine is composed of a hopper into which the steam-shovel dumps the gravel, which is there attacked by two streams of water under pressure, which disintegrate and wash it into a rotating trommel. The trommel is 40 inches in diameter and perforated with holes of $\frac{5}{8}$ and $\frac{7}{8}$ of an inch in diameter. A spiral ledge, 4 inches high and about 12 inches between spirals, keeps the tailings tumbling long enough to be thoroughly washed by the jets of water which proceed under a head of 27 feet of pressure from a perforated pipe passing through the centre of the trommel. The over-size tailings fall upon a belt conveyor, which can be lengthened, shortened and inclined, as necessity requires, and thus find their way to the dump. The under-size gravel, carrying the gold and the wash-water, passes into a box beneath the trommel, from which it is elevated by a centrifugal pump into the head of a sluice-box, which is connected by gates with two separate sluice-ways, provided with Hungarian

*In both 'ground sluicing' and 'hydraulicking' a jet of water under pressure is the agent employed for disintegrating gravels. The term 'ground sluicing' is used by miners of the region when the gravel loosened and moved by the jet of water requires a second handling to bring it into the sluice box; 'hydraulicking' when the same jet which disintegrates and moves the gravel also forces it into the sluice boxes.

riffles, one sluice-way being used when the other is being cleaned up, so that no stoppage of operations is required during the time occupied by the clean-up.

The steam-shovel absorbs 10 horse-power and the gravel-dresser 8 horse-power. The plant is said to cost $20,000 and, with the exception of some castings, which were imported, was designed and constructed in Dawson. The working force consists at present of 20 men, 10 men for each shift of 10 hours. The capacity of the plant is equal to the work of 90 men per shift of 10 hours.

The quality of the ground worked is low grade, and according to the manager's report, carries $1.50 per cubic yard of pay-gravel, and under the favourable conditions which prevail at this claim, much lower grade gravel could be handled with profit. The cost of operation is reported as 13 cents per cubic yard handled. This low cost is accounted for in part by the exceptional cheapness of the fuel in this special locality. There is plenty of wood near at hand costing $4 per cord, laid down at the claim.

The plant just described furnishes an excellent illustration of the method to be pursued in working profitably gravel which could be worked only at a loss by the ordinary placer methods. This will be seen from the following figures: 4·5 cubic yards of compact gravel is about the average amount a man can shovel from a dump into a sluice box in a shift of 10 hours, for which he receives $7.50, the ordinary average wage on the creeks for labour. This is at the rate of $1.66 per cubic yard, exclusive of the expense for labour in bringing the gravel to the dump at the sluice-box.

A steam-shovel is also in operation on claim No. 2, Eldorado, which is being worked for the second time. The shovel here is used to pick up indiscriminately what was left from the first working, including: tailings, stripping and virgin pillars, and putting this material direct through the sluice-box.

Dredge Operating on 42, below Discovery, on Bonanza Creek.

The following description of this dredge offers nothing specially new in construction, and is given merely to complete the record of machinery used in working by the open-cut method.

The dredge is provided with two endless chains of buckets, 29 buckets for each chain, occupying respectively the front and rear of the structure. The chain of buckets situated at the front or bow performs the function of excavator and hoist, the other that of tailings-stacker. The lips of the buckets of the former are armed with strong prongs of nickel steel, those of the latter are plain. A 75 horse-power boiler furnishes the steam-power, 65 horse-power being required to operate the plant.

The excavating buckets elevate and empty the gravel into a rotating perforated trommel, the axis of which is inclined about 10°. The gravel tumbled by the rotation of the drum is washed by jets of water, which proceed under pressure from a perforated pipe, which passes along the axis of the trommel. The over-size falls into the buckets of the tailings-elevator and the fine gravel, carrying the gold, passes along with the wash-water over tables situated on either side of the trommel. These tables are provided for the purpose of catching the gold with mats, which are overlain by expanded metal, which performs the function of riffles. The gold which is not caught on the mats falls with the tailings into sluice-boxes situated below these tables.

The 'clean-up' is effected every morning. The mats are shaken over a pan placed in a large box, and panned in the usual manner. The fine gold, which cannot be thus recovered, falls into the box, from which it is transferred to amalgamators and run over amalgamated plates. The sluice-boxes are cleaned up in the usual way.

Three men for one shift are required to run the dredge, which handles on an average 700 cubic yards of gravel in a run of 20 hours, which represents the labour of 156 men working with a shovel and pick. The consumption of fuel is 3 1-10th cords of wood per day at a cost of $12 per cord. The men receive $5 per day and board.

The depth of water needed to float the dredge is 4 feet. Where the ground is not frozen, the whole depth of the claim is taken up without moving the dredge; where it

is frozen, the unfrozen top is taken up, down to the frost, the remainder is taken up later, when thawed by the sun.

Open-cut Worked by 'Ground-Sluicing' and Bucket-Elevator.

Claim 17, Eldorado creek, acquired by A. W. Hamberger from J. Hall, is being re-worked by the former by the method of 'ground-sluicing.' The gravel is disintegrated and washed down into a sump by a jet of water from a 2-inch nozzle, under a head of 35 feet. From the sump the gravel is elevated 30 feet and dumped into the sluice-box by means of a bucket-chain elevator. Part of the water used for sluicing is elevated by pump from the sump in which the water from the 'ground-sluicing' collects; 25 horse-power is absorbed by the pump and 12 horse-power by the bucket-conveyor, requiring three cords of wood in 24 hours for steam-making; 15 men are at present employed, which will be reduced to 8 next year, 4 men for each shift of 10 hours. The conveyor does the work of about 62 men as regards the quantity of gravel moved, without taking into consideration the work required in lifting the gravel some 30 feet.

This method of re-working ground on open-cut is very effective; the gravel readily yields to the force of the jet and is with little difficulty washed into the sump.

Centrifugal Pump in open-cut on 29 below Discovery, on Hunker, at the mouth of Gold Bottom.

The sluicing on this claim is done at the bottom of the open-cut. The head of the sluice-box in this case is provided with a grizzly, preventing boulders and large size gravel from passing down into the sluice-way. The over-size is forked out into wheelbarrows and deposited in the worked-out portion of the cut. The fine tailings and sluice-water pass into a sump, into which dips the intake of a centrifugal pump, which forces the fine tailings and water through an iron pipe back into the creek.

METHOD OF SHAFT AND DRIFT.

The improvements made in the machinery required for bringing the pay-gravel from the drifts to the sluice-box on the surface consist in the replacement of the windlass by steam-hoists and the introduction of self-dumpers. These latter labour-saving devices are of special interest in that they represent an invention made in the Klondike and credited to one Bernard Esby. There are now a number of patterns in use, but all operate on the same principle, which consists in running a trolley, carrying a bucket, up an incline wire-rope, tightly stretched between shaft and sluice-box, to the head of the sluice-box, where on account of the tightening of a rope attached to the underside of the lip of the bucket, the bucket is capsized, discharging its contents into the sluice-box. On slackening the hauling rope, the bucket is righted, and the trolley returns by gravity along the wire-rope to the mouth of the shaft. Arrived here, the trolley is locked, the pulley to which bucket is attached is released and descends by gravity to the bottom of the shaft. On hoisting, the tightening of the hauling rope, when bucket has arrived on top of shaft, unlocks the trolley, but locks the pulley holding the load to the car, and the trolley now proceeds, as before described, up the incline to discharge its load automatically at the end of its journey.

The foreman of the McDonald Iron Works Company, Dawson, was kind enough to furnish me with rough sketches of two of the most commonly used patterns. The accompanying drawings, based on these sketches, illustrating the operations of these self-dumpers, and showing the functions of the different parts in the critical positions of the trolley, were made by Mr. William J. Graham, through the courtesy of the geographer, Mr. White.

PATTERN No. 1.

