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CONDUCTED BY B. T. A. BELL.

THE OFFICIAL ORGAN

OF

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA,

THE UNITED MINING SOCIETY OF NOVA SCOTIA,

THE ASBESTOS CLUB, QUEBEC,

THE GENERAL MINING ASSOCIATION OF QUEBEC.

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Canadian Mining Schools.

The work and usefulness of mining schools in Canada is, in the phrase of physicians, indicated by (1) the deep and wide-spread ignorance of the country's mineral resources; and (2) the ill success of too many efforts for the development of its mineral wealth. It is too often attempted to hide the first behind sweetly-sounding generalities upon our enormous subterranean riches. Capital and pluck have too frequently been the blind and beaten pioneers in fields where no intelligent investigator has yet entered. No country in the list of the English-speaking communities which stretch round the globe has done so little to promote the scientific investigation of the mineral resources of its territory as the Province of Ontario. Its highest function as yet in the discharge of this duty is in the publication of a very excellent yearly report. While the common sense of the Australian provinces has for many years past found ample reward for its liberal yearly appropriations for diamond drill exploration, Canadian honest imbecility and careful stupidity, which, like Siamese twins, have been yoked together in the rule of Ontario mining affairs, place this part of the Dominion behind all other communities, having regard to the wide extent of its mineral areas and their extensive distribution in the eastern section along the rear agricultural frontier. Nor has the Geological Survey of Canada been less culpable. What work of helpful value has it done for the iron ores of Frontenac, Lanark and Renfrew, for the gold miners of Hastings, for the silver miners of Thunder Bay? While Prof. Winchell's explorations in Minnesota have almost at his heels been followed by capitalists who have developed the greatest iron mines the world has yet seen, resulting in the employment of an army of laborers, the construction of railways, the building of a fleet of the largest freight carriers on the lakes, and in a large measure in the reduction of the price of pig iron throughout the Northern States—thus spreading the benefit among a population six old that of the Dominion—our geologists

have been supplying us with their yearly tale of ponderous waddle, their canoe trips hither and thither, and other topographical work, all very good and useful in its way and excellently well done no doubt by right good fellows, but for the practical development of the industries of the country for the most part of no value whatever. It is plain to every one, to every citizen and to every intelligent foreign visitor that irrespective of anything savoring of politics the men at the head of Government mining affairs in this country have no "go" in them. Look at Ontario's expenditure of \$800,000 in the last 20 years for surveying townships for the benefit of that class alone which gets all the good things in this country—the lumbermen while in the same period she has not expended one dollar for anything in the nature of original mineral exploration. If it is a government function to examine the condition and value of our forest areas so that the purchaser may equally with the seller have reliable information of the value of any part; if it is in the same line of duty that such examination is made of various belts of land as to warrant the advertisement that these are fit or those unfit for settlement; if it is the duty of Government to admonish the farmer of the blunders of his dairying system and instruct him in improved processes, it is more so than all these the duty of Government to explore the mineral areas in its possession as to enable the Crown as the public trustee and the miner as a customer to form an estimate of the value of mining locations and the best methods of exploiting them. For this reason: that where the business of mining has to undergo the least hazard, wherever it is a prosperous industry, it adds vastly more to the national wealth in proportion to the capital and the men employed in it than manufacturing, farming or any other industry.

A paper on "The Growth of American Mining Schools and their Relations to the Mining Industry," by Prof. S. B. Christy of California University, read at the International Engineering Congress, in August last, very clearly establishes the claims of these institutions upon the regard of the State.

Having pointed out that in the United States the yearly increase in the number of students of mining engineering keeps pace very closely with the yearly increase of mineral production, the writer proceeds to show that the numbers of mining, civil and mechanical engineers graduated from the different schools are in the ratio of 1, 6, 11. In answer to the question, "Are mining schools justified?" Prof. Christy answers thus: "Miners may be insignificant in numbers but in respect to the value produced as a result of their labor, they are the most important element in the entire population." In 1880 the actual money value produced in the United States as result of labor per capita was as follows:

Agricultural	\$ 289 00
Manufactures	996 00
Mining industries (all engaged)	1,167 00
Miners only	1,577 00

In 1889:

Actual value produced by all engaged in mining industries	
per capita	\$ 984 00
Per miner only engaged	2,900 00
Per administrative officer	23,020 00
Per estimated engineer	97,872 00

Between the two periods it will be seen that the effective value of the miner's industry was nearly doubled, which was no doubt chiefly due to the improved machinery and methods introduced, and this in turn may be credited to the skill of the mining engineer. "Surely it is not a bad investment to spend a thousand dollars a year in educating a man for four or five years who shall have the direct control of the production of \$5,000,000 as the result of the work directed by each mining engineer in the United States during his working life." "The farmer can harvest his crops year after year; most of his increase comes from sun and air and rain; he has only to fertilize the soil now and then, and his farm remains a source of wealth from generation to generation. But there are no fertilizers for worked out mines. The crops the miner reaps can be harvested but once, and what he leaves behind through lack of skill is forever lost."

The two features of the work of American mining schools which have produced the best practical results are the "Mining Laboratory" and the "Summer Schools of Practical Mining." In the former problems in ore dressing and metallurgy are worked out by the student "very nearly on a scale of 12 inches to the foot." The latter begun as a mere summer jaunt, has been developed by Prof. Munroe of the Columbia School of Mines, into a three months' course in surveying, field geology, mining and metallurgy. Experience gained shows that a saving of energy will be effected if the schools study mainly, though not exclusively, those branches locally more important and readily studied in detail. Thus, for example, where argentiferous galena abounds, the mining and smelting of silver-lead ores will be the principal theme.

The 3rd section of the Canadian Statute establishing the Geological Survey, enacts as follows: "The object and purposes of the survey and the museum in connection therewith, shall be, to elucidate the geology and mineralogy of Canada and to make a full and scientific examination of the various strata, soils, ores, coals, oils and mineral waters, and of its fauna and flora, so as to afford to the mining, metallurgical and other interests of the country, correct and full information as to its character and resources." This is comprehensive enough certainly. It warrants the Government to commit to a summer mining school the exploration by means of the diamond drill of any mineral territory whatsoever in Canada. If such work shall be undertaken in some of the eastern sections of Ontario where the mining industry once active now languishes, the results even if of negative value will be most important. They will either lead, as many believe, to the revival of mining industry upon an intelligent basis, or

they will advise the capitalist to set his capital at work in more profitable channels. It is not claimed that the Dominion Government should endow a mining school by any means, but that it should give effect to the economic purview of the Dominion Survey Act by assisting summer mining schools in connection with McGill and Queen's Universities in the exploration of the mineral regions in the vicinity of populous districts in Ontario and Quebec. In such the expenses will be less than in remote regions and the revival of mining enterprise will more readily follow any favorable results from such exploration. Once the work in such districts is fairly done experience will have been gained for settling the question whether more distant areas should be exploited in this manner. It may be assumed that at no distant date there will be a contingent sufficiently interested in the scientific investigation of the mineral resources of Ontario, who will hasten the funeral obsequies of the Reign of Dulness to whose sway the mining interests of that Province are now committed. Mr. Harty is known to possess liberal ideas, and to be unfettered by the conservatism of departmental traditions. He is pointed out as the coming Minister of Public Works, and is believed to be in thorough sympathy with a liberal mining policy. But in view of such a prospect the Dominion Government should not be idle. Speculation has had its innings in iron and lead and phosphate mines, and failed. The politicians have had their innings and failed, and it is not likely the Wilson tariff will help Canadian miners. Let the mining engineers now have an innings, that it may be seen whether or not our mining school boys will be able to grapple, as we believe they can, with the two prime questions: (1) Are the mineral lodes of eastern Ontario and western Quebec of sufficient value to warrant the investment of capital? (2) What are the principal features in the disturbance, continuity or barrenness of these lodes, and what their stratigraphical relations? It is not unlikely the Dominion Survey will rebel. The mutually repellent membership of that august body will be certain to develop mutual attraction against any project not emanating from them. It is no derogation from their scientific attainments to say that the project on foot can get along very well without them. They can give it most valuable assistance if they will, the result of which may satisfy the country that they can run boring drills without bringing on national bankruptcy or incurring the ridicule of those who understand the business. Such a consummation will draw to the Geological Survey a degree of public regard with which on patriotic grounds the REVIEW is most anxious they shall be invested. The Canadian summer mining school is a candidate for public favor whose claims cannot be ignored by either the Dominion or Provincial Governments.

The Iron Tariff of 1887.

There are two questions of interest in connection with the iron tariff adopted in 1887. The first is, "What has been the effect of that tariff upon the iron industries of Canada?" The second is, "What has been the effect of the tariff upon the imports of iron and steel and of manufactures therefrom?"

I. What has been the effect of the tariff upon the Canadian industries connected with iron and steel?

Examining first the Trade Returns we find: (a) That the total imports of iron and steel and their manufactures during the five year period, 1882-86, (when the old tariff was in force), was \$75,251,232, and during the five years 1889-93, under the new tariff, it was \$76,972,717, a decrease during the last period of \$4,278,515. (b) Analysis according to the degree of labor required for making these imports can be made by dividing them into classes:

1. Interchangeable Mechanism the manufacture of which requires the highest skill in workmanship. This class includes sewing machines, firearms, locomotive engines and agricultural implements.
2. Hardware, cutlery and edged tools.
3. Machinery.
4. Castings and forgings.
5. Rails and railway supplies.
6. Other forms of iron and steel.
7. Pig iron.

Classes 6 and 7 include, 1st. Pig iron, the basis of the iron and steel industries; and 2nd. Other forms of iron and steel, in the making of which skilled labor enters to a limited extent. They constitute the raw material entering into the manufacture of iron and steel articles by Canadian workmen and are (in addition to pig iron), bar iron, rolled or hammered, boiler plate, steel bloom ends, rolled iron for horse shoe nails, steel for skates, files or saws, wrought scrap iron, etc., and parts of articles in other respects manufactured in Canada.

Taking the above division and applying it to our imports from Great Britain and the United States, from which two countries came, in the two periods under consideration, 98 per cent. and 95 per cent. respectively of the whole import, we obtain the following results:-

Interchangeable Mechanism—	
Imports from G. B. and U. S., 1882-86..	\$ 5,369,861
Imports " " " 1889-93..	2,857,637
Decrease.....	\$ 2,512,224
Hardware, Cutlery and Edged Tools—	
Imports from G. B. and U. S., 1882-86..	\$13,094,440
Imports " " " 1889-93..	11,915,967
Decrease.....	\$ 1,178,473
Machinery—	
Imports from G. B. and U. S., 1882-86..	\$10,130,588
Imports " " " 1889-93..	8,393,159
Decrease.....	\$ 1,737,429
Castings and Forgings—	
Imports from G. B. and U. S., 1882-86..	\$ 3,214,366
Imports " " " 1889-93..	1,676,382
Decrease.....	\$ 1,537,984

Rails and Railway Supplies—	
Imports from G. B. and U. S., 1882-86..	\$15,733,927
Imports " " " 1889-93..	\$12,194,419
Decrease.....	\$ 3,539,506
Other forms of Iron and Steel—	
Imports from G. B. and U. S., 1882-86..	\$22,719,719
Imports " " " 1889-93..	\$28,225,739
Increase.....	\$ 5,506,020
Pig Iron, and probably including Scrap—	
Imports from G. B. and U. S., 1882-86..	\$ 4,045,587
Imports " " " 1889-93..	\$ 4,738,946
Increase.....	\$ 693,359

The decreases in imports are all in the groups the several articles composing which require the higher skill in manufacturing. The increases in imports are all in those groups which require the lower skill, thus emphasizing the conclusion that the Iron Tariff of 1887 has given greater employment to skilled hands in Canada engaged in supplying the wants of the Canadian people in the first five groups than was given under the old tariff. The imports of raw material and of partially manufactured articles (classes 6 and 7) have increased \$6,199,479, and the imports of the finished manufactured articles have decreased ten and a half million dollars. In the same time the manufacture of pig iron in Canada has amounted to 160,326 tons (bounty paid).

2. In further corroboration of this conclusion the Census Returns show the following results:

IRON AND STEEL USING INDUSTRIES.

YEAR.	No. of Estab-lish-ments.	Em-ployees.	Wages.	Value of Raw Material.	Finished Product.
1891.	11,998	48,046	17,125,122	27,917,398	61,487,942
1881.	9,312	37,346	11,323,576	16,350,009	37,050,637
Increase.	1,693	12,100	5,741,455	11,565,833	27,431,695

Employees increased.....	33 per cent.
Wages " " " " " " " "	50 " "
Expended for raw material.....	70 " "
Value of output.....	74 " "
Average wages in 1881....	\$309 per employee.
" " " " " " " " " "	1891..... 350 " "

Showing that the work now done requires greater skill than that done before the adoption of the Iron duties.

In addition to these establishments there are others using iron and steel and making products from them in connection with their main business. Thus, carriage making is a manufacture which is of a mixed nature, but in which 60 per cent. of the cost represents manufactured iron and steel in various forms. Carriage making has increased its establishments by 193, its employes by 343, the amount expended for wages by \$720,727, the value of the raw material used by \$1,494,534, and the value of the output by \$3,168,536—the total value of the raw material used in 1891 being \$3,946,080, of which 60 per cent. would be manufactured iron and steel.

