

The diameters of the air cylinders of this machine are 22 inches and 34 inches, and the diameters of the steam cylinders 22 and 40 inches, while the stroke of 48 inches is common to all.

This machine proved the chieftain of the Rand Drill Co's exhibit at last year's Chicago fair, where it received marked attention. The Dominion Coal Co. is to be congratulated upon securing so excellent a compressor.

The following is a synopsis of the features of the fine new air compressing machinery being erected for the Dominion Coal Company, by the Ingersoll Rock Drill Co. of Canada:—

High pressure cylinder 22 in. bore, 48 in. stroke. Low pressure cylinder 36 in. bore, 48 in. stroke. 2 air cylinders 22½ in. bore, 48 in. stroke. The valve gear of the engine is of the well known Corliss type, simple in construction, with all parts easily accessible and adjustable. The bed plates are of the girder type, of tasteful outline and of ample proportions and strength. The cranks are of the disc pattern balanced. The guides are circular shaped. The governor is provided with an automatic stop, which will shut off the steam and stop the engine in case the governor belt should break or come off the pulley. The cross heads, all pins and rods, are of steel and of ample proportions for severe service. The main pillow blocks are provided with removable shell boxes. The fly wheel is constructed in the most substantial manner, having oval shaped arms, the sections being held together by turned bolts in reamed holes.

In the Air Cylinders.—Free air is under thorough control. Air cylinders are completely filled at every stroke. Valves open and close by natural momentum. Cooling by water jackets and complete jacketing of heads. The new patent unloading device for air cylinders. The cylinders are driven direct from the piston rods of the engine.

All pins, including crank, cross head and valve gear pins, are made of steel, accurately turned and polished. All bearings about these pins are made of phosphor bronze, except that of the crank pin, which has brass boxes lined with genuine babitt metal, scraped to fit. The shaft in the bearing is half the diameter of the cylinder. The main bearing has an upper and a lower shell, also quarter boxes lined with genuine babitt metal scraped to fit and provided for taking up wear. The back pillow blocks are made extra heavy. As to the polished or bright work, the ends of the cylinders, cylinder head and steam chests, together with all turned parts about the valve motion and connecting rod are beautifully polished. The cylinders are lagged, the spaces between the lagging and the cylinder are filled in with the best known non-conductor.

The compressors are of the latest and most perfect device invented for the compression of air. The free air, before admission into the cylinders, is under thorough control, and may be taken from that point which is most favourable in its dryness, reduced temperature, and freedom from dust and other foreign matter. The free air is admitted into the air cylinder through a tube (which also acts as a piston guide rod) creating a uniform draft of air in one direction only, this uniform movement giving a certain momentum to the air, causing it to fill the cylinders to their fullest capacity at each stroke.

The air inlet valves are large wrought iron rings which open and close by the natural momentum caused by the movement of the piston admitting of a large area of the inlet with but a small throw of the valve.

Cooling is effected by means of a new form of water jacket, the construction of the air cylinder admitting of complete jacketing of the heads and discharge valves, thus presenting a large cooling surface to the compressor at the end of each stroke, where the air is hottest. Another important feature is the unloading device, maintaining a uniform pressure in the receiver and a uniform speed of the engine by means of connections with a discharge valve on each end of the air cylinder. The discharge valves on the compressors are of the most approved design, and the result of many years experience.

These machines are being built at the shops of the Ingersoll Company in Montreal.

Gold Mining in Nova Scotia—a Review of Operations in the Various Localities.*

By JOHN RUTHERFORD, M.E., Stellarton.