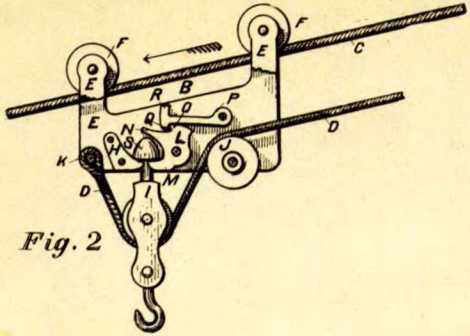

Fig. 2

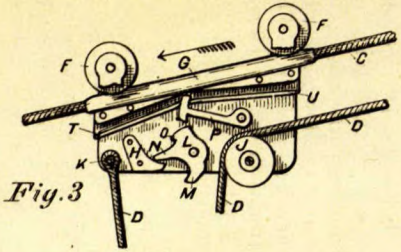

Fig. 3

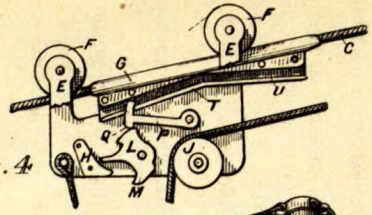

Fig. 4

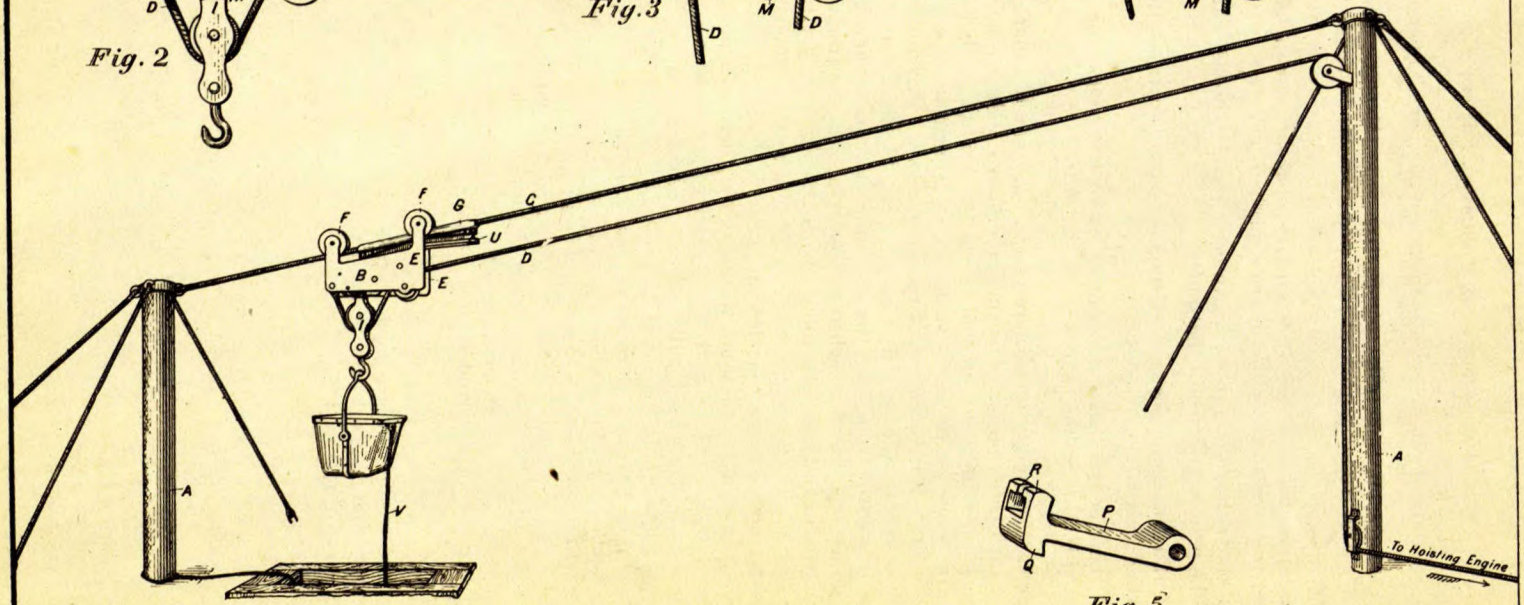

Fig. 1

Fig. 5

W. J. Graham.

Orig Missing

Description of Self-dumper, Pattern No. 1.

Similar letters of reference to indicate similar parts are employed throughout.

Fig. 1 represents a parallel perspective view, showing the general arrangement throughout. The trolley with load in position for its journey along the cable to point of discharge.

Fig. 2 represents an enlarged detail view of trolley-car in side elevation, with outer plate of car removed to show the interior mechanism.

Fig. 3 illustrates the position of interior parts of trolley-car, when in position for releasing the bucket to descend the shaft.

Fig. 4 illustrates the position of interior parts, when locking the trolley, preventing its farther descent.

Fig. 5 represents a detail perspective view of the retaining hook, showing the slot which fits the incline on the cable.

The posts A, strongly guyed, are placed one near the shaft and the other just beyond the point of discharge. The incline of the standing rope C is such that the car will, on slackening the hauling rope D, run by gravity freely from discharge position back to position over shaft and with sufficient momentum to engage the trolley-locking device P U. Q of P is lifted out of recess of cam L (shown engaged in Fig. 2) throwing cam L over from position in Fig. 2 to that in Figs. 3 and 4, allowing head S of pulley-block I to slip from the jaws of cam L and stationary iron piece H. This releases the pulley-block with attached bucket, which is now free to descend. During release, the locking bar P has slid along the incline U from position shown in Fig. 3 to that shown in Fig. 4; Q of locking bar P being now in contact with head of cam L, trolley is prevented from further descent.

On hoisting bucket from shaft, trolley car, being in position shown by Fig. 4, moves up the standing rope until R of lock-bar P, arrives at U and remains locked in this position until heqd S of pulley-block I, passing into gap between H and L and striking the prolongation N of cam L, throws L over, so that jaw M engages beneath head S, while Q of P locks into recess on cam L (as shown in Fig. 2), permitting R of P to lower sufficiently to allow trolley to slip from incline U in the direction of discharge. In this position pulley-block is locked and trolley with its load, on further hoist, travels along incline to point over sluice-box. Meanwhile dumping rope V is stretched taut, and on further hoist capsizes the bucket, dumping its load. At this instant, observed by the engineer at the hoist, power is shut off and the hoist reversed; the bucket assumes its vertical position and the car follows the slack of hoist rope D to position shown in Fig. 1.

The engineer is signalled from shaft when bucket requires to be hoisted, but his position in the engine-house is such that he observes for himself when power is to be shut off and engine reversed after dumping of load.

This pattern works well with loads up to one ton.

PATTERN No. 2.