II. The second question is: What has been the effect of the Tariff of 1887 on the import trade of Canada with Great Britain and the United States?

Taking the same classes and the same periods we have the following:—

A little over 2,000 tons of low grade Canadian Phosphate was shipped to the United States last year.

		5 Year Periods.	
		1882-86.	1889-93.
Interchangeable Mechanism—			
Imports from G. B.	\$	920,305	\$ 399,745
" U. S.		4,749,556	2,547,892
Proportion—G. B.		11.5%	10.8%
" U. S.		88.5%	89.2%
Hardware, Cutlery, Edged Tools—			
Imports from G. B.	\$	4,759,913	\$ 3,096,052
" U. S.		8,434,503	6,098,444
Proportion—G. B.		36.0%	31.6%
" U. S.		64.0%	68.4%
Machinery—			
Imports from G. B.	\$	2,475,474	\$ 1,490,846
" U. S.		7,355,114	6,902,313
Proportion—G. B.		25.4%	17.8%
" U. S.		74.6%	82.2%
Castings and Forgings—			
Imports from G. B.	\$	1,433,952	\$ 696,483
" U. S.		1,780,414	979,899
Proportion—G. B.		44.6%	39.2%
" U. S.		55.4%	60.8%
Railway Supplies and Rails—			
Imports from G. B.	\$	12,629,781	\$ 10,899,048
" U. S.		3,104,146	1,295,371
Proportion—G. B.		80.2%	80.9%
" U. S.		9.8%	9.1%
Other forms of Iron and Steel—			
Imports from G. B.	\$	19,757,893	\$ 20,403,933
" U. S.		2,961,816	7,821,806
Proportion—G. B.		72.3%	72.3%
" U. S.		13.0%	27.7%
Pig Iron—			
Imports from G. B.	\$	2,747,947	\$ 2,822,265
" U. S.		1,297,040	1,916,681
Proportion—G. B.		67.9%	60.0%
" U. S.		32.1%	40.0%

With one exception all the classes have been imported in a decreased proportion from Great Britain as compared with the United States.

Taking totals and from all countries we have:

Total Imports, Home Consumption,	1882-86	\$75,251,232
"	1889-93	70,972,717
Imports from Great Britain,	1882-86	44,125,291
" " " " "	1889-93	39,718,373
" United States,	1882-86	29,683,187
" " " " "	1889-93	28,162,406
" Other countries,	1882-86	1,447,754
" " " " "	1889-93	3,091,938
Proportion from Great Britain,	1882-86	58.6%
" " " " "	1889-93	56.0%
" United States,	1882-86	39.4%
" " " " "	1889-93	39.6%
" Other countries,	1882-86	2.0%
" " " " "	1889-93	4.4%

It is thus apparent that Great Britain has lost an average of \$881,373 a year; the United States have lost an average of \$304,160 a year, and other countries have gained an average of \$329,837.

Taking the last year of the old Tariff (1886), and the latest year of the new (1893), examination shows that Great Britain's goods were tariffed in Canada to the extent of 10.9 per cent. in 1886, and in 1893 to the extent of 15.2 per cent. In 1886 the United States goods were tariffed to the extent of 22.7 per cent. and in 1893 26.2. It is thus seen that the United States' goods were tariffed in 1886 11.8 per cent. higher than those of Great Britain, and in 1893 11.0 per cent. higher, showing that on the whole the tariff has not caused a discrimination against Great Britain.

With respect to the proportion of free and dutiable goods, the returns for 1886 show the free were 37.3 per cent. and dutiable, 62.7. In 1893 the free were 39 per cent. and dutiable 61,

showing a 1 increase in free goods. In 1886 the imports from Great Britain were: Free, 39.4 per cent. and 60.6 dutiable. In 1893 there were free 42.4 and dutiable 57.6 per cent. In 1886 the imports from the United States were 9.3 free and 90.7 dutiable. In 1893 there were 11.8 and 88.2 respectively. The increase in the free goods from the United States is due to the fact that all mining machinery was practically upon the free list in 1893.

Taking the division into classes we find the following percentage of duty paid:—

Interchangeable Mechanism—	1886.	1893.
Per cent. of duty on total imports, G. B.	21.65	21.74
" " " " " " " "	U. S.	27.50
" " " " " " " "	U. S.	30.15

No free goods in this class.

Hardware and Cutlery—	1886.	1893.
Per cent. of duty on total imports, G. B.	24.26	30.00
" " " " " " " "	U. S.	28.80
" " " " " " " "	U. S.	30.44
" " " " " " " "	U. S.	28.95
" " " " " " " "	U. S.	60.80

Machinery—

Per cent. of duty on total imports, G. B.	1886.	1893.
" " " " " " " "	U. S.	23.99
" " " " " " " "	U. S.	27.00
" " " " " " " "	U. S.	28.22

Castings and Forgings—

Per cent. of duty on total imports, G. B.	1886.	1893.
" " " " " " " "	U. S.	25.68
" " " " " " " "	U. S.	31.02
" " " " " " " "	U. S.	58.12
" " " " " " " "	U. S.	31.62

Rails and Railway Supplies—

Per cent. of duty on total imports, G. B.	1886.	1893.
" " " " " " " "	U. S.	1.64
" " " " " " " "	U. S.	32.80
" " " " " " " "	U. S.	13.40

Other forms of Iron and Steel—

Per cent. of duty on total imports, G. B.	1886.	1893.
" " " " " " " "	U. S.	11.97
" " " " " " " "	U. S.	19.21
" " " " " " " "	U. S.	21.49
" " " " " " " "	U. S.	26.30

Pig Iron—

Per cent. of duty on total imports, G. B.	1886.	1893.
" " " " " " " "	U. S.	10.10
" " " " " " " "	U. S.	30.00
" " " " " " " "	U. S.	No free goods.
" " " " " " " "	U. S.	36.16

Taking the two countries the changes which have taken place in the imports, by classes, in 1893, compared with 1886, are—

Imports of—	1886.	1893.
Interchangeable mechanism from..... G. B.	\$ 3,834	6.6%
Interchangeable mechanism from..... U. S.	50,587	10.3%
Hardware and cutlery from G. B.	266,417	32.06%
" " " " " " " "	U. S.	7,389
" " " " " " " "	U. S.	17,297
" " " " " " " "	U. S.	5,529
Castings and forgings " G. B.	22,653	20.90%
" " " " " " " "	U. S.	114,222
Rails and r'y supplies " G. B.	464,200	25.80%
" " " " " " " "	U. S.	4,624
Other forms of iron and steel from..... G. B.	522,370	15.80%
Other forms of iron and steel from..... U. S.	\$1,219,033	186.00%
Pig iron from..... G. B.	27,960	7.20%
" " " " " " " "	U. S.	215,454

- A study of the tables indicates,—
- 1st. That the tariff has developed the iron industries of the country very greatly.
 - 2nd. That in providing themselves with machinery to the considerable extent they have, our workers in iron have met the changed conditions with commendable enterprise.
 - 3rd. That this development of an important industry has been accomplished without making in the change any considerable difference in the

conditions under which the two countries from which we buy are placed relatively to each other in their competition for our trade; and

4th. That other countries have entered the field to a larger extent than formerly, and are supplying us with a considerably increased amount, the changes being as under:—

		1886.	1893.
Imports from countries other than Great Britain and United States.			
Interchangeable mechanism.....	\$	15,109	\$ 24,559
Hardware, cutlery and edged tools.....		149,734	205,690
Machinery.....		5,452	64,557
Castings and forgings.....		2,504	413
Rails and railway supplies.....		45,388	54,549
Other forms of iron and steel.....		131,563	275,229
Pig iron.....		2,067	359
Total.....		\$351,817	\$625,355

The Real Estate Miner in Ontario.

Thirteen columns of the last number of THE REVIEW were given to a report of the annual meeting of what is known as the Ontario Mining Association, held at Sudbury on the 14th ultimo. We shall now devote a little space to review and comment on that report, and if we cannot agree with all the resolutions of the Association and the opinions of its officers, we have at least given them the honor of a hearing.

It might with truth and force be said that the report of the meeting is its own best comment, for the vein of fault-finding and peevishness which runs through almost all the papers will condemn them in the judgment of sober men. It might also be said that an apology was due to the readers of THE REVIEW for publishing the report at all, for the manner of discussing subjects pursued by the president and other members of the Association is utterly foreign to any candid or scientific method of dealing with a subject. But there is no better cure for grievances than to let them find utterance. If they are reasonable redress will come. If they are the vaporings of idle and mischievous men, a breath of free air will explode them.

It will doubtless be asked: Who are the men composing this Ontario Mining Association? This is an important question if we would set a right value on their opinions. Who are they? Few of them are known to us as mining men. In the list of those who were present at the meeting, and who may or may not be members of the Association, we do not find more than one or two who are known as miners or mine managers. There are a few lawyers, three or four doctors, half a dozen speculators in mining lands, two or three land surveyors, and half a dozen others whom the lawyers and speculators employ at odd intervals to explore the woods for mineral after fly time. The leading men are Mr. Hammond, the president, Mr. Aeneas McCharles, Mr. John McKay, and Mr. James Stobie. Who has ever heard of these men as miners, or mine captains, or mining engineers, or mining capitalists, or law makers or statesmen? Within a very narrow circle they are known in a small way as mining brokers who buy and sell

the lands of others at the best commission they can bargain for, or as men who, by some chance have got hold of a good location at a low figure and are doing their utmost to make a fortune by the sale of it. These are leaders in the Ontario Mining Association, the men who mould its opinions and crystallize them into resolutions.

The president's address at the opening of the meeting is unique in the record of addresses. We have never seen or read anything of its kind before. It is long, but that does not describe it. It is demonstrative, and the vigor is lost in swelling words. It is historical, and the narrative founders in mazy phrases, and long sentences which end up in the bottom of a bag. It is critical, and the critic's weapon is a blade of lead. It is personal, and the personalities are puerile and rude. It is many other things besides, the half of which never before were brought together in one address, since the days of Anacharsis Cloots, Attorney-General of the Universe. If we had to describe it in a word we would say of this address, that it is fustian—one long unmatched web of fustian from first to last. One wonders if the air or rocks of Sudbury favor the begetting of such a literary prodigy as this Mr. Hammond—or has he come to us from over the borders? Fustian is a common product of the rostrum over the borders, where the American bird soars and screams; but the fustian of President Hammond's address is an exaggeration even of the rhetoric of Sir Hudibras.

Mr. Hammond finds a hundred faults with men and laws and governments, but we cannot pursue his long wail into particulars. Sir Oliver Mowat and Mr. Hardy do nothing right; they will not follow where Hammond, McCharles, Stobie *et hoc* would lead; and so they are weighed and found wanting. "The reign of bluster and boodle is drawing rapidly to a close." The Legislative Assembly too, is selfish and stupid, both sides of it; but thank heaven the Ontario Mining Association is going to send down "country-first" men, who will alter this state of things, and give the millions taken for timber and mining lands to Hammond, McCharles & Co. But the worst enemy of all in the eyes of President Hammond, is "a man by the name of Mr. Blue." Whether it is the color or not, one cannot tell, but to the delicate organism of the presidential ear this name is as offensive as is a red rag in the eye of a bull. So it is also to the Stobie ear and the McCharles ear. What has Mr. Blue—a most efficient officer of the Bureau of Mines—done to make these men his enemies? From their manner of writing they almost make him famous, so that instead of mentioning him as "a Mr. B" he would be better described as "the Mr. B." But we protest against this greatness being thrust upon one man, much as Mr. Blue may have done. He is not the Government of Ontario. Neither is he the Legislature of it. He does not make and unmake laws. He does not vote public moneys, or build railways, or work mines, or create a market for iron, copper and nickel. Not even the royalty is a thing of his creation, much, per-

haps, as he might like to be a king and draw the royalties into his coffer, à la Hammond, McCharles and Stobie. He may now and then have drawn tribute in blood from these crowned heads of the Sudbury hills, with the pen he wields so skilfully; but if he would draw more of it, and draw oftener, the crowned heads would be cooler and wiser. Then there is Mr. Ian Cameron, "a Scotchman," manager of the Dominion Mineral Company. He, too, is a bad man for presuming to express an opinion in favor of royalties payable to the Government, and from the way in which he is spoken of, it might be thought that in some men's minds it is a crime to be a Scotchman. Be this as it may, we know that Mr. Cameron has done more to advance the mining industries of Ontario during the short time he has been in the country than his traducers have done in a lifetime.