When it occurred to the writer that he might be able to extract from the records of gold mining in Nova Scotia, something that might be worth while bringing to your notice, he placed before him, in the first instance, as the prominent question to be dealt with, the query—Is gold mining in Nova Scotia worth carrying on? and the more he reflected on this query, the stronger was the feeling that if the idea prevailing in his mind had truth for its basis, the inquiry might not be without advantage. If, on the other hand, an examination of all the circumstances in connection with the practical operations and the position of the auriferous lodes should lead to the conclusion that gold mining in this province is a failure, then a frank avowal of this cannot be considered inimical to the interests of the province. Better far that capital should be placed in less highly remunerative operations, but which have the essentials of durability and steadiness of return, than to explode it with the result only of a flash *et præterea nihil*.

The writer is sensible that in stating the preceding premiss he may be thought to be adventuring boldly, for while to some it may occur that all is not gold that glitters, this inquiry is entered on with the hope that it may be shown that there is more gold than glitters.

It is not intended on this occasion to deal with the subject from a scientific point of view, so far as that bears a geological aspect. The writer is not desirous to arouse a discussion on the formation of gold or the character and position of the matrix, but rather to treat the matter in this sense: Gold has been found here, there, over a widely spread portion of the province; it is there, in situ, and it is wanted; how can it best be got and when got, is it worth the candle?

Now, this how can it be got query is of prime importance. There lies before us a portion of ground containing veins of quartz in which is embedded, sometimes conspicuously, sometimes almost invisible, the precious metal, a metal that in its intrinsic value varies very slightly so that its profitable abstraction depends entirely on the means adopted to bring it into a marketable condition. Progress as regards the skillful application of methods of mining and the scientific treatment of minerals like every other pursuit, is gradual and we should look therefore with less wonder at the crude adaptation of mechanical appliances in the early mining operations. This remark applies very forcibly to the early stage of gold mining in Nova Scotia; though with the knowledge that had been gained in California and Australia, it might have been expected that a more rapid application of that experience would have taken place.

The writer in his position of Inspector of Mines, to which he was appointed in 1865, became acquainted with these early operations; and with regard both to the means of mining and raising to the surface, and the subsequent treatment of the quartz

or rock containing the ore, it has frequently occurred to him since, that but for the fact, that sufficient gold was obtained to render the operator easy as to the question whether he was getting all the lode would yield or not, such comparatively simple appliances as were then in vogue seemed to give marvellous results.

From various sources, however—from the general manager, from the underground foreman, and from the intelligent workman's statement of wages made and the show of the lode, he gathered the prevailing opinion in those days that a field of gold of ten dwts. to the ton of quartz crushed, paid. Let this be noted as a starting point; it will be referred to subsequently.

What the writer now proposes to do is this: To briefly, and as summarily as possible state the result of the operations in the different localities, as regards the yield of gold; dividing the inquiry into decennial periods, beginning with the year 1862, to make such remarks as occur to him in the course of the inquiry and to adduce the opinions of others, competent to form them, on the causes of unsteadiness in the operations which have occasionally occurred. It is hoped that this course, without elaboration, will in its results justify the ultimate opinion arrived at in reply to the inquiry with which the subject is started.

In the report of the Chief Commissioner of Mines for 1862, the localities named in which gold mining is being carried on are Tangier, Waverley, Oldham, Lawrence-ton, Wine Harbour, Sherbrooke, Stormont, Ovens and Renfrew. In the course of the ten years forming the first of the decennial periods embraced in the review, the following localities were also brought into operation, viz., Uniacke, Gold River, Cochran Hill, Fifteen Mile Stream, Gays River, Musquodoboit and Caribou; and it may here be noted that with the exception of the Ovens at Lunenburg and Gold River near Chester, these localities are in the eastern part of the province and extend over a tract of country that may be roughly estimated at 1500 square miles.

Mining was more or less steadily carried on at all these places and the records of yield in the period now referred to—1862-1871, gave the following results:—

Average yield of gold per ton (of 2,000 lbs.) of quartz crushed:

	Oz.	Dwts.	Grs.
Tangier	—	17	10
Wine Harbor	—	14	10
Sherbrooke	1	4	14
Stormont	1	6	12
Renfrew	—	18	7
Oldham	—	17	16
Waverley	—	10	4
Montague	2	4	22
Caribou	—	16	16
Uniacke	—	18	12
Other districts	1	8	14

and an average yield from all localities of 1 oz., 1 dwt., 14 grs.