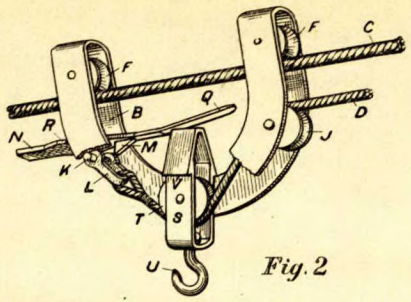

Fig. 2

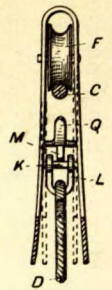

Fig. 3

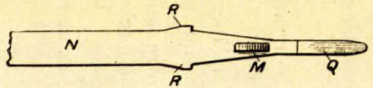

Fig. 4

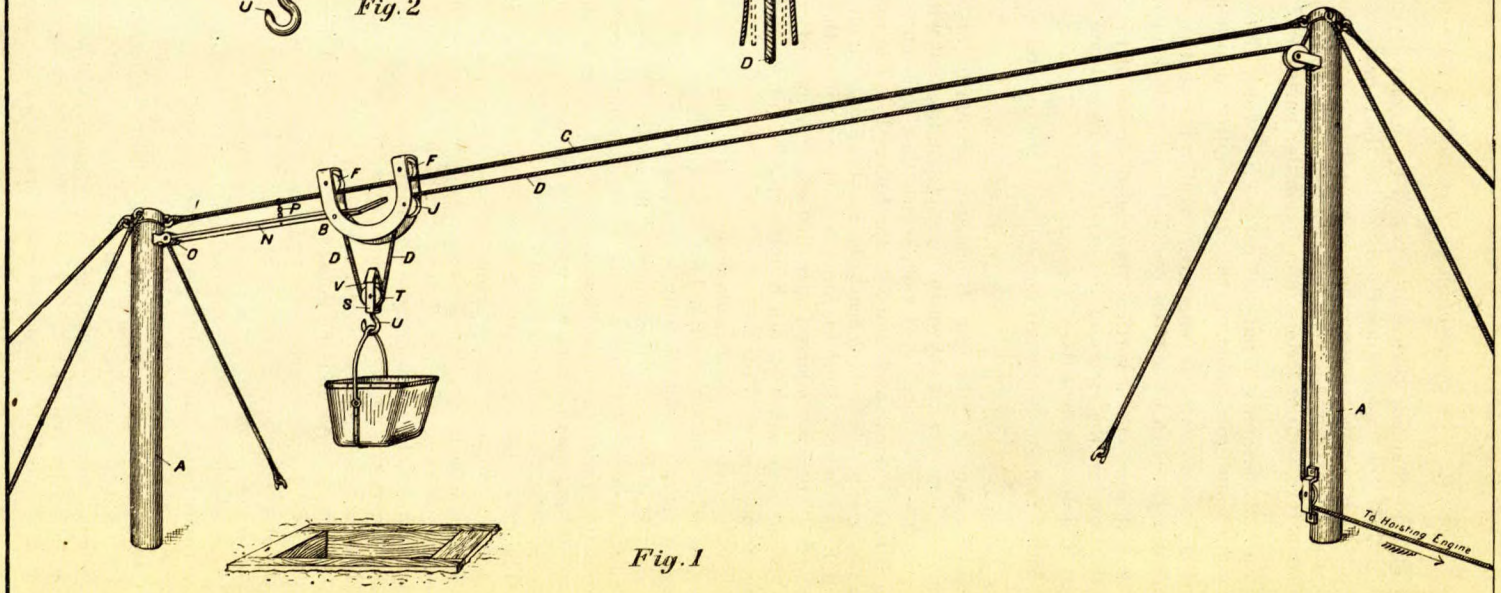

Fig. 1

W.J.Graham.

Orig missing

Description of Self-dumper, Pattern No. 2.

This mechanical device, illustrated by accompanying drawing, is even more ingenious than the one just described, in that the operations are performed by fewer parts and of such simple construction that, with the exception of the pulley and the two rollers of the trolley, the remainder can easily be constructed by any good blacksmith.

As before, similar letters refer to similar parts.

Fig. 1 represents a parallel perspective view, showing the general arrangement throughout, and the bucket in the act or position of either ascent or descent.

Fig. 2 represents an enlarged angular perspective detail view of trolley car on standing rope, with bucket removed and pulley-block in position for carrying the load.

Fig. 3 represents a vertical transverse section of the car near its centre, and showing the limbs of the frame of the car in the spread position in which the bucket is released to descend the shaft.

Fig. 4 represents a detail plan view of the underside of the locking bar at its front end.

The frame of the car B consists primarily of an elliptic or steel outline, which is afterwards, as shown in Figs. 1, 2 and 3, bent with a round turn parallel to the minor axis. The turn is of such width that sufficient space is left between the two semi-elliptic sides to accommodate the rollers F. The roller J, over which the hauling rope is carried, is located beneath the standing rope C; on the opposite side of the frame a pin K serves as a support for clevice L, to which the hauling rope is permanently attached. There is sufficient space between the eyes of clevice L to permit catch M of locking bar N to pass over pin K, engaging the pin K, on slackening hoist rope D, when in position shown by Fig. 2.

The locking bar N consists of a flat iron bar jointed at O to post A, and secured by chain P (as shown in Fig. 1) so as to hang at the proper distance from standing rope C, to permit catch M fully to engage pin K.

Part Q of the bar N is inclined upward. The bar itself widens gradually from its outer extremity to the points R where stops are situated (as shown in Fig. 4) which prevent the trolley car from descending further on the incline of the standing rope C. This widening portion acts as a wedge to spread the car frame, as shown in Fig. 3, and also as a brake to ease the blow on the stops at R.

The pulley-block S, carrying the roller T, consists of an iron frame, wedge-shaped at its upper end, and the lower end furnished with hook for the support of the bucket. The wedge-shaped portion acts as a guide between the limbs of the car-frame and at the same time provides the catch-ledges N, which rest on the upper edges of the lower parts of the limbs of the car, when the frame springs back to its original position, thus supporting firmly the block with its load upon the car.

The capsizing rope, on under side of lip of bucket, is not shown.

Operation: Assume the bucket with its load (see Fig. 1) in position of ascent. On hoisting, the wedge-shaped part of pulley-block S, entering between teh limbs of frame of car, strikes the part Q of lock-bar N, which disengages the catch M from pin K, releasing the car B. On further hoist, the car in its onward movement along standing rope C slips gradually from the inclined sides of lock-bar N; the limbs of the frame of car approach each other until the catch-ledges V rest securely upon the upper edges of the lower part of the limbs of the frame. Any further hoist moves the car with its load along the standing rope C to the point of discharge.

On return by gravity, arrived over shaft, upper part of frame of pulley-block S slides along incline Q of lock-bar N, lifting catch M above pin K, at the same time wedge-shaped part of lock-bar N opens limbs of frame of trolley to allow pulley-block, on further slackening, to pass between them and the bucket descends the shaft. As the top of pulley-frame leaves the lock-bar N, the lock-bar descends and catch M engages pin K, locking the car in position over shaft.

Observations were made regarding the efficiency of self-dumper, pattern No. 1, on discovery claim, lower Dominion creek. By counting the number of buckets raised in a given time it was found that on an average 300 buckets could be raised from the shaft, which in this case was 46 feet in depth, and dumped in sluice-box in a shift of 10 hours, on the supposition that a loaded bucket was always ready at the bottom of the shaft to be exchanged for the empty bucket arriving.

The Need of Testing Ground by Panning when Drifting.

In taking out gravel by drifting, it is necessary, to avoid passing from the 'pay-streak' and mining barren gravel, that the ground be continually tested by panning as the drift advances. Neglect of this precaution leads frequently to disaster. An illustration of the consequence of such disaster, cited by the mining inspector for the Gold Run district, is that of the case of Mr. Denker, who worked on a 'lay' the claim No. 12, below Discovery, on Quartz creek. It is stated that Mr. Denker worked all last winter taking out gravel from the claim, which he supposed to be 'pay.' On sluicing in the spring, it was found that most of his dump consisted of barren gravel. The claim passed into other hands, and by panning and keeping within the 'pay-streak' the present operators found the claim a profitable venture.

A still more telling illustration is given by the mining inspector of the Dominion creek mining district. Mr. Louis Pond, owner of No. 31 Creek Claim *b*, Upper Discovery, on Dominion creek, worked all last winter with three steam plants, employing 21 men, accumulating on the dumps large quantities of gravel. No panning was done during the winter's work. On washing up the gravel in the spring, most of it proved to be barren. The new owners, by careful panning, kept within the 'pay-streak,' and were able by three weeks work to pay the purchase price of the claim, $2,500.

HYDRAULICKING.

The Coffee Hydraulicking Plant.

The claim worked by this plant is situated on King Solomon Hill, at the mouth of Boulder creek. The water, brought from a point 4 miles above the mouth of Boulder creek, conducted by ditches, flumes and syphon, is delivered at the distributing point on King Solomon Hill under an effective head of 150 feet. The diameter of the nozzle is 3 inches, that of the pipe 10 inches. The gravel is guided by channels into a long sluice-box, provided with block-riffles shod with iron. The tailings are deposited on claim No. 1, Boulder creek. The plant is very effective.

The hydraulic plant of George Johanson has already been described by Dr. Miers, in his 'Visit to the Yukon Gold Fields, August, 1901.' It may be stated, however, that since then Mr. Johanson has put in a new condensing plant to purify the water of the creek for the boilers, and that, according to his statement, he expects his claim to be worked out next year, and that he will then remove his plant to his hydraulic claims on the Big Salmon river.

I learn from Mr. Robertson, Mining Inspector, Grand Forks, Y.T., that Andrews & Company have secured Cheechako Hill, with the object of converting it into an hydraulic proposition, and that Mr. Andrews has secured the necessary pumping machinery. During the present season, Mr. P. H. Hebb, owner of a large block of claims on the Hill, has been working these claims by the method of 'ground-sluicing,' and has, up to September 1, uncovered about 50,000 square feet of bed-rock, yielding upward of $50,000.

'To do this work Mr. Hebb employed on an average 10 men for all work, 2 men being required for the actual work of 'ground-sluicing.' The amount of water used was, when at its best, about 50 miners' inches, 30 miners' inches being the usual amount, which is very little more than half a sluice-head, while for a considerable time this water was being used for the second time, it having been used to sluice dumps on the hill at a higher level.

'The water used was pumped from Bonanza creek by a Worthington pump, driven by an 80 horse-power boiler, at a cost of about $60 per day, requiring about 4 cords of wood for 24 hours.'