Another man who comes in for the censure of the Ontario Mining Association leaders, is Professor Coleman, of the School of Practical Science, at Toronto. Dr. Coleman had the temerity to say in the last report of the Bureau of Mines that the best agricultural lands in Ontario have already been taken up, and that the northern portion is chiefly valuable for its minerals. He did not say that there is no good agricultural land in the Laurentian and Huronian districts of the north. There is much good land there, and doubtless it will all be taken up in due time; but the minerals are the most important source of that extensive region's wealth. Mr. Hammond is indignant at the inference which he himself draws from Dr. Coleman's words; yet he could listen without a word of protest to Mr. Stobie's description of the "vast unknown territory" between the Great Lakes and Hudson Bay as "too far north to be of much value for agriculture, and the greater part of it is of little value for timber." Dr. Coleman said nothing so unkind as this of northern Ontario; yet he must be denounced as an enemy by the President of the Ontario Mining Association. On another point, too, Dr. Coleman comes in for censure at the hands of the president, in venturing to express the opinion that "for some time to come we may expect Americans, Englishmen, and everyone else except Canadians to develop and profit by our mineral resources until we have time to learn from them and gather the knowledge and courage to do our own mining and smelting." This is described as a humiliating confession from a Canadian, and the president exclaims: "We would be pretty slow and small spirited if we did not find a way of justly sharing in the credit and profit connected with this business. Now is the time to strike, and to strike high." Quite in the tragic vein! But why don't these gentry get to work? They have never done anything but talk, and scold, or perhaps, sell a mining lot on a broker's commission.

President Hammond, however, has a personal grievance against the Government, for the better understanding of which we quote his statement of it:

"The discovery of nickel ore in large quantities in association with the copper ore of these districts has drawn here a large number of people who upon exploration bought mining lands in the laudable hope of thereby bettering their fortunes, myself amongst the number. Coming here in '89, when prospecting for mineral was still the rule among energetic men, young and old, I joined in aiding and prosecuting this important work. In the latter part of 1890 I was in New York advertising and negotiating the sale of a large and valuable mining property in the district, when on reaching the line at Prescott, on my return, I learned that the Ontario Government had just withdrawn from sale all mineral lands for some forty or fifty miles east and west of this town (Sudbury), two of my own claims included. I could hardly believe my ears. I telegraphed right and left. I tendered the purchase money in person, having received no notification of any such intended action, and for the further reason that the claims had been located but a short time before. The money was refused. Thus, without warning, we were left in the dark for months, some for a year."

Now, what does it mean? Plainly this: that Mr. Hammond went down to New York to negotiate a sale of public lands of the Province, to which he had no right and no claim. If the lands were his, the act of the government in withdrawing land in a certain district from sale could not have interfered with his negotiations in the slightest degree, and no telegraphing right and left and no tendering of purchase money would have been called for in his case. Had he done some work on the lots before they were withdrawn from sale, or made a payment on the purchase money, the patents would no doubt have gone to him under the old Act. But upon his own showing he sought to make the sale of a large and valuable mining property of the lands of the Crown as if they had been his own. The Commissioner of Crown Lands interposed his fiat; and hence those tears and sneers and jibes of President Hammond of the Ontario Mining Association. Out upon such graceless men who seek to make a public grievance out of their own failure to carry out a crooked deal!

We thought of saying a few words more on the papers of Mr. Stobie and Mr. McCharles—McCharles, the great Æneas of the Sudbury Mount Ida—and also on the policy of the Association as formulated in the resolutions; but we are conscious of having already given too much time and space to the men of this Association and the grievances which they flaunt in the eye and ear of the country. When they show that they are mining men they will be entitled to a hearing, and they will get a respectful one; but mere brokers and speculators in mineral lands cannot hope to dictate the mining policy of Canada, or of the least of her Provinces.

The Editor of the REVIEW acknowledges the receipt of a handsome gold pin from Mr. Poole, the retiring President of the Mining Society of N.S. Needless to say, this souvenir will be cherished with the memory of many pleasant gatherings with the "boys."

The "Critic" at its Old Tricks.

With the assurance that is characteristic of profound ignorance the revised version of the Halifax *Critic* (etc., etc.) in its issue of March 9th, pretenses to "edit" our recent review of the gold industry of Nova Scotia in 1893.

Only in so far as the accuracy of our figures is concerned do we propose to take notice of what, otherwise, is simply an impudent attempt to fill space with material taken from the *Review*, purloined in so garbled a manner, and so distorted by defective punctuation as to make it impossible for its readers to understand what is quoted from the *Review* and what is the product of the *Critic's* remarkable editorial brain.

Briefly:—The figures of the gold output of 1893 were obtained (through the invariable courtesy of the Mine's office staff) from the sworn returns on record in the office of the Department of Mines, and are correct.

The *Engineering and Mining Journal* on January 20th published the yield of Nova Scotia gold mines for 1893 at 18,730 ozs., but on February 17th made a correction and put the production at 19,900 ozs. The new editorial scissors being sharp and the paste pot full, the *C. C. G.* and *Critic* had the same item in its issue of March 2nd, but of course carefully omitted to credit it to the *E. and M. Journal* whence it came.

The figures of 19,900 ounces were correct as far as the returns were filed up to January 20th, but before the *Review's* figures were made up (on the 1st of February) additional returns of 360 ozs. mined and milled in the year 1893, were filed, so that the correct return was, as given in the *Review*, 20,260 ozs. Had the *Critic* any desire to ascertain the facts it could have verified the *Review's* figures by stepping across the street and compiling the returns for itself, but the deceased *Critic* never had any hankering after truth nor for work, and its successor it is quite evident is following in the same path.

Next, the *C. C. G.* and *Critic* says, "The *Review* states the yield of 1892 as 21,080 ozs., the Government as 19,998 ozs." If this omniscient knight of the paste pot had taken the trouble to read the Governments' reports he would never have written that line.

On page 69 of the Report of 1892 the yield is given at 21,080 ozs., 3 dwt. 18 grains, and on page 31 of the same Report there is given in detail the figures making up this total; page 30 of the Report for 1893 also gives the total of 21,080 ozs. as the correct yield for 1892.

Then the *C. C. G.* and *Critic* endeavors to find "something unsatisfactory" in the paragraph relating to high yields at Oldham, which read "Oldham has also kept up its record for high yields per ton; August 1893, recording a yield of over 125 ozs. per ton of quartz." Perhaps this statement is "unsatisfactory" to the *Critic*, but it is a statement of fact. On the 26th of August, 1893, the Standard Gold Co. of Oldham crushed six tons of quartz—four of these tons cleaned up collectively 191 ozs. of gold, or

at the rate of 47½ ozs. per ton; the other two tons gave a yield of 252 ozs. or at the rate of 126 ozs. per ton. We do not think many people would consider such a statement "unsatisfactory," and, fortunately, the *Review* has not yet come to such a pass as to first inquire of such an irresponsible organ as the *Critic* whether it is "satisfied" before publishing the truth.

Finally we are told that our paragraph: "The district coming third in the list is Caribou (and Moose River) which, however, records a loss of 500 ozs. from the yield for 1892, is at variance with the facts."

On page 31 of the Report for 1892 we learn that Caribou and Moose River yielded 2,335 ozs., 16 dwt., 10 grs. plus 750 ozs. returned in December, or a total for 1892 of 3,085 ozs., 16 dwts., 10 grains. The yield for 1893 was 3,542 ozs., hence the decrease was 543 ozs.; we called it 500 in round numbers—where's the variance *Mr. Colin Ochiltree Macdonald Killicerankie?* The variance is really in the *C. C. G.* and *Critic's* defective arithmetic. By what mathematical process the editor makes 2,542, 206 less than 2,335 is unknown in Ottawa and must be indigenous to the atmosphere of the *C. C. G.* and *Critic's* sanctum.

The President of the Mining Society of Nova Scotia.

Mr. John E. Hardman, S.B., who succeeds Mr. H. S. Poole, M.A., F.G.S., A.R.S.M., in the Presidential chair of the Mining Society of Nova Scotia, is well known not only in the Province of Nova Scotia, where he resides, but throughout Canada, as a mining engineer of great ability and enterprise, notably in gold mining, where his successes at Colman and West Waverley have done much to revive confidence in the future of this promising industry. Since he graduated at the Massachusetts Institute of Technology Mr. Hardman has had a varied experience in metalliferous mining in the United States, and the excellent equipment of his works at the Oldham and Waverley mines bear high testimony to the thoroughness of his training and his skill as an engineer. The economies in milling practice which he has introduced are models worthy of imitation at many of our gold mines elsewhere in the country. Mr. Hardman is an able writer, a ready, fluent and incisive speaker, and an energetic worker for the advancement of provincial mining. Many of the most important amendments, made in recent years, to the Mines Act, are very largely due to his watchfulness, while his numerous contributions to the literature of the Society, notably his papers on "Recent Gold Milling Practice in Nova Scotia," "Government Aid to Mining," etc., have been of the greatest service and value. Mr. Hardman is a member of the American Institute of Mining Engineers, the Federated Institute of Mining Engineers (Great Britain), and the General Mining Association of the Province of Quebec, by

whom, at its last session, he was elected an honorary member. In his election we congratulate the Mining Society in having found a worthy successor to Mr. Poole, the esteemed retiring president. Our engraving is from a recent photo kindly furnished by Notman, Halifax.

Our Pig Iron Industry and the Tariff.

By the time this issue is in the hands of our readers, the Budget will doubtless have been presented to the House by the Minister of Finance, putting an end to the suspense which has interfered seriously with the development of business during the past month or two.

The Canadian Iron Industry has been the theme of much discussion since the question of a change in the tariff was first brought forward, and the amount of information that has been elicited during the course of this discussion must enable both sides of the House of Commons to deal most intelligently with the question of the continued encouragement of this industry. It is satisfactory to be assured that in a general way the principle of protection will be preserved, for it must be evident to the mind of every one who desires the development of the natural resources of this country, that if there is one distinctly Canadian industry, it is the manufacture of iron.

In its first stage, that of the smelting of iron ores into pig iron, the representatives of the Maritime Provinces, of all political opinions, cannot fail to see that the prosperity of these Provinces is dependent to a large extent on the encouragement of this industry. From the various articles that have appeared in the newspapers from time to time, it is satisfactory to note that pig iron can now be produced and sold in Nova Scotia at prices quite as low as the same grades of Scotch iron are sold at in the centre of the Scotch iron trade in Glasgow. The long distance, however, separating the Nova Scotia furnaces from the Quebec and Ontario markets, which are the principal users of pig iron, and which requires to be covered by rail haulage, has to be provided against. The rate of freight charged by the Government Railway, the Intercolonial, via Levis and Grand Trunk Railway, to Montreal, is about \$3.50 per ton, of which the greater part of course goes to the Government. The steamer freight from Glasgow is in summer not over \$1.00 per ton.

It will be seen, therefore, that a large part of the present protection covers merely the difference of freight between foreign and Canadian iron to its principal market, this difference going back to the Government in the form of freight paid to the Intercolonial Railway. It is surely a good thing to support an industry that pays such a large amount of freight to this line.

The Province of Quebec has also especial claims on the country, for here the manufacture of charcoal iron is one of the principal natural industries, giving employment to the very class whose claims on the consideration of the country are being pressed so prominently at present.

The members of the House have doubtless had an opportunity of reading the very interesting and instructive address on the Canadian Iron Industry recently delivered by the Vice-President of the Quebec Mining Association, Mr. Geo. E. Drummond. It is particularly interesting to note from it the great number of persons who are employed directly with this industry. Not only are they not confined to the comparatively small number engaged in smelting the ore at the furnaces; there are the farmers, who mine the ore on their farms; the wood cutters, who prepare the wood in the forests for the making of charcoal; the large number of teams and men who haul this wood and ore to the furnaces and charcoal kilns, and the many others who are connected in one way or another with preparing the material necessary for smelting the ore. It is certainly a benefit to any country to have varied interests, and this is one which has been a boon to the farmer in these days of cheap grain.

The pig iron smelted in Canada is at present used for two purposes only. The larger quantity is of course used by the various foundries throughout the country for the manufacture of iron castings, and the balance is used in the manufacture of mild steel, by the Nova Scotia Steel Co. It has still to find a further and much larger outlet in the manufacture of all the other descriptions of iron and steel used throughout the country.

The pig iron stage has reached a wonderful development during the past few years. Let us hope that the Government will still encourage it to such an extent that in a few years more nearly all the heavy iron and steel used in the country will be rolled from Canadian material.

Cape Breton Coal Trade.

It is pretty safe to predict a season of great activity for the coal trade of Cape Breton, greater probably than this district has heretofore enjoyed. The Dominion Coal Co., who, in addition to the collieries they operated last year, now control the Victoria mine on Sydney Harbor, have been busily engaged all winter in preparing for enlarged output and more rapid and larger shipments. A magnificent shipping wharf in Sydney Harbor, erected upon the site of the old "International" wharf, will be completed by 1st May, in readiness for the opening of navigation. This wharf, which is built of Georgia pine upon cressed piles imported from Perth Amboy, will possess labor-saving features and facilities for rapid, and, at the same time, careful shipping, which have been hitherto unknown in Cape Breton. The new wharf is considerably higher than the old one, and the water on both sides was dredged last autumn to admit of large steamers completing their cargoes alongside. A crane is being erected upon the wharf to lift and lower cars into vessels' holds, thus avoiding the breaking up of the coal which has hitherto been a necessary result of the old methods of shipping by drops and chutes.