Now, this must surely be considered a very remunerative yield, and it calls for special attention in connection with the remarks that occur in the reports of the Chief Commissioner of Mines on the varying energy with which mining was carried on, and the general conduction of the operations. As instances, the following may be quoted. In the report for the year 1865 it is remarked of the Waverley district, "the great productiveness of this district for the past year is due less to any exceptional richness in the auriferous quartz lodes than to the enterprise and energy with which mining operations have there been carried on." In the report for 1867 it is stated, "leads are now operated upon profitably which at the commencement of mining operations could not have been worked except at a loss, and there is no doubt that with the increased experience in mining, and in separating the gold from the ores, many leads, now deemed worthless, will be worked; and though under the present system of manipulation the profits are large, yet it is well known that a large percentage of the gold contained in the quartz is not saved;" and in the report for 1868 the following sentences indicate the character of the operations at that time: "A number of well paying mines have been abandoned at a depth when manual and horse labor could not perform the hoisting and pumping required, the profits having been divided as made and no working capital set aside to meet emergencies and provide necessary machinery. Commencing mines on a small area of ground has also proved detrimental to the gold mining interest, and sinking shafts seems to be a mania. We give as an instance, 30 shafts sunk on one lead, in a distance of eighteen hundred feet, and 23 shafts in a distance of sixteen hundred and fifty feet on a lead not more than fifty feet from the first named. There is also a great want of appliances and skill in saving the fine gold; it is computed by good authority that at least 30 per cent. of this gold is lost in the tailings."

Again in the report for 1869 it is remarked: "In a review of the business of gold mining for the past year it is proper to state that the results have not been as large as anticipated, partly, no doubt, owing to the depression of business generally, but largely to the want of skill in management, expensive modes of mining, heavy works engaged in without an adequate object, and the utter absence of any but the most simple appliances for saving pyrites, mercury and fine gold, compared with the appliances used in other quartz mining countries."

Another very trenchant explanation of the cause of suspension of working in some localities is given in the report for 1870. "Speculation," it is said, "has also been very detrimental to the mining interests, as now there is a number of paying mines (judging from returns), that are not working from the want of means to put up necessary machinery, etc., there having been so many worthless properties sold that capitalists are afraid to have anything to do with them."

It may be permitted here to refer to the discontinuance of the personal report of the Chief Commissioner of Mines. Up to the end of the year 1872 this report was a distinct feature in the general report issued from his department, and it frequently contained information of much interest, inasmuch as from his position he was able to give statements explanatory of the difficulties appertaining to the opening of new districts, and to causes of suspension of operations (such as have been referred to), during financial depression; or, until a change of ownership was effected. In most cases coming under the first head, difficulty of access to the various localities has been very considerably lessened, and the transportation of machinery and the necessary supplies of a general character is not now the hindrance that formerly existed.

But apart from this, the writer cannot but think that the Chief Commissioner's review of each year's proceedings with remarks on the special bearing of the various clauses of the Mines' Act as circumstances occur in connection therewith, would not by any means be the least interesting portion of the annual report.

In the report for 1872, the first year of the second decennial period, there is a noteworthy reference to a change of system of working that was prevailing largely at that time, that is, the adoption of the "tribute system," and in connection with this the following extract from the report of the Inspector of Mines for that year, having a bearing on the object of this paper, is submitted.

"Much has been written on the general want of method attending gold mining in Nova Scotia, and sweeping condemnations of the management and want of skill shown while working the mines have been published. Much, doubtless, most justly, and yet somewhat hasty comparisons would seem to have been drawn between the wide and comparatively easily wrought leads of other districts and the thin leads of this Province enclosed in hard and tough country rocks.

* Read before the Mining Society Nova Scotia.