A large hydraulic plant arrived at Dawson, on September 5, for Cecile Cole, to be used for pump-hydraulicking on Last Chance creek.

The time is rapidly approaching when efforts will be made to work by hydraulic methods the benches and hillsides in the Bonanza mining division. To enable operators to carry out such purpose, the requisite dumping ground will require to be provided. At present it is the practice of owners of worked out or worthless creek ground to hold their properties at such high figures as effectively to prevent the hillside operator from acquiring such ground for dumping purposes. It seems in the best interests of the region that bona fide hydraulic operators be protected from the 'hold up' which is being practised in this matter by owners of worked out claims. The grant for placer mining issued by the Department of the Interior expressly provides that 'the said grant shall lapse and be forfeited unless the claim is continuously and in good faith worked by the "owner" or his associates.' Insistance on the carrying out of these conditions expressed by the terms 'continuously and in good faith' will release many of these claims and render them available for the much needed dumping ground.

ROCKERS.

Very few examples of the primitive method of rocking out the gravel remain to be seen in the region. The few observed were on claims Nos. 9 and 10, on No. 7 Pup, a tributary of Victoria gulch. On No. 9 four men were at work, two men employed pick, shovel and barrow, supplying the two rockers with pay-dirt. The men claimed to be making an average of $10 per day per man. On No. 10 only two men were at work, and their average earnings were about $7.50 per day.

But for the scarcity of water, the proper method of working this steeply inclined gully would be by hydraulicking.

PUDDLING MACHINES.

On a bench claim, which I examined, on Last Chance creek, the pay-gravel, which is found only a few feet below the surface, is distributed through a very tenacious clay, which prevents the recovery of the gold by the ordinary method of sluicing, and requires to be distintegrated before being run into the sluice-box. For this purpose the gravel, which is trammed down the hillside to the creek, is dumped into what is called by its operator a puddling machine. This machine consists of two concentric wooden cylinders, about 3½ feet high and of respective radii 2 and 6 feet. The space between the cylinders is floored and the interior cylinder filled with earth, tightly rammed about an upright post, occupying its centre. This post carries a strong iron pin which fits into a hole of a wooden beam, about 3½ inches in diameter. This hole divides the beam into the respective lengths of 4 and 8 feet. At a distance of 4 feet from the centre on each side the disintegrator is attached. This consists of a triangular frame of wood, into which stout iron pins are driven, after the manner of a common harrow. These pins rest upon the floor-space and to prevent the tilting of the disintegrator, as it is moved along in its circular path by a horse hitched to the longest part of the beam, it is loaded with boulders. The operation is as follows:—The pay-gravel is dumped into the circular space between the cylinders, water is added and the disintegrator dragged through it by the horse hitched to the longest end of the beam. One charge, consisting of perhaps 4 cubic yards, requires 8 hours puddling before it is sufficiently disintegrated to be allowed to pass into the sluice box, which is connected with the puddling machine by a gate in the outer cylinder. A second machine of a similar character was in process of construction at the time of my visit.

I could not learn from the workmen how much gold this clayey gravel carries per cubic yard, but it must evidently be quite rich to pay working it by such a crude and primitive machine.

THE CLEANING OF AURIFEROUS BLACK SAND.

Where pay-gravel contains much black sand, the separation of the gold from the black sand is, on account of the high specific gravity of the latter, not completed in the sluice-box. This sand is usually saved and sold to persons who make it a business by special methods to effect the separation at a profit. Mr. Napoleon Huot, on No. 35, below Upper Discovery, Dominion creek, cleans his own black sand, of which great quantities collect in his sluice-boxes.

His method consists in using mercury to amalgamate the gold. This mercury is retained by high transverse riffles, two for each length of sluice-box, the entire sluice-box comprising nine lengths. The water carries the black sand above the high riffles, the gold is retained by the mercury. This separation is not complete. Specimens of the black sand, cleaned by this process, were found on assay still to contain 0·47 oz. per ton, valued at $9.71.

The tin-stone, which occurs in large quantity on this claim, was found to be auriferous. The specimens collected assayed 0·01 oz. gold per ton, valued at $0.21.

CHARACTER OF THE GOLD.

During my visit to the various claims, I have taken every opportunity which presented itself to examine the gold won at these claims. I was impressed with one characteristic which was common to nearly all the gold examined, viz.: the shape of the grains. The grains were flat, roughly elliptical plates, more or less smooth on both surfaces. This shape would not result from travel of the gold along with the gravel down the creek-beds, but rather from the pressing and polishing action of the gravel, as it passed over the gold, flattening out the grains and elongating them in the direction of the passage of the gravel over them.*

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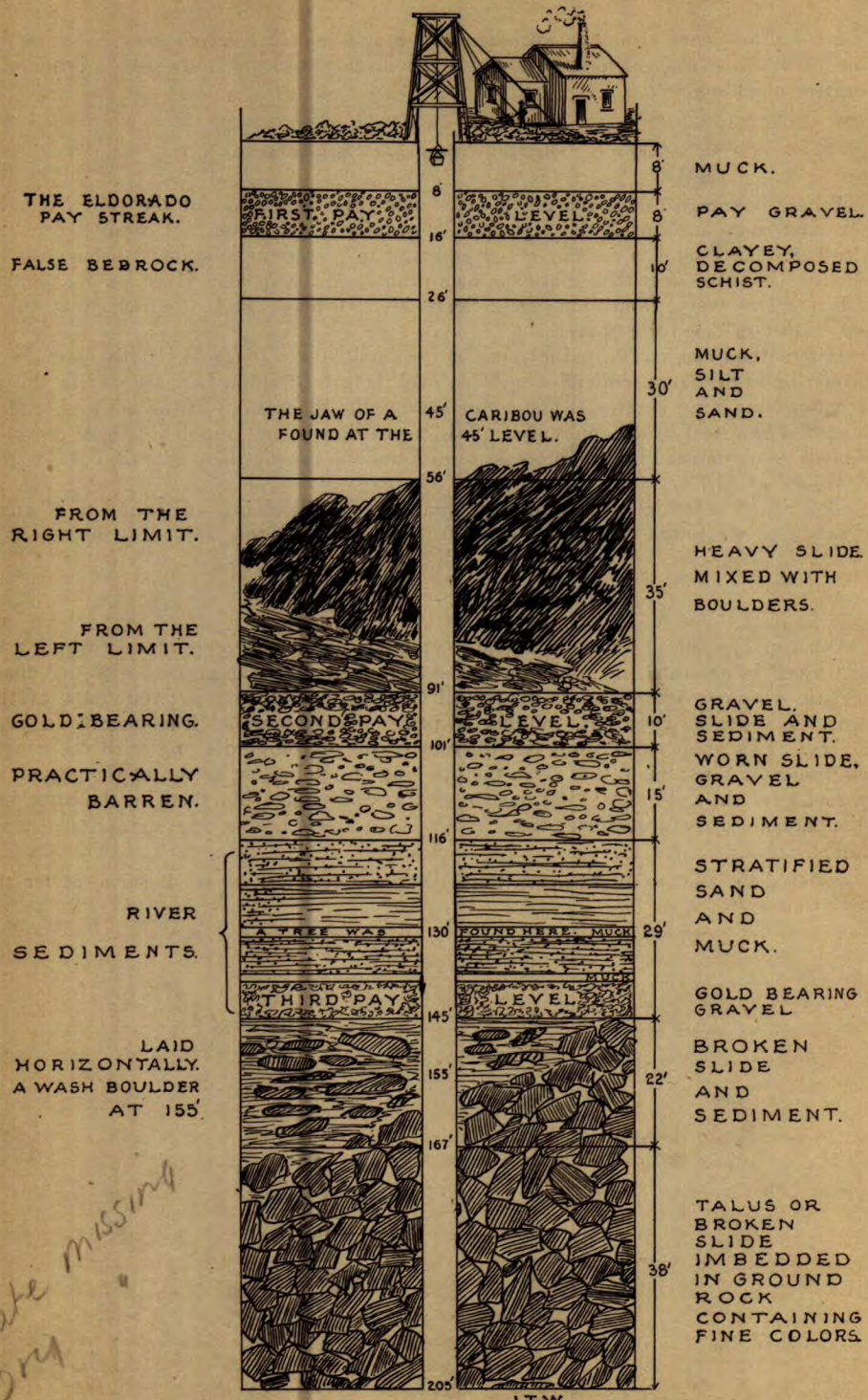
*See also Mr. McConnell, Summary Report of the Geological Survey Department for the year 1901, page 26.