At the mines themselves work has been correspondingly brisk. It is true that the Gardiner and Emery pits have been closed down, it having been found by experience that they were costly and difficult to work, while the coal from neither pit was good enough to counteract these disadvantages, but, on the other hand, a new shaft (Dominion No. 1), has been sunk at Old Bridgeport, to the Phalen seam, which will in a very short time be putting out three or four times the combined output of the pits that have been abandoned. In addition to the sinking of this shaft, which is the largest in Nova Scotia, the Old Bridgeport and Caledonia shafts and heapsteads have been enlarged and improved to admit of largely increased outputs. In the case of the Caledonia mine the Dominion Bridge Co. have erected an iron heapstead, which is another new departure in this section of the mining world. The International, Reserve, Glace Bay, Gowrie and Victoria collieries, while they have not received the special attention devoted to Caledonia and Old Bridgeport, have all been put in good shape, and at the present time are busy banking out coal. Mr. David McKeen, M.P., has now associated with him as assistant manager Mr. W. Blakemore, late of Cardiff, England, a gentleman standing high in the ranks of mining experts in the old country. Mr. Blakemore, whom many of our subscribers will remember meeting at the last two gatherings of the Mining Society in Halifax, will, no doubt, find full scope for his abilities in developing the immense resources at the command of his employers. In addition to work upon the new shipping wharf and at the James, the Dominion Coal Co., or rather the firms under contract to them, have been actively pushing on their railway to Louisburg during the winter. The new line from Bridgeport to Glace Bay was opened for traffic on January 1st, and the extension to Cow Bay will be ready for operation early in August. The remaining distance to Louisburg will be finished with as little delay as possible, one section of it being already well on the way to completion. Over and above the large amount of work done under contract, the company themselves have had from 400 to 500 men employed all winter upon the railway approaches to their new wharf, so that it can be seen that the winter of 1893-4 has been a busy one for the laboring classes in Cape Breton. The new company, about which there have been so many "Mother Shipton" prophecies in the local press, has so far done nothing to merit the abuse so freely hurled at it, but, on the other hand, has brought prosperity to very many who could not have looked to the old companies under the former regime for work during the winter months.

In a review of the Cape Breton coal trade the Dominion Coal Co. naturally monopolizes the chief notice, but it must not be overlooked that the General Mining Association, whose "Old Sydney" colliery was not acquired by the syndicate, will still be doing business at their old stand at North Sydney, where they are making considerable additions to their shipping facilities.

They are sure to hold their own, especially as sellers of house coal, and will probably roll off a shipment during the coming season which will eclipse any of their previous efforts. And finally, the Messrs. Burchell will also be doing business at their "multum in parvo" colliery at New Campbellton, upon an independent basis, and are justified in hoping, from the success their coal met with during the short time their mine was in operation last year, that they will be secure as many crumbs from the richer men's tables as they will be able to digest. With freights still low everything points to the probability of Cape Breton coal not only holding its own during the coming season, but pushing farther afield than ever before, and we trust that our predictions of an active and lucrative season will be amply verified.

The Importation of Free Mining Machinery into Canada in '93.

During the fiscal year ended 30th June 1893, the value of the mining machinery imported duty free into Canada under the provisions of the law admitting mining machinery of a class or kind not manufactured in Canada, amounted to \$87,208 of which \$72,478 came from the United States and \$14,730 from Great Britain. The distribution by provinces shows the importations as follows:—

To Ontario	\$27,889
" Quebec	18,519
" Nova Scotia	22,019
" New Brunswick	30
" Manitoba	9,166
" British Columbia	9,585
Total	\$87,208

Asbestos Shipments 1893.

The quantities of Canadian asbestos shipped by the Quebec Central Railway from the Eastern Townships mines during the year ended 31st December last were:

From Coleraine	20 288
" Black Lake	1,551 1444
" Theford mines	5,338 1444

To this must be added the quantities shipped from the Ottawa and Elzevir districts, Ontario, figures of which are not obtainable at date.

Gold Production of British Columbia in 1893.

The Annual Report of the Hon. the Commissioner of Mines is to hand, and as usual contains a mass of valuable and interesting information respecting the mineral developments of that Province during the past year. The export of gold dust as reported by the Banks in Victoria was of a value of \$316,279, and the estimated yield \$353,355. In explanation of the decrease from the export in 1892 (\$332,938) it is stated that a large portion of the product of

the mines in the Yukon district was shipped to San Francisco, and that the majority of the shipments from the Kootenay country left the Province via Spokane, Washington, and were therefore not reported in Victoria. While the amount produced by placer mining is somewhat less than that obtained in 1892, the total yield is greater, owing to the returns of some of the quartz claims in the Yale and West Kootenay district having been taken into account.

The anticipations formed in 1892, of an increased output from hydraulic workings, have not been realized, owing to the development work on the majority of the claims not having reached the stage when results could be expected, whilst in other cases operations have been hindered by an insufficient supply of water.

This branch of placer mining is yearly attracting greater attention throughout the Province, and the amount of capital already invested and to be laid out during the coming season, more particularly in working the bench lands in the vicinity of the Fraser River and its tributaries, is very considerable.

Interest is also being taken in the beds of the Fraser and Thompson Rivers, with a view to dredging, and, judging from the number of applications for leases for this purpose, a serious attempt will be made to prove the worth of the gold hidden in the strata of these rivers. Special machinery for dredging is in course of construction at different places on the Fraser River.

The returns of the principal districts are given as under:

<i>Cariboo District.</i>	
Barkerville division, 1st July to 15th Nov.	\$ 73,000
Lightning Creek, " " "	49,000
Quesnelle, " " "	25,450
Keithley Creek, " " "	54,550
Estimated product from 15th Nov. to 31st Dec., say.....	8,000
	\$210,000
<i>Cassiar District.</i>	
Dease Creek.....	\$ 6,500
Thibert Creek.....	4,409
McDane's Creek.....	9,876
Liard River.....	1,700
Stikine River.....	450
	\$ 22,935
<i>East Kootenay.</i>	
Wild Horse Creek.....	\$ 19,000
Moyie River.....	700
	\$ 19,700
Liloot.....	51,376

EN PASSANT.

Intelligence has been received of the decease at Gresse, in the Duchy of Mecklenburg, Germany, of Baron Ohlendorff, founder of the great European fertilizer of Ohlendorff & Co. (now the Anglo-Continental Guano Works, Ltd.), owners of the Squaw Hill and Aetna phosphate mines on the Lievres River.

The announcement of a united meeting of General Mining Association of Quebec and the Mining Society of Nova Scotia, at Sydney, Cape Breton, during the week commencing 7th July, has created the liveliest satisfaction among the mineral operators of both provinces. The visitors are invited by the Dominion Coal Co. and the General Mining Association, Ltd., of London, whose guests they will be. The outline of the attractive programme sketched by Mr. Blake-more at the last meeting of the Mining Society (see this issue), should conduce to a record attendance.

In view of this invitation a general desire has been expressed in Quebec that the June meeting of the General Mining Association should be postponed, and it is more than likely that this arrangement will be ratified at an early meeting of Council.

We are authorized to state that the claims made with so much ostentation by the *Canadian Colliery Guardian, Critic, &c., &c.*, to be the organ of the Dominion Coal Company, Ltd., are wholly without foundation. The management repudiates any connection with such an irresponsible sheet.

The *Stellarton Trades Journal* sizes up the personality of this revised edition of the Halifax *Critic* succinctly in a recent editorial as follows: "A fortnight ago we hinted our suspicion as to the personality of *Guardian* writer. We suspected a certain impecunious fellow—a mercenary mountebank. The style of the article in the *Guardian* furnishes proof that we made a bull's eye. If a man is hungry he may beg bread; if he be ignorant he may acquire knowledge by application; if he be poor he may accumulate wealth by industry, but, as one has quaintly observed, 'if he lacks common sense, God help him; he can get it in no other way.' And that is what the *Guardian* fellow lacks."

During the debate in the House of Commons the REVIEW will have on exhibition in the main Parliament Building a thoroughly representative exhibit of the products of the Nova Scotia Steel and Forge Co. (Ltd.), the New Glasgow Iron, Coal and Railway Co. (Ltd.), the Pictou Charcoal Iron Co. (Ltd.), the Londonderry Iron Co (Ltd.), and the Canada Iron Furnace Co. (Ltd.) thus practically demonstrating to both political parties the growth and development of the iron industries of the country under a beneficent protective policy. The whole exhibit is an excellent object lesson. The bounty must be continued for a fixed period—ten years if possible, and it is sure to carry.

Mr. J. A. Mara, M.P. for Victoria, B.C., the gentleman to whom more than any other the whole mining community is under a deep debt of gratitude, for his successful efforts in the House of Commons to have mining machinery not manufactured in Canada admitted duty free, had an interview with the Hon. G. E. Forster, M.P., Minister of Finance, on the 19th instant, and urged that, at all events so far as British

Columbia was concerned, all mining machinery should be admitted absolutely without restriction. This protection to the most promising of our native industries deserves favorable consideration.

The Dominion Coal Company (Limited) has purchased the very fine vertical three-stage compressor which was a prominent feature of the exhibit of the Rand Drill Company at the World's Fair. As this machine is not made in Canada we are anxious to ascertain whether the Jenckes Machine Company is making any opposition to the claims of the Dominion Coal Company to have it entered duty free? To be consistent they should certainly do so, but then the shoe would be pinching near at home.

The proposal to federate the existing Canadian mining organizations is receiving attention and there is good prospect of something being done at the next meetings of the societies interested. In the meantime committees have been delegated to form a basis of federation.

Photography in mines was the subject of an interesting paper by H. W. Hughes at a recent meeting of the North Staffordshire Institute of Mining Engineers. The writer pointed out that for mining it was necessary that the operator should either be an engineer or have an engineer associated with him, and for many obvious reasons it was necessary that the camera should be of the lightest and most compact form for underground work, as it often had to be erected in awkward and confined situations. Practically speaking, it might be said that the rapidity of a lens depended on its aperture and focal length, and as in underground work speed was of the greatest importance, a lens possessing such advantage should be secured. The difficulties to be overcome in mine photography were not many, but were hard to surmount. In all classes of mines the smoke resulting from blasting, the moisture-laden and misty atmosphere, and the dripping of water from the roof, were generally present, these being supplemented in coal mines by the presence of coal dust, which not only thickened the atmosphere, but deposited particles on the lens and plate. The condensation of water, on the lens and plate was, perhaps, the most difficult matter to avoid. So far as the plate was concerned, one had to trust to luck; but with the lens the best preventive was to carry them in the trousers pocket, and so warm them up to the temperature of the body.

At the same meeting Mr. T. H. Wordsworth gave particulars as to the working and cost of a disc coal getting machine made by the Yorkshire Engine Company, which was at work at the Middleton main, or Silkstone seam, at Messrs. Pope & Pearson's collieries at Altofts. This seam has been worked at three collieries for the past thirty years, at a depth of 420 yards, up to a large fault. The method of work was the long wall with park gates. When the seam was first opened an attempt was made to hole by hand, but the cost was excessive, 2s. per ton.

With two men, under favorable circumstances, the machine in question would cut sixty yards in one shift of eight hours, but if another man was sent to cut away the debris, a greater length could be cut. The machine was worked by means of compressed air, and the number of shots had been reduced in a face 570 yards long from thirty per day to twelve. It was hoped by still further increasing the cut to still further dispense with them, and the total cost of getting the coal was 1s. 7d. per ton. The number of men, too, was reduced, 120 being able to do the work of 173.

Tyrellania has been suggested as a most appropriate designation for that section of north-western Canada, recently the scene of some exploration by Mr. J. B. Tyrell and about which there has been so much nauseating flatulency in the columns of the daily press. In glancing at the mass of inspired puffing and free advertisement of the doings of this modern Gulliver one cannot restrain a smile at the utter insignificance of the work done both in its value to the country, and in comparison with the sterling achievements of many of the members of the present staff of our Geological Survey. Moreover it must occur to most that \$7,000 out of the total annual appropriation of \$60,000 for the Survey's work is a somewhat heavy expenditure to squander on a section of country entirely beyond the economic uses of the people for many generations to come. The country is thirsting for knowledge of its resources much nearer at home and extravagant junkettings of this kind should be tabooed.

The holders of the Mac Arthur-Forrest cyanide process patents in South Africa the African Gold Recovery Company have had a very good innings on the Rand, but now trouble is looming ahead. According to the South African *Mining Journal*, it is currently reported that the committee which has for some time past been privately engaged in investigating the validity of the African Gold Recovery Company's patents has come to the conclusion, after patient investigation of all the evidence available, that the patents could be opposed with good prospect of success in a Court of law. An ultimatum will probably be shortly presented to the company demanding substantial reductions in the royalties at present paid, and should the demand be refused, immediate litigation will probably result. What will be the consequence of such action it is impossible at present to predict. One thing, however, is certain, if change is to result, it will certainly not be in the direction of increased charges for the use of the patents, seeing that competition with other chemical processes as well as with improved appliances for the extraction of gold by concentration will have shortly to be faced. In this important item amongst the total cost of gold mining and recovery, there is, therefore, good prospect of reductions being effected, which, with those daily being brought about as a result of recent lowering of price of coal and dynamite, should certainly exert an

appreciable influence during the coming year in increasing the profits earned throughout the district.