J.T.W.

LOOKING DOWN ELDORADO

Plate missing
Ory

215 Foot Shaft on No. 3 A, Eldorado Creek.

In 1901, upon the right limit of No. 3 Eldorado 'pay' was struck below what had been considered the bed-rock. Mr. Asa Thurston Heydon, M.E., in the *Dawson Daily News*, of August 11, makes the following statement in connection with this interesting discovery. 'This "pay,"' he writes, 'was of a local character, and its continuation was struck upon No. 3 A . . . . The next step forward was taken by Messrs. Thompson, White and Granger, who, acting upon Mr White's knowledge that there was still muck below the deeper "pay," purchased No. 3 A and commenced searching for the deepest "pay." After purchasing, they drifted 30 feet towards the creek, from the bottom of the shaft through what appeared to be a point of solid bed-rock, and found a mixture of worked-over silt and gravel containing good "pay." As this mixture descended a little draw or sag in the run at an angle of about 30 degrees, it was followed a distance of 90 feet, which gave a total of 80 feet from the surface. By that time the gold had left the bed-rock and worked up into the slide. As the combination of shaft and incline made the hoisting both inconvenient and expensive, the old workings were abandoned, after incurring an expense of $6,000, and the present, known as the deep shaft, was begun last February.

'After passing through the eight feet of muck, the regular Eldorado "pay" streak, 8 feet in thickness, was struck. This was the first "pay" level encountered and rested upon 10 feet of slide or false bed-rock, formed of a clayey decomposed schist. This was underlaid by a 30-foot deposit of muck, silt and sand. Beneath this was a heavy slide from the right limit, resting upon another from the left. These slides aggregate 35 feet in thickness. Underneath there was a 10-foot layer of mixed slide, gravel and sediment, containing good "pay." This formed the second "pay" level. As the gold differed from the creek gold, and was almost identical with the beautiful French Hill gold, the belief that the missing bench gold had broken down into the deep channel was still farther confirmed. Incidentally this is undoubtedly the same layer that was followed down by the incline.

'The next layer, 15 feet in thickness, is composed of river-worn slide, unmingled with gravel and sediment. The fact that it is barren at that point does not militate against its being valuable elsewhere. This was followed by 29 feet of river gravels and sediments, containing the layers of muck, one of which held a tree some 12 inches in diameter. These gravels and sediments, aside from a slight and natural variation in colour, are identical with those upon the benches, and afford farther proof of the correctness of the deep channel theory. The lowest stratum of these river gravels forms the third "pay" level and, although low grade at that point, would in all probability develop into a "pay" proposition by cross-cutting it.

'The third "pay" level rests upon a mushed up mass of broken slide and sediment with an occasional wash boulder, all laid horizontally until it gradually merges into what appears to be a talus or broken slide, such as gathers at the base of a bluff or steep declivity.

'The boulders of this slide are embedded in ground rock and lie upon each other in all shapes, while there are frequently open spaces between them of considerable size. This mass had been penetrated to a distance of 60 feet by the shaft, which has reached a depth of 205 feet. From the indications uncovered, it would hardly seem as though it could be more than 50 feet to solid bed-rock, but there are absolutely no data upon which to base an estimate, consequently the only thing to do is to keep sinking until something definite one way or the other is discovered. It is also quite likely that the solid formation would be struck upon the rim or side, which would necessitate some drifting in order to reach and test the deep channel.'

The description just given is substantially the one given me by Mr. Thompson on my visit to the shaft, who informed me also that since the publication of the description of the shaft by Mr. Heydon, they had added 10 feet to the depth, so that the shaft, when I left, was 215 feet down. They were still in broken sericite schist. The sinking

of the shaft, Mr. Thompson stated, was undertaken in the hope that on reaching the true bed-rock, they would strike a rich 'pay-streak,' which would justify the outlay on what has proved so far a costly venture.

I found the shaft timbered all the way down and was not, therefore, able to check the section of the shaft, as published by Mr. Heydon, and which is here reproduced.

INDIAN RIVER CONGLOMERATE.

It had been my intention to visit and examine the conglomerate deposits on the Indian river, but I was informed by Mr. Beaudette that no development of any consequence had been made, and that not much could be learned by mere inspection. He further reports that two tons of this conglomerate were put through the stamp mill of the Ladue Company, at Dawson, with the result of a yield of $2.24 per ton. The ore was taken from a drift driven into the conglomerate deposit to a distance of 15 feet.

A fire assay was also made by the assayer of the Ladue Company, giving a result of $2.27 per ton, which corroborates the mill run, and shows that in milling practically all the gold was saved.

The opinion was expressed that the gold is distributed through the cement, and is not carried by the quartz pebbles. This appears to be substantiated by the fact that, on panning the cement, colours were obtained.

QUARTZ.

Great activity has been manifested by prospectors in searching for auriferous quartz and many quartz claims have in consequence been staked.

I visited what were represented to me at the time as some of the more important of these quartz claims, where some development was reported to have been made. Specimens were collected and assays of these made at the Dominion of Canada assay office, Vancouver, B.C.; results of the assays of these specimens are given at the end of description of each locality from which the specimens were obtained. The gold values are calculated at the rate of $20.67 per Troy ounce.

Lone Star and New Bonanza Mineral Claim.

This claim is situated on top of Victoria Hill, which constitutes the divide between Bonanza and Eldorado creek. It was reached by way of Victoria gulch and trail leading up to the top of the hill. The development work consisted of a shaft 4 feet square, 38 feet deep, at the bottom of which a tunnel, 50 feet in length, had been constructed. The quartz here occurs in the form of stringers, which are separated from each other by thin layers of sericite schist. These stringers differ in width from the thickness of a knife blade to several inches, swelling out into lenticular masses, which again become constricted, only to widen out again. They are enveloped by sericite schist, abundantly mineralized with iron pyrites and galena. What is regarded as the foot wall is quartzite, the hanging wall, sericite schist. Free gold occurs in all the specimens examined on the contact surface between the quartz and mica schist. At a distance of about 28 feet from the shaft another shaft had been sunk, but this was filled with water at the time of my visit. A number of cross-cuts had been made on the surface, in each of which quartz showed abundantly. Masses of quartz were seen protruding from the surface all about the locality where the shaft was sunk, and it needed only to wet the surface of the quartz with water to reveal the bright specks of gold adhering to their surface. These quartz blocks seemed to have been weathered out from the country rock, and evidently occupied their original position.

On leaving the mines, we passed down towards Gay gulch to the road along Eldorado creek. On our way down we met with many cross-cuts, which had been made

wherever there seemed to be an indication of quartz. About two-thirds of the way down the hill a pit, 4 x 8 feet, had been blasted out of the quartz to a depth of about 3 feet. There is no doubt regarding the abundance of quartz indications, but in what condition and in what quantity it was impossible to determine.

Gay gulch and Victoria gulch, the former a tributary of Eldorado creek, the latter of Bonanza creek, limit Victoria Hill toward the sources of Bonanza and Eldorado creeks. Above Victoria and Gay gulches, Bonanza and Eldorado creeks respectively are unproductive, below these gulches the creeks are rich. It seems a reasonable conclusion that the gold in these creeks, at least as far as thy flank the sides of Victoria Hill, was derived from Victoria Hill.*

The following are the results of assays made from the Lone Star mineral claim. The specimens were taken from the shaft above described:—

Specimen No. 1.—

Thin pieces of quartz stringer coated with sericite schist.
Gold per ton, 0·51 oz.; value, $10.54.

Specimen No. 2.—

Quartz from interior of thick piece of stringer, free from sericite schist.
Gold per ton, 0·12 oz.; value, $2.48.

These assays, while corroborating the observation that the gold chiefly occurs at the contact surface, between the sericite schist and the quartz, furnish no indication of the average tenor of the quartz, since the distribution of the gold is very irregular.

On the Divide which separates the left Fork of Hunker from the left Fork of Dominion Creek.