Mention is made in a recent issue of the *Honduras Mining Journal*, among other things, of a somewhat curious discovery, bearing not only on the theory that the Aztecs did not smelt their gold ores, but on the immense antiquity of gold mining as a Mexican industry, which has lately been made in the State of Chiapas. For a long time the superintendent of the great Santa Fé copper mine was perfectly satisfied that the mine was absolutely virgin, since none of the immense masses of copper ore cropping out in all directions showed the slightest trace of having been touched. True, there was one shallow hole near by, which, however, might easily have been sunk by some wandering prospector during the last few years. Lately, however, it was found necessary to grade out a hillside some 200 yards from the mine. The hill was densely wooded, but, after felling the timber and excavating two feet of black vegetable mould, traces of ancient workings were discovered resulting in over 50 metres of an ancient dump being unearthed. This dump was found to contain blocks of rich gold bearing copper ore, thrown away as useless. The shaft of an old mine was also found. The whole workings appeared to be entirely separate from the Santa Fé mine and in a lower formation. A further discovery was made on the Victoria mine, half a mile to the south-west of the Santa Fé mine. Here also there was not the slightest trace of any human being having worked on the mountain, not a dump, not a loose stone, and the ground covered with immense forest trees. A tunnel was being driven to crosscut the ore body, and had gone through over 70 ft. of ore, when suddenly an ancient working is blasted into. There are no traces in the neighborhood of any patios, dumps, arrastras, or furnaces, no trace of human habitation beyond an occasional idol found in the caves or hollows in the Santa Fé mine. The small broken grinding stones which might well have been used for maize, were found, but where was the free milling gold ore treated which came from the mines that must have been extensively worked, judging by the extent of the Santa Fé dumps and of the Victoria workings?

The deposits of domestic gold bullion at the mints and assay offices of the United States during the year 1892 aggregated \$32,367,850, and the deposits for the calendar year 1893, \$36,056,300, showing a gain in the deposits of gold of domestic production in 1893 over that of 1892 of \$3,688,450. It is now estimated by the bureau of the mint, says the *Wall Street Daily News*, that when the final figures are received covering the statistics of the production of gold in the United States for the calendar year 1893, an increase over that of 1892 of about \$4,000,000 will be shown. The largest increase in any single state during the year was in Colorado, and which approximates \$2,000,000. The only state in which a decrease is shown is

Nevada, which shows a falling off in 1893 as compared with 1892 of about \$575,000. The present indications are that the production of gold for the current calendar year will largely exceed that of 1893. The larger part of the increase will be from the mines of Colorado.

A report by Mr. Henry Hall, Inspector of Mines, has been presented, in the form of a blue book, to the Royal Commission on Explosions from Coal Dust in Mines, giving the result of a series of experiments made with coal dust collected from the principal seams in various mining districts. Altogether fifty-two samples were received, and, with the exception of four or five, all were tested in a mine shaft placed at Mr. Hall's disposal by the proprietors of the White Moss Colliery, Skelmersdale, a wrought iron cannon being used for the gunpowder shots. Mr. Hall says that a careful examination of the results warrants the following conclusions: (1) That the flame from a blowing out gunpowder shot in the presence of dry coal dust always ignites more or less of such dust, and so increases the burning and charring effects of the shot; (2) that when a large flame, such as that of a blowing out gunpowder shot, or the flame from the ignition of a small quantity of fire damp, traverses an atmosphere containing a very moderate quantity of dry coal dust, the dusty atmosphere will explode with great violence, and the explosion will continue on and pass throughout any length of such atmosphere, its violence and force increasing as it progresses; (3) that coal dust from several seams in different districts, notably those from Glamorgan, Monmouth, Durham, Lancashire, Yorkshire and Scotland, are almost as sensitive to explosion as gunpowder itself; (4) that coal dust is, as a rule, more sensitive to explosion in proportion to its high quality and freedom from impurities; (5) that a ready supply of oxygen, such as is supplied by a brisk ventilation, has the effect of making coal dust explosions more probable and more severe; (6) that certain "high explosives" are incapable of igniting or exploding coal dust. Of the whole of the dusts tested, that from the Albion Colliery, Glamorgan (Aberdale or Merthyr 4 ft. seam or upper 4 ft.), excelled all others in violence and sensitiveness to explosion, and this seam has the worst history of any in the kingdom, upwards of 1,600 persons having been killed in it by explosions since the year 1845. It was also evident from the experiments that the higher the quality of the coal seam the more liability there is to explosions of dust. With regard to precautionary measures to be taken in the face of these facts, Mr. Hall urges the total abolition of gunpowder from coal mines and the substitution of certain "high explosives." Many of the largest firms in the country have, he says, already of their own motion taken this step.

A locomotive made by a Manchester firm, Messrs. Beyer, Peacock & Co., has been utilised for the first time on the Argentine railways for the purpose of testing the value of petroleum oil as fuel in the place of coal. A tank engine was

successfully run from Buenos Ayres to Ferrari, a distance of 74 kilometres, in one hour and four minutes, petroleum being the only fuel employed.

The Broken Hills Mines, Australia, established a record last year by putting out in round numbers 12,500,000 oz. silver and 48,000 tons lead. In only five years—1873 to 1877 inclusive did the whole of the Comstock mines yield in the aggregate so much of the white metal. The Comstock silver record is 21,750,000 oz.; that was in 1877, which was 18 years after the mines there were opened—a comforting reflection in these days: when the notion is prevalent that silver mines are things of but three or four years! Carrying comparisons a little further, says the *Australian Mining Standard*, it is found that, notwithstanding the falling off in the value of silver and lead, the output of Broken Hill last year was worth £2,915,000, which is more than the gold output of the whole of Victoria has been for any single year since 1886.

An Australian miner in South Africa thus describes his experience in South Africa: "Johannesburg is a large place for its age. It has a population of about 40,000 whites. Everything in the way of necessaries is very dear; any sort of a shop will bring about £40 to £50 per month, and small at that. Most of the business people are Jews. There are more people out of work in Johannesburg than ever I saw in Sydney, and before long there must be a general reduction of wages. Many Australians have found their way here, and, for what reason I cannot learn, the South Africans have a terrible down on them. I certainly would not advise anyone to come here. As soon as the war is over I shall make my way to Matabeleland, where they say gold is to be found. I cannot hear of any alluvial in this country anywhere. As to the mines, there is a run of country being worked some 40 miles long. Coal mines are at each end, so that fuel is easily obtained. Very little timber is to be seen, and that used for mining purposes is nothing but saplings. The largest timber used is pine, and there is not much of that.

"All the mines are worked with Kaffir labor, and the wages are about £1 per week. A white man superintends some 35 Kaffirs. The Kaffirs can work as well as a white man, and I imagine if similar labor was introduced into Australia many reefs would pay to mine which are now lying idle. The reefs here are not worth more than 8dwt. or 9dwt. The "basket," as it is called here, reminds me very much of cemented wash, in fact it is nothing else. There is a large amount of machinery here. The batteries in almost every instance are large, varying from 40-head to 200-head of stamps; so that Johannesburg ought to turn out a large quantity of gold. No concentrating is done here; the cyanide treats the tailings, and the battery work, consequently, is not as careful as it is in Australia. Another feature of the mines here is the extensive use of rock drills. In some there are quite

30 in operation, one white man, with 10 negroes, having charge of each machine. These men work 10 hours per day, and earn £1 per week, and there is plenty of demand for such work. As the result of my experience on this field, I certainly should not advise miners from Australia to come here."

At the monthly meeting of the Leeds Association of Engineers, Mr. W. D. Wansbrough, Lincoln, read a paper on the history and development of the portable engine. He said that as these engines were usually placed in the hands of unskilled attendants, an important object had been to simplify every detail. Further, the ever-increasing demand for them had led to the development of manufacturing appliances for the duplication of pieces of machinery, which had now reached such perfection that a working part could be taken out of one engine and used in another with equal facility. He estimated the number of portable engines annually produced in this country at not less than 10,000, some of which were sent out to the most obscure corners of the earth. In short, portable engines had become great pioneers of civilization, and were the hewers of wood and drawers of water for our colonists. Although the portable engine did not become a commercial success until recent times, yet so far back as 1775 Smeaton described a movable engine with boiler and condenser, of 6 feet stroke, self-contained, and internally fired. Mr. Wansbrough alluded to the inventions of Murdock, Murray and Trevethick, and that about the year 1839 several portable engines of improved design were patented, amongst which were the self-contained threshing engines of Tuxford & Ransome. The famous Cambridge boiler, brought out in 1847, in which the flue was carried the length of the boiler three times before entering the chimney, and which is still made, was a distinct improvement on the earlier types. In 1861 Messrs. Robey & Scott introduced a boiler for portable engines, the principle of which has been adopted by Mr. F. W. Webb for the London & Northwestern locomotives. The great fault in portable engines at this time was that the working parts were not sufficiently accessible for examination or repair, but Mr. Wansbrough showed, by a comparison with later types, that this defect had been completely eliminated, and a general appearance of neatness maintained. Link-motion expansion gear was introduced in 1869, but it was only recently that persons appreciated its advantages. An engine could now be governed so perfectly that it would not vary its speed whether the full load was put on or entirely removed.

A new invention for the pipe induction of coal claims is now being discussed in the United States. The system embodies the reduction of all coal at the mines to the form of impalpable dust, at a cost of 3 to 5 cents per ton; the separation from the coal by one of the present washing processes of all free sulphur, pyrites, slate, etc., at the cost of another 5 cents per ton; the mixture of the coal powder with about its own weight of

water; thus converting it into a sort of black milk, and the pumping of it in that state to any desired distance to any desired market, as oil now is pumped.

When the mixture has arrived thus far, it is deprived of most of its water in great settling basins; but as much as 8 or 10 per cent. of the fluid is left in the mixture, which in that state is pumped short distances only to points of consumption where the remainder of the water may be dried out by the otherwise waste heat. The capacity per day of twenty-four hours of a twenty-four-inch pipe, with a mean speed of five miles per hour, is about 31,000 long tons, taking the coal conveyed at 351 pounds per cubic foot of mixture. At 1,200 pounds pressure for pumping stations thirty miles apart, a four-inch pipe would carry 320 tons daily; an eight-inch pipe, 1,834; a twelve-inch pipe, 5,120. The total coal consumption of New York City averages considerably under 25,000 tons per day; the New England States burn about 50 per cent. more than this; the whole United States nearly twenty times as much, it round figures, so that comparatively few pipes would suffice to handle the whole coal supply of the country. The evaporation of the water from the coal dust presents no serious difficulty.

This system opens up again the question of the comparative value of coal dust for fuel. While in many cases coal dust is commercially valueless, in others it cannot be replaced by any other form of coal for real services; for instance, in the manufacture of fuel or other gas; the making of stiff coke; the mixing with iron ore dust before coking, to the great improvement of the product, both in quantity and quality; the remedying of the smoke nuisance, as the dust mixed with air is blown into the furnace, and the maximum combustion is secured; and generally, wherever coal is burned merely to generate heat in properly designed combustion chambers. The inventor of the pipe conduction of coal claims, and apparently with good reason, that it effects a great saving in cost of transmission.

At the New York meeting of the American Society of Mechanical Engineers, Mr. C. H. Manning read a paper in which he described a method of manufacturing large steam pipes he employed 11 years ago for several thousand feet of 20 inch pipe, with very satisfactory results. The pipe was made of mild steel $\frac{1}{4}$ inch thick, double riveted, and with die forged flanges $\frac{3}{8}$ and $\frac{1}{2}$ inch thick. The pipe was riveted with an Allen pneumatic riveter having 70 inch reach of arms which limited the length of the sections. The longitudinal seams were placed quartering 45° from top of pipe, with the laps pointing up so as to be readily accessible for calking. The quarter turns were made of two 5-16 inch sheets curved on a cast-iron former, and having a row of rivets along the back and another row along the throat. The tees were made of three sheets, shaped over similar formers, and the rivets were all on the sides. A serious difficulty had been previously experienced in keeping the round-about joints tight. Leaks had been caused by

condensed water being retained by these seams, which caused unequal expansion, as the portions covered by them heated much slower than the unprotected or dry surfaces. This was remedied by making the section conical, and bringing all the laps in one direction, and then laying the pipe on a down grade with the smaller ends the lowest, so that the water ran out. The last course of the pipe was not coned, to avoid having two sizes of flanges. Mr. Manning has never known a riveted pipe to give out under water-hammer, and a hammer that would completely wreck a cast-iron pipe or split a welded pipe would only strain the longitudinal joints of a riveted pipe.

The investment of money in coal mining in France has not been profitable, according to *L'Economiste Français*. From the statistics of the Ministry of Public Works, it appears that the capital invested in the coal mines of the country was very nearly 1,700,000,000 fr. In 1882 and 1883 the average interest earned on this amount was only 2½ per cent. in the years 1884-89 it was 2 per cent.; and only in the exceptionally prosperous years 1890 and 1891 did it go as high as 3¼ per cent. It is true that in 1891 the average earnings in the two districts of Nord and Pas-de-Calais reached 6¼ per cent. on the capital, but in the same year the average returns for the mines outside of these districts was only 2½ per cent. A few coal mining enterprises in France have been financially successful, but these are offset by a long list of failures.

In an address before the students of Case School of Applied Science, Cleveland, Mr. T. D. West, considering some of the elements essential to success in foundry and other engineering achievements, and pointed out that the advancement of the times called for the manager of such works to possess a fair knowledge of chemistry; not necessary to make a chemical analysis of metals, but to understand the different elements, such as silicon, carbon, sulphur, phosphorus and manganese, have in influencing the attainment of desired results in mixing metals. Chemistry is rapidly coming to the front as a very beneficial factor in aiding the founder to determine the results in mixing of metals, and allay much of the uncertainty and loss in that line, which past and present practice reveal in the operations of a very large majority of our foundries. The science of steam, gases, and metallurgy, combined with a knowledge of electricity and construction of machinery, are more essential to a manager of a foundry to-day than is generally conceded, and one aiming for such an occupation, cannot make any mistake in obtaining all the knowledge he can of all the elements here outlined. For the foundry he could with all assurance say, there is a large field for displaying intelligence, knowledge, skill and experience in managing men and overseeing the manufacture of foundry products, and he doubted if the demand is not about the same with all industries that have in any wise made progress in keeping up with the "times." The higher the standard of intelligence and knowledge exacted from the manager or overseer, the

better for all concerned, also far fewer strikes and bickerings with workmen, for whatever failings workmen may possess, they readily recognize true ability, and will respect discipline, when enforced by intelligence and common sense.

Mr. Benjamin Jones, of Cleveland, has invented a new process in molding, claiming particular advantages in connection with the casting of steel. The improvement is in the preparation of molds, mold facings and cores, the object being to produce cores and molds capable of withstanding the intense heat had in the manufacture of such castings and that will shrink with the casting in cooling and cleave readily from the casting.

After giving the components of the core, and stating how the core and mold facing are prepared, the patent sets forth that the core having been thus built up, a suitable binding and hardening substance is introduced so as to form one compound with the sand and combustible substance of which the mold or core is composed. Being applied while hot and in a liquid condition this binding substance is burned into the mold. If all the gases in the hardening substances were retained, disastrous results would ensue in the operation of casting, through the formation of blow holes, but by burning the binding substance into the core and mold, enough of the gases is eliminated to avoid these troubles. It is claimed by the inventor that a core, mold or mold-facing composed in accordance with his formula will not only withstand the intense heat produced in steel casting, but will shrink approximately with the casting in cooling, and thus permit of the casting in steel of complicated work such as propeller blades and bomb shells.

A recent test made at the plant of the Cleveland Rolling Mill Co. was a partial demonstration of the possibilities of Mr. Jones's method. A feed roll, with reductions from 17 inches to 13 inches, was cast in steel, with arms and hubs, the whole coming out clean, without crack or flaw. The length of the roll was 5 feet 10 inches, and contraction brought it to 5 feet 8½ inches. The thickness was one inch and one quarter. Heretofore rolls of this description have been cast at this plant in three pieces.

A few years ago pig iron was bought by French rolling-mill managers and iron founders in accordance with contracts made at a fixed price (*a prix ferme*) made in advance for a certain period; but now this system has been to a large extent superseded by contracts based upon a sliding-scale (*échelle mobile*), the variations in the price of the pig depending on the fluctuations of that of coke, which is, observes the *Revue Industrielle de l'Est*, a much more rational arrangement. The advantage to both buyers and sellers of being constantly posted up in the average price of the coke consumed by the Meurthe-et-Moselle blast furnaces (which yield more than half the out-turn of France) has induced the above-named journal to publish, month by month, a return of the quantity of coke bought from the furnaces, and the mean of all the prices paid for it by the ironmasters.

Each rolling-mill manager and founder will thus be enabled, by the mean of the previous month, to calculate the price he will have to pay during the current month as per contracts made in accordance with the sliding-scale.

Prof. Carpenter in a recent address at Gray College, discussed the comparison of different methods of transmitting power, reaching the following conclusions as to the loss in per cent. required for different methods:

Line shafting:	Per cent. of Loss.
Loss by friction (average 25 per cent.)	15 to 40
Electricity:	
Loss in transforming from mechanical to electrical, and vice versa	20 to 30
Line loss	2 to 5
Total loss	22 to 35
Conveying steam:	
Naked steam pipe (still air)	37.6
Pipe covered with solid wood and earth	11.2
Pipe covered with solid wood and pipe covering	4.8

Carbon reactions in the blast furnace, formed the subject of a paper before a recent session of the South Staffordshire Institute of Iron and Steel Works Managers, in which the writer, Mr. W. J. Hudson, claimed the keynote of economic smelting was to deoxidise the ore by means of carbon monoxide at a temperature too low to permit of any of the carbon dioxide then formed being reduced again to the lower oxide. In concluding the paper, in which technicalities were mostly dealt with, the writer observed that it was evidently of the highest importance to secure complete calcination of the ores when they were of the carbonate variety, such as Cleveland ore or the native mine of South Staffordshire. For every unit of carbon (of dioxide) remaining unremoved from the ore another unit of carbon might have to be removed from the fuel, thereby increasing a preventable waste. The chairman said that, according to the remarks of Sir Lowthian Bell in a recent paper he had written, the size of the furnace giving the best results was about 11,500 cubic feet. That furnaces of medium cubic capacity were capable under certain conditions of producing equally as efficient results as those of much larger capacity was amply proved by the fact that in America furnaces of 25,000 cubic feet were made to produce as much as 3,000 tons of iron per week, whilst in Cleveland, where the cubic capacity of the furnaces was as much as 33,000 feet, the average yield was only about 800 tons per week. In addition, the fuel consumption in America was about 3 cwt. less per ton of iron, as compared with Cleveland. Of course, the difference in the quality of the ore obtainable in the two countries accounted in a great measure for this disparity, but not altogether, as was shown by the fact that the Dowlais Iron Company, Cardiff, could produce better results with the same economy of fuel, with a furnace of 25,000 cubic feet capacity, than was obtained in Cleveland with furnaces of 30,000 cubic feet. It appeared to him that the manufacturers of the Middlesborough district—much as they prided themselves on being foremost in the iron and steel making industries—were too much wrapped up in the formulas and scientific attainments, and did not pay sufficient attention to acquiring that practical knowledge which would enable them to get the most economical driving out of their furnaces.



THIRD ANNUAL GENERAL MEETING
OF THE

Mining Society of Nova Scotia
AT HALIFAX, ON 7th MARCH.

The Third Annual General Meeting of the Mining Society of Nova Scotia was held in the rooms of the Society, Halifax, on Wednesday, 7th March. There were present:-

- H. S. Poole, M.A., A.R.S.M., Acadia Coal Co., St. John's.
- R. G. Leckie, M.E., Londonderry Iron Co., Londonderry.
- John E. Hardman, S.B., Oldham Gold Co., Oldham, N.S.
- R. H. Brown, M.E., General Mining Association of London, Ltd., Sydney.
- W. Blakemore, M.E., Dominion Coal Co., Glace Bay, C.B.
- G. W. Stuart, Caribou Gold Co., Truro.
- J. C. McDonald, Antigonish Gold Co., Country Harbor.
- C. F. Andrews, Richardson Gold Co., Country Harbor.
- D. E. Copeland, Richardson Gold Co., Country Harbor.
- Dr. E. Gilpin, Jr., Inspector of Mines, Halifax.
- Hugh Fletcher, B.A., Geological Survey, Scotch Village.
- T. Burchell, Cape Breton Coal Co., Sydney.
- James Baird, Juggins Mines.
- B. C. Wilson, East Waverley Gold Co., Waverley.
- A. A. Hayward, South Unaieka Gold Co., Waverley.
- R. G. E. Leckie, Torbrook Iron Co., Torbrook.
- T. R. Gue, Acadia Powder Co., Halifax.
- Duncan McDonald, Truro Foundry Co., Truro.
- W. G. Matheson, Matheson & Co., New Glasgow.
- Howard Clarke, Halifax.
- Dr. A. H. Mackay, Halifax.
- H. A. Saunders, Lake Lodge Gold Co., Caribou.
- Capt. George MacDuff, Waverley.
- W. K. Thomas, F.G.S., Montagu, N.S.
- C. E. Willis, Canadian Rand Drill Co., Halifax.
- I. W. Sward, Ingersoll Rock Drill Co., Montreal.
- B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa.
- H. M. Wylie, Halifax.
- G. E. Francklyn, General Mining Ass'n. of London, Eng., Halifax.

The proceedings opened at half-past ten o'clock in the forenoon, Mr. H. S. Poole, M.A., F.G.S., *President*, in the chair.

New Members.

The Secretary having read the minutes of previous meeting, the following new members were elected:-
Robert Archibald, Canada Coal and Railway Co., Joggins' Mines.
Dr. Martin Murphy, Halifax.
W. Blakemore, M.E., Dominion Coal Co., Glace Bay.
A. B. Sheraton, Halifax.
Capt. A. L. Howard.
H. A. Sanders, Caribou.

Report of Council, 1893-4.

The Secretary then read the Report of Council for 1893-4, as follows:-

The Council has pleasure in reporting to the members the continued success of the Society during the year now closing.

On the founding of the Society in March, 1892, there were enrolled some 58 members; at the end of the year the numbers had increased to 75, and now the roll includes 83 members, after deducting the names of several who have resigned, having severed their connections with the mining industry of the province.

The following is a synopsis of the finances of the Society for the past year:

Receipts.	
Balance, 1st March, 1893	\$115 13
Subscriptions collected, 1893	790 00
Subscriptions in arrears	82 50
Balance	190 58
	\$1,178 21

Expenditure.	
Printing Transactions, &c.	\$584 67
Operating expenses—guests, postage, &c.	146 45
Reporting meetings	39 50
Subscriptions to CAN. MIN. REV.	137 39
Secretary, 1893	250 00
	\$7178 21

Meetings.—Quarterly meetings were held in March, June, September and December. The June meeting, in

response to the kind invitation of the members of the Society engaged in mining in Pictou Co., was held at New Glasgow. The works of the Pictou Charcoal Iron Co., the New Glasgow Iron, Coal and Railway Co., the Nova Scotia Steel and Forge Co., and other points of interest were visited and inspected. The Society is greatly indebted to the management of these companies for their kindness and courtesy in showing the visiting members of the Society over the works. The March, September and December meetings were held at the headquarters of the Society at Halifax. During the September meeting a visit was paid to the gold mining districts at Montagu and Waverley, where the party was very hospitably received by Managers Hardman, Thomas and Woodhouse.

Transactions.—Five parts of the Transactions have been issued during the year, viz: Part I, Vol. I., containing the By-Laws, &c., and a history of the formation of the Society, and parts I., II., III., IV., Vol. II., containing reports of the four quarterly meetings and papers. The Council would again take this opportunity of urging members to come forward with papers.

Exchanges.—A considerable number of exchanges have been added to our list during the year. The following papers and reports, &c., are on file in the Society's room: The Engineering and Mining Journal. The Iron and Coal Trades Journal. The Colliery Guardian. The American Manufacturer and Iron World. The Journal of the British Society of Mining Students. The Canadian Engineer. The Canadian Mining and Mechanical Review.

The Canadian Colliery Guardian, Critic and Journal of the Iron and Steel Trade. Transactions of the Manchester Geological Society. The Proceedings of the South Wales Inst. of Engineers. The Massachusetts Inst. of Technology. The Transactions of the Am. Inst. of Min. Engineers. The Transactions of the Canadian Inst. The Trans. of the Mining Ass'n and Inst. of Cornwall. The California State Mining Report. Catalogue of Stratigraphical Collection of Can. Rocks. Transactions of Federated Inst. of Mining Engineers. Geological Survey of Canada, and others.

The Importation of Mining Machinery.—In conjunction with the General Mining Association of the Province of Quebec, the Society had under consideration the necessity of a more uniform interpretation at the ports of entry of the present law respecting the free admission of mining machinery not manufactured in Canada. At the request of the Comptroller of Customs a statement showing the machinery known to be made in this country was prepared by a joint committee of machinery manufacturers and members of the Society and forwarded to Ottawa. This, it is hoped, will obviate some of the difficulties experienced by our mining companies in passing in machinery entitled to free entry. It was also resolved to ask that the Dominion Government when considering a revision of the tariff should extend the language of the Act so as to include not only mining machinery but all tools, supplies, machinery and appliances for mining, quarrying, handling, smelting, refining, concentrating and other processes, for the mining, extraction and treatment of ores and minerals of a class or kind not manufactured in Canada. Copies of this resolution were forwarded to Ottawa.

Local Mining Legislation.—At the meeting of the Society in September a numerous delegation waited upon Premier to urge that all new legislation in regard to mining should pass through the Mines Department before being introduced into either House.

Mr. Fielding, while agreeing with the spirit of the matter presented by the Society, pointed out the impossibility of precluding individual members from introducing private bills which might affect mining legislation, yet assured us that so far as lay in his power he would endeavor that a hearing should be given to the Society and others in all proposed legislation affecting the mining industry.

Committees.—A committee appointed to co-operate with those of the School of Art and the Institute of Natural Science and other similar institutions, report that they met with a favorable reception from the Premier of the province who expressed himself in sympathy with the movement looking to the erection of a suitable building for the proper exhibition of the Provincial museum, housing the libraries of the several scientific societies and supplying the needful class and lecture rooms for meetings.

The committee appointed to interview the Premier of the Dominion, Sir John Thompson, on the free admission of mining machinery not made in Canada and the transportation of explosives over Government railways and a reduction of duties on explosives, reported having received a careful hearing from the Premier, and the matters brought to his attention would, it was understood, be carefully considered.

The Report was adopted.

President's Address.