On top of this divide occurs an exposure of quartz, 51 feet in length, with a maximum width of 17 feet. A shaft, 12 feet in depth and 8 x 4 feet cross-section, was sunk, the whole being in quartz. The quartz is milky, tinged with oxide of iron and free from spangles, or thin layers of sericite schist, which is the rock in which the outcrop occurs. At a distance of 310 feet to the west of this outcrop occurs another, 20 feet 9 inches in length, and rising above ground to a distance of 6½ feet. Large masses of quartz appear all over the hillside, which seem to lie in their original positions, having been weathered out from their matrix of mica schist. The creeks, left fork of Hunker and left fork of Dominion, which skirt the hill, are barren.

A specimen taken from shaft assayed 0·02 oz. Gold per ton valued $0.41.

On Gold Run, opposite 33 Creek Claim, left Limit.

An attempt has been made to drift into the side of the hill. The tunnel was securely locked, work and tools had been abandoned, and it was impossible to learn anything definite regarding the distance to which the tunnel had been driven, nor of the character of the deposit. From the dump outside it could be seen that the quartz was highly mineralized, being liberally peppered with iron-pyrites. A specimen taken from the dump gave the following results:—

Gold per ton, 0·02 oz.; value, $0.41.

Quartz Claim, opposite No. 73, below Discovery, on Hunker Creek.

Sixty feet above the road a tunnel has been driven into the side of the hill, following what appears to be a true fissure vein to a distance of 250 feet. The vein passes

*Regarding Victoria Hill as the source of some of the gold in Bonanza creek, Mr. McConnell makes the following statement: 'That some of it came from this point seems beyond question,' page 36, Summary Report, Geological Survey Department for the year 1901.

through graphitic schist in a direction of 95° W. of north, according to observations taken by Mr. Beaudette.

Specimens for assay were taken at distances of 100, 200 and 250 feet from mouth of tunnel and also from dump. The following are results of assays:—

No. 1. 100 feet from mouth of tunnel—Gold, 0·05 oz. per ton; value, $1.03.

No. 2. 200 feet from mouth of tunnel—Gold, 0·01 oz. per ton; value, $0.21.

No. 3. 250 feet from mouth of tunnel—Gold, 0·03 oz. per ton; value, $0.62.

No. 4. 250 feet from mouth of tunnel—Gold, 0·02 oz. per ton; value, $0.41.

The following specimens were taken from dump:—

No. 5. Gold, trace.

No. 6. Gold, 0·03 oz. per ton; value, $0.62.

No. 7. Gold, 0·03 oz. per ton; value, $0.62.

The Ladue Quartz Property on Lepine Creek.

This property is situated some 15 miles north-east of Dawson, and is reached by trail. The width of the exposure of quartzite is 296 feet, the dip 45° south and strike N.W. An extensive talus reaches from the outcrop down the declivity of the hill to Lepine creek. The face of the outcrop shows the rock in a very shattered condition. Specimens for assay were taken from different parts of the outcrop. The results of these assays are as follows:—

No. 1. Greenish-gray quartzite, containing minute crystals of iron-pyrites, No. 2 lower tunnel Tupper—Gold, trace.

No. 2. Weathered iron-stained quartzite, No. 1 high tunnel Tupper—Gold, trace.

No. 3. Weathered quartz, iron-stained from talus—Gold, trace.

No. 4. Greenish-gray quartzite, containing iron-pyrites, slightly iron-stained, No. 3 right hand tunnel Tupper—Gold, 0·15 oz. per ton; value, $3.10.

The Ladue Company contemplate removing their four-stamp mill from Dawson to this property, with the expectation of adding to the number of stamps, if the quartz prove profitable. There is plenty of good wood in the immediate vicinity of the property for fuel, and coal within three miles, which has the following composition, determined by Dr. Hoffmann, through the courtesy of Dr. Bell, Acting Director, Geological Survey:—

Hygroscopic water	14·38
Volatile combustible matter	34·26
Fixed carbon	42·80
Ash	8·56
	100·00

Coke non-coherent.

There is sufficient water in Lepine creek to furnish 700 horse-power, if dam be constructed to give a fall of 6 feet.

From the assays of the specimens quoted, taken from what were regarded as the most promising of the quartz locations, it will be seen that quartz of sufficient richness and in paying quantities remains yet to be discovered in this region. The comparatively high assay value of some of the specimens taken from the Lone Star mine, on Victoria Hill, is no indication whatever that much of the quartz will carry similar high values. In fact the assay of the quartz from the interior of the stringers shows that the average tenor may be comparatively low.

FUEL.

The fuel at present employed in firing the boilers is wood, which varies in price according to locality from $12 to $17 a cord. But little wood is left in the vicinity of the creeks which are being worked, and it is becoming necessary to go further and further afield for the supply, which increases the cost by the additional amount of teaming required. The wood, which is spruce, with here and there a little birch, is cut green, loosely piled and set on fire, which burns off the branches, carbonizes the bark and partly dries out the wood. In this condition it is delivered in 16-foot lengths.

Owners of claims requiring a heavy outlay for fuel to operate their machinery are looking forward with interest to the experiment being made by the N. C. Company, of Dawson. This company is equipping all its river boats with apparatus for using coal oil under the boilers, and is erecting four storage tanks along the route from St. Michael to Dawson. These tanks are to be constructed of 3-inch wood of a capacity of 5,000 barrels. To distribute the oil for storage in these tanks the company will employ two tenders carrying metal tanks. The oil to be used will be brought by tank-steamers direct from the California oil fields to St. Michael.

I understand from Mr. Phillips, Manager of the N. C. Company at Dawson, that the change from the present method of heating with wood to that of coal oil is easily effected and at comparatively small expense, and that the saving in time of transit and firing costs in one year is expected to be sufficient to cover the entire expense incurred in making the change.

The superiority of coal oil as a fuel over the best coal and wood is easily understood when it is recollected that 1 pound of coal oil on perfect combustion is equal in heating effect to 27,000 B.T.U.,* one pound of the best Welsh anthracite is equal to 14,858 B.T.U.** and one pound of dry wood to only 5,943 B.T.U. Hence, coal oil is, as a heat producer, about twice as effective as anthracite coal, and four and a half times as effective as wood.

It appears that coal oil, if introduced as a fuel, will meet the needs of the miner in that region. Its transportation along the government roads in iron tanks presents no difficulty, and claim-owners in adopting oil as fuel save the extra labour involved in handling solid fuel and in stoking.

FUTURE OF THE KLONDIKE.

The first workings of the claims of Bonanza and Eldorado creeks by the cruder methods of earlier years have been so wasteful that it has been found to pay to work them a second time, and some claims have yielded, on second working, larger returns than on first working. Many of these claims are now worked out 'from end to end and rim to rim, and are fit for nothing else than dumping ground.' No claims on the other creeks, as far as I could ascertain, are being worked a second time, nor is it likely that it would prove profitable to re-work them, since the methods of extracting the gold have greatly improved, and care is exercised to get out maximum percentage of the 'pay.'

It must not, however, be overlooked that there are long stretches of creek bottom and gulches, which, being of too low a grade to be worked by ordinary placer-methods, can be worked profitably on a large scale by machinery. Many claims, which are 'good pay,' are held back for lack of water, awaiting the exhaustion and relinquishment of adjoining claims to enable the owners to take advantage of the water now being used by their neighbour. Still other claims are held back, awaiting improved conditions as regards transportation, labour and fuel. To this ground now lying idle must be added the hillsides awaiting to be worked by hydraulicking.

*Page 368 E. Tremlett Carter, C. E., motive power and gearing for Electrical machinery.
**l. c. Table IV., page 54.

But whatever generous estimate may be made as regards the quantity of gravel still to be worked in the Klondike, this gravel will be worked on a large scale by the more rapid methods of machinery, employing comparatively few men. It is quite probable that other auriferous regions may be discovered in the Yukon, which will develop into placer-mining camps,—we know very little as yet of the resources of the Yukon,—but such discoveries will simply shift the population to the new mining camp. That this is realized, and that it is understood that the Klondike as a mining camp must look for permanency to the discovery of paying quartz and in paying quantities is evidenced by the energy manifested by prospectors in searching for quartz. Very many quartz locations have already been staked and recorded.

QUARTZ MILL.

On my return from the creeks, I received a communication from the Acting Commissioner, Major Z. T. Wood, asking my opinion regarding the proposed establishment of a quartz mill in Dawson, to which I replied:—

DAWSON, September 2, 1902.