MR. H. S. POOLE, M.A., A.R.S.M.—With the anticipated pleasure of seeing to-day elected as my successor in office one who has done so much to assist the development of our Society, and under whose guidance much more may be confidently expected, there is in me a feeling of gratification that the lot to appear at the head of a movement that holds out so much promise as does our Society should have been mine at this auspicious and to-day. A continuance of such vitality as our organization has shown during the past two years warrants us in

believing that more than a justification exists for the formation and continuance of a mining society in Nova Scotia. The growth, the vigor of our Society is seen in the increased membership, and in the prominence and character of the men who have joined us, and our growing weight in the community is marked by the general interest taken in our proceedings, and by the attendance at our meetings.

It was also a source of gratification to us to find members of our sister society, the General Mining Association of Quebec, made special effort to attend two of our meetings and take part in our proceedings. In addition to the Association's active Secretary we have an Honorary Secretary to draw us closer together when our cause is in common, and to stimulate us to healthy rivalry in membership and in the papers presented for publication in our Transactions. That the papers we have issued have been of more than local interest has been shown by the republication of some of them in English and American journals.

Of material for future papers we have an ample supply. A comparison of past with present practices is always interesting, and in the developments now rapidly making, and in the improved machinery constantly introduced, and in writing accounts of difficulties overcome, there is ever a new ending source. If members will only set before themselves to tell of such they do not lack.

In times past Nova Scotia was famed for her ship building, and in the days of wooden hulls her craft were to be met in every quarter of the globe. To-day the question is not a recovery of her once proud position in the shipping world, but in the economic carriage of minerals at all seasons of the year, and the adaptation of the large system of transportation to our storm beaten and forlorn coast.

Our papers and discussions on gold mining have emphasized the fact that although this branch of our industry is over 30 years old no gold mine has yet attained a vertical depth of 500 feet, an insignificant depth in comparison with that reached in other gold fields in half the time. Coupled with it there is a common belief that the pay streaks do not extend to any greater depth. For my own part I am not satisfied that the reasons offered for holding this belief are sufficiently reliable or convincing, although at the same time I acknowledge a difficulty in proving either one theory or the other lies in the generally small extent of the pay streaks, and the want of a key to the order, if there be any, in which they occur. To the researches and mapping of the Geological Survey and carefully kept records of mining experience we can alone look for satisfactory guidance.

In connection with coal mining we have recorded a most unusual occurrence, an explosion of mine gases by lightning, under conditions that leave no room for doubting the accuracy of the conclusion.

However well pleased we may be with the standing we have attained, however full our hopes may be of effecting one or more of the objects that specially instigated us to draw together, and however diverse our individual interests may be, we all feel the latter should be subordinate. That in making common cause against the varied difficulties that meet us as miners in this Province, lies our strongest hope of successfully competing in the open markets of the world. That in united appeals to public opinion can the above hope for extraction from the sloughs of legislation through which well-meaning friends have diverted our road of life. It is perhaps not without some comfort to find that Nova Scotia Legislation does not in this respect stand alone—New Zealand presses us hard for muddiness of mind on mining matters. We led off and publicly declared that after January 1st, 1884, "It shall not be lawful for any person not having a certificate of competency to be employed at any mine in the Province." To appreciate in full the force of this enactment the broad definition in the law of what constitutes "a mine" should be remembered, and that boys and laborers are persons employed under ground. New Zealand, not to be outdone, in section 29 of the law of that Province, enacts that no person under 15 years of age is to have charge of an engine for raising or lowering men, and the Act then proceeds under the general rule to forbid anyone under 21 years of age to have charge of a steam engine. In the same Act section 27 prohibits the employment of boys in any capacity, while section 31 carefully provides for the registration of boys employed in connection with mines.

Our turn to declare comes round again, and we enact, in the cause of humanity, that at coal mines the drivers of engines and of gins, and those in charge of winlasses, shall be holders of certificates of competency. Then we publish a standard for examination that would put to the blush many a student of a course in mechanical engineering. "To make clear those who may not know how foreign to construction and repairs are the duties of nine out of every ten engine-drivers at coal mines, this requirement may be likened to an enactment calling on all drivers of black horses to have passed a veterinary college. Mark the restriction of black horses only, the drivers of horses of all other colors to be untrammelled as are the gin and engine-drivers at all other mines but those of coal under this Act.

But before saying anything more on the relevancy of such a Statute, let me remark no reflection is intended on

From some seventy questions the substance of several is as follows:
State the breaking strain of an engine-shaft of a given size. What is steam? Find the mean effective steam pressure. What should be the area of a chimney where a given quantity of fuel is consumed. State the advantages and disadvantages of a chimney of nine dimensions? How do you find the strength of steel chains, hemp and wire ropes? Explain the rule proportions of crank pins for different classes of engines?

the wisdom of opening the door of instruction on mechanics to engine-drivers and others laudably desirous of adding to their knowledge and fitting themselves for more responsible positions, but don't let it be done on the plea that the book-taught man will drive an engine or a gin, or turn the handle of a windlass, moving living freight more safely than one with experience alone. Again, I would repeat every credit is due for the faculties now supplied for the education of workmen. The criticism I make turns on the muddiness of mind* that confuses the user of a machine with a mechanic. As well insist that every dispenser of drugs shall be a doctor; every wearer of clothes, a spinner and weaver; every printer, a paper-maker, or every master of a passenger ship carrying sons and daughters of Africa shall be a marine architect.

Let us turn again to the sections of the law here called in question and not the confusion that follows the attachment of the rider "holding a certificate of competency." Originally they grouped together the doers of certain things on account of their age only, for their duties call for no book learning, no knowledge of anatomy or abstraction of thought, but do call for prompt response to signals, quick observation and close attention to immediate surroundings. I unhesitatingly express the belief that nine out of every ten men who will make 60 per cent. of the marks on examination papers, such as have been published, will be thereby not one whit the better able to perform the work of driving engines, driving gins or turning windlasses, for their daily task will not give them any opportunities for exercising such an education.

Nor is this feature the worst part of such legislation. No alternative is open but to break the law, and break it too with the knowledge of the Department of Mines.

I have dwelt perhaps too much on this one amendment, but I wished to make it a typical case. I have already drawn your attention to other points in the Act which appear to me inconsistent with the fundamental object of the law, the preservation of life, and I will ask you to recall to mind what I said at Montreal a year ago. Inconsistencies that I then hoped had only to be pointed out to be remedied, but now I find they are defended. Credit is claimed for them as made in the interests of the working man; credit for deleting the General Rule which prohibits the unramming of shots, a rule expressly made to protect the working miner; credit for failing to allow work to proceed under substitutes in the absence through sickness or otherwise of certificated officials; credit for making the sinking of a hole for coal illegal, that when for water, or for gold, or for iron is within the law. If such restrictions are right and proper the country should see that they be not exceptional, but are as a part of one harmonious system, dealing with all classes of labor impartially.

As a Society we should not be content until it becomes a recognized practice for proposed mining legislation to pass through the Department of Mines and opportunity be given for mine workers to fully consider and discuss it.

We should not be content until the right, given by the Legislature to the Dominion Coal Company, as tenants in dispute with a landlord to appeal to the courts of law, be a right equally enjoyed by every lessee of a gold or other mine in the province.

And finally with regard to much of our legislation, I may say it seems to me too generally thought that a remedy for a danger is effected when a law relating to it is framed, it matters not whether it be operative or not. Given the patient and the knife, skill in the surgeon is secondary; the knife may be double bladed and wound the hand that holds it, but the credit for work performed with it is due to it and the maker thereof only.

Amendments to Constitution and Bylaws.

MR. B. T. A. BELL gave notice of the following amendments to the Constitution and Bylaws of the Society:—

Section IV. That there be a Secretary-Treasurer instead of a Secretary and Treasurer as heretofore.

That new sub-sections be added as follows:—
The President shall not hold office for more than two consecutive years, but shall be eligible for re-election to that office after an interval of one year.

Retiring Presidents shall be elected Past Presidents and shall hold office *ex-officio*.

All officers and members of Council shall retire annually, but shall be eligible for re-election.

Section V. Be amended by the addition of the following:—General Meetings for the reading and discussion of papers and the transaction of business shall be held twice in each year at such time and place as the Council may determine. Any special business or subject for discussion shall be specified in the notice convening such meetings, and the Secretary shall give not less than fourteen days notice thereof to all members of the Society.

Extraordinary or urgent business may be transacted at any meeting when considered absolutely necessary by a three-quarter majority of those present.

Election of Officers and Council, 1894-5.

The following were elected for the ensuing year:—

Past President.

HENRY S. POOLE, M.A., A.R.S.M. (Acadia Coal Co.) Stellarton.

* An amusing case of this is Chapter 43, page 84, of the Acts of 1893, which was enacted, so the title says, to encourage the growth of cranberries, a service to other plant life generally relegated to stable manure or commercial fertilizers; and Mr. B. Russell, Q.C., has lately pointed out in the public press that this characteristic is not confined to acts relating to mines.

President.

JOHN E. HARDMAN, S.B. (Oldham Gold Co.) Oldham.

Vice-Presidents.

R. G. LECKIE, M.E. (Londonderry Iron Co.) Londonderry.

DAVID MCKEEN, M.P. (Dominion Coal Co.) Glace Bay.
GEORGE W. STUART (Caribou Gold Co.) Truro.

Hon. Secretary.

B. T. A. BELL (Editor Canadian Mining Review) Ottawa.

Secretary-Treasurer.

H. M. WYLDE, Halifax.

Council.

W. R. THOMAS, F.G.S. (Nova Scotia Gold Mines, Ltd.) Montague.

R. H. BROWN, M.E. (Gen. Mining Assoc'n. of London, Ltd.) Sydney Mines.

DUNCAN McDONALD (Truro Foundry and Machine Co.) Truro.

CHAS. FERGIE, M.E. (Intercolonial Coal Co.) Westville, N.S.

W. L. BLAKEMORE, M.E. (Dominion Coal Co.) Glace Bay.

W. G. MATHESON (I. Matheson & Co.) New Glasgow.
C. E. WILLIS (Canadian Rand Drill Co.) Halifax.

GRAHAM FRASER (New Glasgow Iron, Coal and Ry. Co.) New Glasgow.

GEOFF. MORROW (Stairs' Sons & Morrow) Halifax.

Votes of Thanks.

MR. R. H. BROWN proposed a vote of thanks to the Past President and retiring officers.

MR. W. G. MATHESON seconded the motion, referring especially to the valuable services rendered to the Society by the ex-President.

THE PRESIDENT.—To the kind words used by Mr. Brown and Mr. Matheson, I wish personally to add that Mr. Matheson has not begun to rightly estimate the amount of work done by our Past President, and if the Society continues to flourish in the future as in the past, it will be due to the fact that the plant in its infancy was so tenderly nourished and well watered by the President.

MR. POOLE.—I will merely say this, that the labor which I have had in connection with the Mining Society has been a labor of love, and I am more than amply repaid by the pleasure and satisfaction it has given me.

MR. T. R. GUE.—As one of the retiring officers, I may say that any praise of my efforts would be entirely undeserving. The only work done by me has been to sign cheques. I was very glad when the two offices were amalgamated to-day.

Election of Honorary Members.

MR. B. T. A. BELL.—I desire to submit the name of Mr. John Rutherford, M.E., Stellarton, for election as an Honorary Member, and in doing so I need hardly remind you of his invaluable services to the Province as its late Inspector of Mines. Mr. Rutherford is now out of active mining, but he takes a deep interest in its welfare and the work of this Society. I am sure in honoring him we would greatly honor ourselves by this election.

MR. WYLDE seconded, and the election was carried unanimously.

Federation of Canadian Mining Associations.

MR. B. T. A. BELL.—At the last meeting of the General Mining Association of the Province of Quebec the question of consolidating the existing mining associations in Ontario and Quebec, was favorably discussed, and Mr. F. A. Halsey, of Sherbrooke, and myself were delegated to bring the subject before you. I regret exceedingly that illness in Mr. Halsey's family has prevented him being here. Two propositions were discussed, namely, complete consolidation into a Canadian Mining Institute, operated by a representative council and local boards of management. The other, federation. It has been thought that either of these propositions would considerably augment the influence of the various societies as they now exist, but before doing anything our Association would be pleased to have your views on the matter.

The question having been discussed, was referred to the following committee: Messrs. H. S. Poole, C.E., Willis, the President and Secretary. To consider, first, the possibility of federation; second, that they be empowered to confer with representatives of other associations, and third, to report progress at the next meeting of the Society.

AFTERNOON SESSION.

Invitation to Visit Cape Breton.

The members met at two o'clock, the President in the chair.