SIR,—I beg to acknowledge receipt of your letter of the 19th ultimo in reference to the proposal of the 'Dawson City Water and Power Company, Limited,' to erect an experimental quartz mill for the purpose of making mill runs of auriferous quartz of owners of quartz claims and prospectors, charging certain fees per ton put through the mill, if the government will assist the enterprise by giving a bonus for three years of $5,000 per annum, and asking my opinion as to the advisability of the government entertaining such a project.

In response to this request I have the honour to state that the development of the Yukon district and its permanence will largely depend upon the finding of a sufficient quantity of auriferous quartz of a degree of richness which will render it feasible under existing high prices to erect stamp mills and work such quartz at a profit. It is, therefore, of prime importance that owners of quartz claims and prospectors shall have the opportunity at not too great expense of testing their properties by obtaining reliable returns from actual mill runs made under proper supervision. Such authentic mill returns will decide the feasibility of working the various claims, encouraging the erection of plants in case the percentage of gold per ton is found sufficient to guarantee a profit, and in the reverse case, prevent the useless expenditure of capital and render improper speculation difficult.

In view of these facts I strongly recommend that the proposal of the 'Dawson City Water and Power Company, Limited,' be entertained, and the bonus, which is reasonably low, be given. The scale of charges is fair, considering the cost of operating the mill, and this will be the more apparent from the prices quoted by the Ladue Company, which I inclose herewith.

I may state in addition that the Australian government has set a precedent of governmental aid to quartz mining by establishing a number of mills, at their own expense, in different localities in their territory.

I have the honour to be, sir,
Your obedient servant,

(Signed) EUGENE HAANEL,
Superintendent of Mines.

Major Z. T. WOOD,
Acting Commissioner,
Yukon Territory.

An agreement was entered into by the government with the Dawson City Water and Power Company for the erection of a quartz mill, which, according to contract, was to be in operation by November 15, 1902. In order that the mill-runs might be corroborated by fire assays, it was stipulated that a properly equipped assay office was to be provided in connection with the mill by the Dawson City Water and Power Company, the mill and assay office to be under the supervision of a thoroughly competent government officer. I was asked by Mr. Smart, Deputy Minister of the Interior, to find a competent man for this position, and was fortunate enough to find such a man in the person of Gustave Eugene Beraud, formerly assayer and stamp mill operator of the Ladue Company. Mr. Beraud has attended for one year the Ecole des Mines, of Paris, and has been in charge for two years of the assay office of the Anaconda Copper Mining Company. I have been informed by Mr. Smart that Mr. Beraud has been appointed as assistant to Mr. Beaudette at a salary of $3,000 per annum, his duties to commence on October 1, 1902.

By telegram of November 19, Mr. Matheson advised me that the mill was ready for operations, and requested that a balance be sent him for the assay office established in connection with the mill.

In response to this request an assay balance, which could be spared from the Dominion of Canada Assay Office, was forwarded by express from Vancouver to the address of Mr. Matheson, in care of Mr. Beaudette, and a set of weights ordered from Trœmner, of Philadelphia, to be sent to the same address.

GEOLOGICAL WORK IN THE KLONDIKE.

Mr. McConnell informs me regarding this subject that a portion of the two seasons, 1899, 1900, were spent by him in the Klondike, and interim reports on the condition of the camp published in the publications of the survey. The work was hampered by the want of a topographical map, and a considerable proportion of the limited time at his disposal was occupied in topographical work. 'A fairly good map,' he states, 'is now available, and it is highly desirable both from an economic and scientific standpoint that a full season at least should be devoted to detailed work in this important district. The work would embrace as its chief points the geological mapping of the region, and, in connection with this, a study of the relationship, if any, existing between any of the various rock groups and the placer gold, the classification of the various gravels, their distribution and approximate values, and an examination of the quartz occurrences in the district, with reference to the possibility of lode mining. The water question and fuel supply would also come within the scope of the work. It is evident that the knowledge gained in a detailed study of the Klondike gold fields would probably apply in large measure to other camps, which may be discovered in the future, and would be of great value in framing rules for their proper working.'

ASSAY OFFICE.

Representations have repeatedly been made to the department of the desirability of establishing a federal government assay office in Dawson to insure the miners the full value of the gold sold for export. It was claimed that, under present circumstances, the banks, to which the miners were obliged to sell their gold, charged too high a percentage in handling their gold. Regarding the justice of such claim, I have made the following observations:—

The two banks established in Dawson, the Canadian Bank of Commerce and the Bank of British North America, to which the bullion is sold by the miners, no longer purchase it, as formerly, at an average price per ounce of dust, but on weight after melt and after the fineness of the bullion has been established by assay, allowing the miner full value for the gold and silver contained in his bullion. The two banks have

each an assay office, which I was permitted to inspect. I found them fairly well equipped and the assayers thoroughly competent to perform their work with accuracy. This latter fact is evidenced by the agreement shown between the assays of the bank and the assays for the same bars made by the Seattle assay office, to which the bars were sold. I was accorded the privilege by Mr. Cameron, of the Canadian Bank of Commerce, to make this comparison and found that in many cases the assay returns of the bank were in favour of the miner.

The banks charge 2 per cent for handling the miners' gold. Of this amount 1½ per cent (information obtained from express agent, Dawson, Y.T.) is absorbed by marine insurance, consular invoice and express charges to Seattle, the remaining ½ per cent represents the commission which the bank exacts to cover assaying and office expenses, and the loss of interest on money paid to the seller of the gold for the time elapsing between payment to the miner by the bank and receipt by the bank of payment by Seattle assay office, to which the gold is shipped.

Whatever may have been the practice of the banks in previous years, it is quite evident that the miner is at present accorded by the banks very fair treatment, and that the claim repeatedly made that the banks charge too high a percentage in handling the miners' gold is not now justified by the facts.

Under these circumstances, it does not appear that the removal of the Dominion of Canada Assay Office from Vancouver, the central position in reference to the gold fields of the west, to Dawson, or the establishment of an additional government assay office in Dawson would be justified.

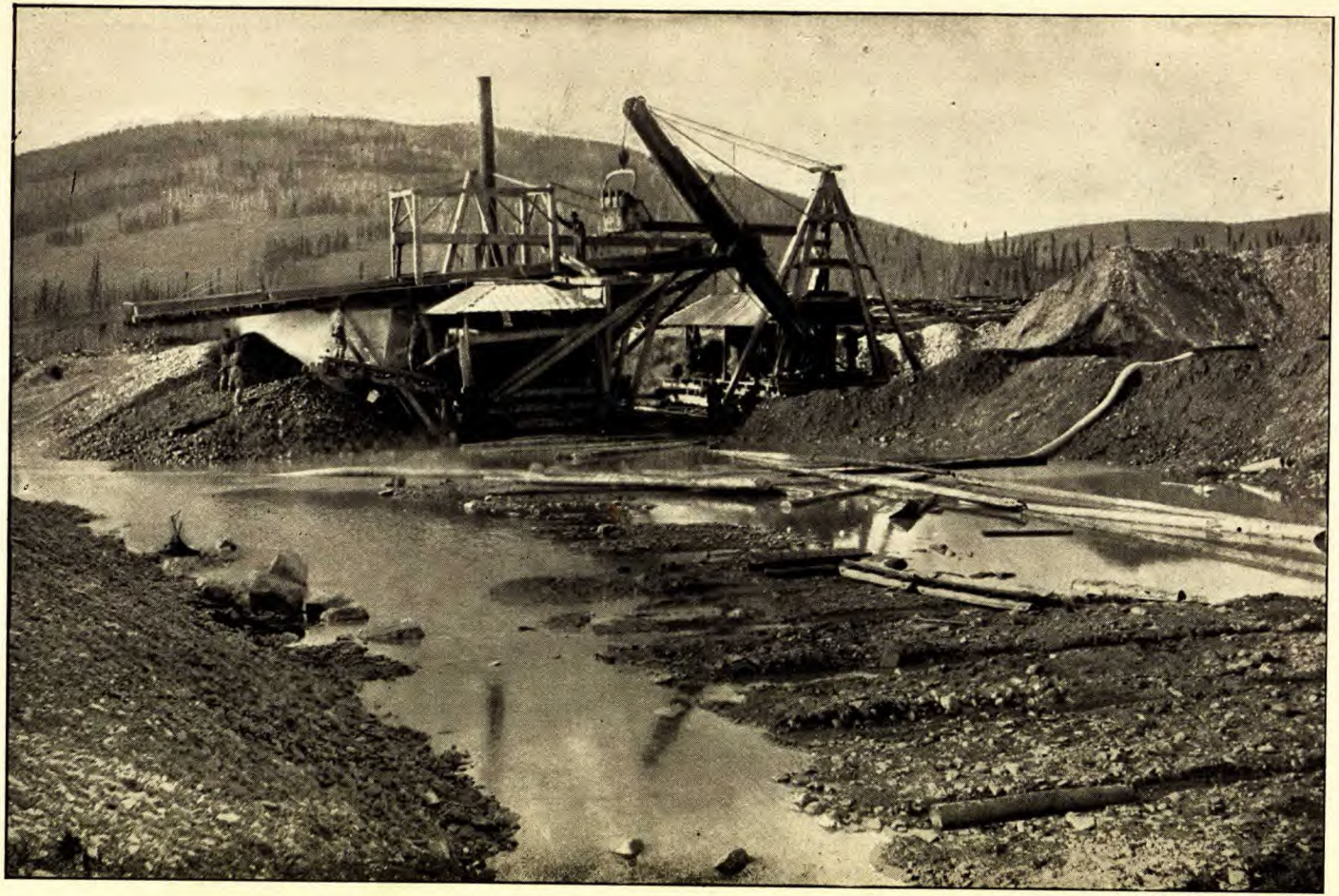
MANUFACTURE OF MACHINERY.

The present freight rates on raw material prevent the manufacture of machinery to any extent in Dawson, the freight on raw material being the same as for finished machinery. Coke landed at Dawson is worth $180 per ton, and the cost of producing plain castings, exclusive of pattern, is eighteen cents per pound. Wages in machine shops and foundry run from $1 to $1.25 per hour. Yet in spite of these disadvantages, the MacDonald Iron Works Company turn out about 22 tons annually of castings of all grades of iron, brass and bronze. The actual consumption of castings is about 500 tons annually, and these are supplied principally by firms in the United States.

It may be interesting to mention here that the high benches along the Klondike river furnish an excellent moulding sand, of a reddish-yellow colour, fine grained, yet very open, allowing the gases produced in the moulds to escape very freely. It has a silky feel and the peculiar and valuable property of not burning fast to the iron castings. It is not necessary with this sand to finish the moulds with plumbago, or any other preparation to loosen the sand from the castings, which require but very little tumbling to free them from the particles of sand clinging mechanically to the surface.

I have the honour to be, sir,
Your obedient servant,

EUGENE HAANEL,
Superintendent of Mines.



STEAM SHOVEL PLANT OF DOUGHERTY AND STILES, IN OPERATION ON CLAIM 134, BELOW LOWER DISCOVERY, ON DOMINION CREEK.

Department of the Interior

HONOURABLE CLIFFORD SIFTON, MINISTER

1903

WHITEHORSE COPPER BELT

Scale 4000 Feet to 1 Inch

0 1 2 3 Miles

Accompanying Report by Dr E. Haanel, Sup^t of Mines.

WHITEHORSE

LEWES RIVER

Whitehorse Rapid

Govt Wagon Road to Grafter

Govt Wagon Road to "Copper King"

Hunker Creek

Trail

Mc Farlane Cr.

Wolf Cr.

White Pass and Yukon Railway

Wigan

Dugdale

Valleria

MINERAL GRANTS

No.	Name
51	TAM O'SHANTER
52	ARCTIC
53	MCKILLIGAN
54	DIXIE
55	KENILWORTH
56	HIGHLANDER
57	PUEBLO
58	UNION
59	SHAMROCK
60	BOSTON
61	BORNITE
62	FLYING FOX
63	PROVINCE
64	NINA
65	QUEEN MARY
66	ALOIA
67	KANGAROO
68	NORTHERNLIGHT
69	FRISCO
70	TAMARAC
71	CARLISLE
72	PTARMIGAN
74	KESTREL
75	ORIENT
99	MANITOU
301	BAL MAIDEN
375	MANITOU NO. 2
376	KEEWENAW
377	HIAWATHA
378	TECUMSEH

MINERAL CLAIMS

No.	Name
1	PERCY M.
2	MINNIE G.
3	MONTANA
4	LITTLE MAGGIE
5	COLORADO
6	NEVADA
7	COMSTOCK
8	RENO
9	OKLAHOMA
10	STANDARD
11	OMAHA
12	PARAGON
13	WALKERVILLE
14	AMY
15	KENT
16	ADMIRAL
17	GIRLEY R.
18	EMERALD
19	COMMODORE
20	GREEN RIDGE
21	NELLIE SHUTE
22	BONANZA
23	TACOMA
24	DELTA
25	DEL REY
26	IBEX
27	MADEIRA
28	HAWK
29	EAGLE
30	HAZEL

MINERAL CLAIMS

No.	Name
31	SEAGULL
32	LITTLE WILLIE FRAC.
33	VIRGINIA
34	RARUS
35	LUCKY CHANCE
36	QUEENSTON
37	JUBILEE NO. 2. FRAC.
38	WHITEHORSE NO. 2
39	ANACONDA
40	RABBITS-FOOT
41	COPPER QUEEN
42	COPPER KING
43	ORA
44	LE ROI
45	WAR EAGLE
46	CONNECTICUT
47	TEXAS
48	DAKOTA
49	NORA
50	SCOTTISH CHIEF
73	CROOKED DOCTOR
76	MILDRED
77	KATIE
78	BEN HUR
79	FERGUSON
80	TIPTOP FRAC.
81	ROTHESAY
82	BLUEBELL FRAC.
83	AUSTRALIAN
84	WANITA
85	OWL
86	RAINBOW
87	PEACOCK SUNRISE
88	SUNOL
89	COLUMBINE
90	KATHERINE
91	RHODES
92	JAMESON
93	CRUSADER
94	SARACEN
95	MAMIE
96	CLEVELAND
97	OHIO
98	SKYLARK
100	CONTINENTAL
101	AGNES R.
102	SPRING CREEK
103	ANNEX
104	EMPRESS OF INDIA
105	RETRIBUTION
106	BEST CHANCE
107	DAISY FRAC.
108	LITTLE COMET
109	ARLINGTON
110	GRAFTER
111	JUPITER
112	ALGONQUIN
113	ARGOSY
114	SURPRISE
115	POCAHONTAS FRAC.
116	IRON HORSE
117	PRUDENCE
118	BLACKSMITH
119	PALERMO
120	CARNAGE
121	VERONA
122	FLORENCE
123	HELENA

MINERAL CLAIMS

No.	Name
124	GOLDEN GATE
125	WHITEHORSE
126	ARTIC CHIEF
127	ALPHA FRAC.
128	CORVETTE
129	VENDOME
130	AUTOGRAPH
131	SUBURBAN
132	CUB FRAC.
133	BIG BEAR
201	POLAR QUEEN
202	POLAR ANNEX
203	POLAR BEAR
204	POLAR CHIEF
205	CONCORD
206	LAKEVILLE
207	POLAR KING
208	POLAR STAR
209	MOUNTAIN MEADOW
302	PORTLAND
303	LELIA
304	COPPERHEAD
305	DOLCOATH
306	ZEALANDIAN
307	BRADFORD
308	BIG CHIEF
309	LAKESIDE
310	PAYMASTER
311	LITTLE CHIEF
312	PAPOOSE
313	CENTRE STAR
314	VALERIE
315	LANDSDOWNE
316	ZIGAZIG FRAC.
317	KERBERKAN FRAC.
318	BUCKINGHAM
319	ELMIRA
320	NORTH STAR
321	HECLA
322	MOUNTAIN VIEW
323	LITTLE NELL
324	MYSTERY
330	SILVER TIP
331	ORPHAN BELLE
332	YUKON BELLE
333	TENNYSON
334	MORNING STAR
350	SUNDAY
351	WILDCAT
352	CANADIAN
353	[illegible]
356	DUXFIELD
360	LAKEVIEW
361	COPPER CLIFF
362	COLUMBIA & KOOTENAY
370	ESMERALDA
371	ARTHUR
372	EXCELSIOR
373	NO. 1.
374	V. R.
379	BIG FOUR
390	ALICE
391	COLUMBUS
392	SNOWBIRD
393	ONTARIO
394	GRANITE MOUNTAIN
395	GRACE
396	BEAVER
397	BROWN CUB
398	BLACK CUB

INDEX MAP

Scale 15 Miles to 1 Inch