MR. W. BLAKEMORE.—You will remember that at our last meeting Mr. McKeen invited us to hold the summer meeting at Cape Breton. He now writes me to submit a programme. It is his desire to make the visit a pleasant one and he says both in the mines and shipping arrangements of Cape Breton and in the scenery of the country there will be found ample to repay anyone for making the

visit. He says further that any member of the Quebec Association will be heartily welcomed. He suggests that the members leave Halifax on Monday, July the 9th. They will arrive at Sydney on the evening of that day. There will then be a large hotel in order and it will be ready to receive the gentlemen. On Tuesday it is proposed to take the members to the International Pier which will be one of the largest on the continent. It will load two vessels of the same size as the "Teutonic." There is an immense tower by which the buckets can be swung around to either side of the vessel. At the pier the works will be explained by Mr. H. Donkin, C.E. Then the party will be brought back on the steamer to the Sydney hotel and have lunch. In the afternoon they will go out on a special train to some of our mines, probably the Caledonia. That mine is being equipped in a superior manner. The shaft has been doubled in size. We are putting in self dumping cages, cages of double capacity in putting out coal. All the arrangements for weighing, etc., are new and very complete. The air compressor is a duplex compound steam compressed air of large size. The coal cutting machinery will be new. We have the Stanley heading machines, in the advertisement of which it is claimed that in eight hours the machine has been able to cut from ten to twelve feet. In a six feet heading, we are heading thirty feet in eight hours, blasting it, loading and carrying it away. That is quite a record in heading, such as I think was never seen in the old country. We have also the longwall cutter for under-cutting the coal. We have the Sergeant and Harrison machines. All of this machinery will be interesting even to our gold mining friends from a mechanical standpoint. The mine is lighted up by electricity. You might then have the ordinary meeting in the evening, the reading of papers and transactions. The representatives of the Dominion Coal Company will read several papers explaining the workings of their departments. The Company's engineer, Mr. Pearson, will read a paper on compressed air, and I will read one on underground work. Mr. Brown of the Sydney mine, has invited the members out to the old Sydney mines on the following day. They are the oldest in Cape Breton, and have a very interesting history. In the evening it is Mr. McKeen's desire to entertain the members at a public dinner at the hotel, to which will be invited the prominent men of Sydney. On the third day he will place a steamship at your disposal to take you to Louisbourg. The cruise down the coast will be very interesting. Those desiring to return on Friday can do so, but if they desire to remain there are many things of interest to be seen. These suggestions are now open for your approval. Mr. McKeen is anxious that our large and important property be inspected.

THE PRESIDENT.—I think I may say on behalf of the Society, that this programme which Messrs. McKeen, Blakemore and Brown have arranged, is exceedingly courteous in its character. I hope that this Society may be able to give a full attendance sufficient to warrant these gentlemen in going to this expense and interfering with their business to entertain us.

MR. B. T. A. BELL.—On behalf of the Quebec Association I can only express heartiest appreciation of the thoughtfulness which has prompted the invitation to our members. We had arranged to hold our June meeting in Quebec and were in hopes of having the pleasure of the company of members of the Mining Society. I will, however, submit this kind invitation at the earliest opportunity and I hope to be able to report that our Association has cancelled its Quebec meeting and that we will be fully represented in Cape Breton.

Publication of Transactions.

MR. B. T. A. BELL.—As a matter of economy in printing, I think it might be well this year to defer publication of the Transactions until the end of the year when a full report of the year neatly bound and indexed would be of more service than the present method of issuing quarterly parts.

This was agreed to.

On the Relative Costs of Mining Narrow Veins— Hand Drills vs. Air Drills.

MR. JOHN E. HARDMAN.—Having recently had occasion to make up some data involving the cost of development work upon the narrow lodes common to our gold fields, I was led to investigate costs of mining when done by air drills as compared with the same done by hand drilling.

Believing that one of the objects of our Society is to make our individual experiences available for others, I have incorporated the results of my investigation in this paper.

By way of premise I may say that the figures given and conclusions reached are based upon the cost books of the last four years' work in Oldham District, where, during that period, I have had exceptional opportunities for comparing the two methods of work upon identical ground, and often side by side at the same time. The cost books referred to take account of all items, excepting only amortization of plant, and the costs mentioned are therefore actual ones and are reliable.

The figures given are the averages of large totals, e.g., those for stoping represent over 5,000 tons, those for driving are averaged from nearly 4,000 feet of levels, etc.; those for sinking represent a total of 1,100 feet.

For convenience I have tabulated the results as follows:

SUPPLEMENT TO "CANADIAN MINING REVIEW"



MR. JOHN E. HARDYAN, S.B., OLDHAM, N.S.
President Mining Society of Nova Scotia.

BY HAND DRILLS. BY AIR DRILLS.

		Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.
Shafts, per foot sunk	\$	23.58	4.81	14.32	16.46	13.82	15.52
Winzes, " " "	\$	13.08	9.40	11.53	13.32	8.92	11.38
Raises, " " raised	\$	9.00	7.11	7.99	.....	.....	.....
Drifts or Levels, " " driven	\$	9.45	3.75	6.86	8.05	5.28	6.86
Cross-cuts, " " "	\$	10.19	3.52	8.84	4.54	4.23	4.45
Stopes Overhand, " fath. stoped	\$	23.48	6.91	14.40	18.34	11.32	15.34
" " " ton	\$	14.24	1.53	5.34	20.58	12.29	15.49
" Underhand, " fath. " "	\$	36.07	14.26	30.73	19.41	14.12	15.69
" " " ton	\$	11.77	7.01	10.20	25.57	11.39	17.94

Taking first the figures for shaft sinking, it is seen that there is a slight difference of \$1.20 per foot, or nearly 8% apparently in favor of the hand drill. This difference, however, is only apparent and not real. There are several factors of this question not shown by the figures, the lode, in addition to being small, is flatly inclined (at an angle of about 43°), the result is a practical impossibility of getting a hole to look in towards the hanging wall seam, making the use of a larger quantity of dynamite imperative, and necessitating much quarrying and often a hand hole to square down the corners. These items add much to the cost of sinking in such a vein with an air drill. In the case of a vertical shaft sunk during 1892-3, the figures stand at \$23.58 when sunk by hand, against \$15.52 when sunk by air, a difference of 33% in favor of the air drill as to actual cost per foot sunk, but a much greater difference is shown when the element of time is considered, the average distance sunk per diem of 24 hours by hand being 5 inches; by air, 12 inches.

The great difference between the maximum and minimum costs by hand (\$18.77), and the small difference between the same figures by air (\$2.64) strengthen the view already expressed.

The figures for winze sinking, like those for shafts, are nearly identical, \$11.53 for hand against \$11.38 for air; nor is there much discrepancy between the maxima and minima, and what has been said as to shafts will apply equally to winzes.

The figures for the levels or drifts are identical, but on looking to the maximum and minimum columns we see quite a difference, and this difference draws attention to the explanation which is similar to that already given for shafts or inclines. On narrow veins, in levels driven by hand, every advantage can be taken by right or left hand strikers, to point the holes as shall be most advantageous, either to foot or hanging wall seam; but the air drill, on account of its length (which in the Rand and Ingersoll types, runs from 4 feet 5 inches to 5 feet 2 inches), cannot be so pointed in narrow veins as to take an equal advantage with the hand drill. Hence, one of two things will result; either one of the walls must be broken, to carry a wide drift, necessitating thereafter trimming and timbering, or the holes lie practically parallel with the enclosing walls, and hence require double or treble the explosive, and final costs about balance.

This explanation derives still further endorsement from a study of the figures relating to cost of cross-cutting. Here we see the wide difference of \$4.45 per foot for air and \$8.84 per foot for hand, the latter being practically double the former. Moreover, the difference between the maximum and minimum in the case of air is only 31 cents, or about 7% of the average, whereas by hand the difference between the maximum and minimum is \$6.67 or 75% of the average. Showing that where there are no side seams, and where a sufficient width can be obtained in which to swing the drill, the petty matter of slips, seams and headings affect little the progress and general average cost of the work, but showing also that where by hand, good ground came in, the cost could be cut to \$3.52; yet where these slips were troublesome the cost would run to three times that figure (\$10.19.)

The figures for stopes are not by any means so flattering to the air drill. The explanation for this in the case of the overhand stopes is doubtless to be ascribed in part, as before, to the length of the machine, but also in part to its weight, and to the inevitable delay and loss of time in removing the heavy drill and stopping bar to a place of safety when firing, and the bringing back and setting up of the drill afterwards. From the nature of the case in a narrow lode but few holes can be drilled from one setting up of the machine, and lightness becomes an all-powerful consideration. The difference between having to carry a 150-pound drill and a 250-pound drill up a narrow, flatly inclined belt over a back-stope, becomes painfully apparent when you try it yourself.

The drill made by the Rand people, weighing 147 pounds, and having a length of but 3 feet 10 inches, particularly recommends itself to this work. The same criticism will apply to the figures of cost for underhand stoping.

One feature, I may be pardoned for alluding to here, is the great difference shown in favor of the overhand stope over the underhand. A cost of \$5.34 per ton as against \$10.20 should be sufficient to convince the most obstinate of those "old-timers," of whom, I regret to say, there are still many in the gold mining business here.

It would therefore seem, from the foregoing figures, as if there were scant grounds for advising the use of a compressed air plant for narrow-vein mining, and were we to stop at the figures given there would be little or nothing to be said for air drills. But what the table does not show is the great advantage in time that is gained by the air drill. In shaft and winze sinking the rate by air has been

(with us) doubled, enabling one to sink 100 feet with air before hand drilling could reach 50 feet. In driving and cross-cutting the rate is from two to three times the speed obtainable by hand work.

A monthly run of 57 feet in cross-cutting hard white rock being compared with 20 feet by hand in the same cross-cut. In another case one shift with an air drill drove 1.4 as many feet as double shift by hand could do in the same ground, showing nearly three times the speed.

In mining (if in any business whatever) is time of the essence of the business, for we must not forget that on general principles, other things being equal, the quicker a deposit of known value and magnitude is worked out the better and the bigger is the ultimate profit.

In all that I have said I desire to be distinctly understood as dealing only with the narrow inclined belts so common in the Province. As to the general economy and utility of the air drill, there has and can be no two opinions. There has, however, been room for a considerable divergence of views when attempting to apply such machinery to local conditions in the gold fields. But in view of our experience during the last four or five years, I feel little or no hesitation in advising the use of an air drill plant whenever the extent and richness of the deposit warrant the expenditure.

Some Remarks on the Gold Production of Nova Scotia and How It May be Increased.

MR. B. C. WILSON (read by the President).—The last report of the Commissioner of Mines shows a falling off in the yield of gold in 1893 as compared with the previous year. It may be claimed that this decrease is more apparent than real, in consequence of the Government change in the fiscal year, whereby the report covers but nine months instead of twelve—yet, making correction for this, it still shows some decrease, and an examination of previous reports shows that decrease has been more or less continuous for the past four years.

To a person comparatively familiar with our gold mining, and who notices the statement from time to time of encouraging prospects and large yields from some exceptionally productive districts, it must be somewhat of a surprise that the precious metal does not materialize better and present an increased yield rather than a decrease, even though that decrease may be small, and also reasonably ask why it is when persons have a mine giving a continuous yield of five to ten ounces that less than 200 tons a year are mined; and it is clearly in order to ask the "reason why" for this condition of things, as having an important bearing upon this branch of our mining industry.

Having been intimately associated with gold mining since its inception in the Province, and generally familiar with its "ups and downs," I fail to find any evidence—and do not consider—that the decreased yield of the past few years at all indicates any exhausting of the supply of gold, or that the profits of the industry are any less on the amount of gold produced, but is rather attributable to the altered conditions, requiring larger outlay of capital, consequent upon the transition from mere surface mining—or more properly *prospecting*—to a more advanced and systematic mode of operating, rendered necessary by the increased depth of the workings, the additional plant necessary to treat larger quantities of low grade ore, and the presence of more refractory ore—or more properly of ore which has not become disintegrated by elemental surface influences and from which our universal practice of free gold milling and amalgamation fails to extract the gold as it readily did from the surface rock where the gold had been liberated by natural process during untold periods of time.

Beside, a decline in yield, after a score of years or so, is but the history of gold mining generally, and notably so in the two great gold producing countries of modern times, California and Australia, and probably from the same, the exhausting of the easily reached surface deposits which were operated by numerous individual adventurers, with limited or no capital and incomplete appliances, and which decreased yield marked the transition period from these early primitive methods to the more complex and elaborate mining practice and management, involving increased capital and greater skill.

As a people we have not taken kindly to gold mining as a business, but have rather "dabbled" in it as a side venture, or "trying one's luck," as frequently expressed. Wherein we hoped to achieve grand results from a very small outlay, and the exceptional richness of some of our lodes at the surface largely favored this anticipation and was responsible for an ill-advised and extravagant style of mining (if it could be honored with that name) and called into existence a multiplicity of mining investments of a very limited and superficial character, operated with very primitive appliances and generally with worse mining ability, and just sufficient working capital to ensure a failure, and it is notorious that in the early days of mining here, and even till quite recently, the exploiting of our mines was largely relegated to men who had been unsuccessful in farming, fishing, trading, or other callings and whose only qualifications as miners, was, perhaps, their impetuosity, energy and sanguine temperaments and thus was inaugurated our mining practice which could hardly be considered other than prospecting or demonstrating the existence of gold in our ores.

This method was comparatively profitable for a number of years, while working near the surface with the old hand windlass, horse whim—or perchance an anti-

quated engine with a ship's pump and a hoist fearfully and wonderfully made and marvelously operated and with ore in which the gold held in the sulphurets had been liberated by the slow decomposition of the pyrites and making it susceptible to the simplest processes of amalgamation.

But it was inevitable that our people should after a time find themselves confronted with the problem of deeper mining and more refractory ores involving more expensive plant and more complex methods of treatment, requiring men of greater mining and engineering experience and business ability as managers, and all of which called for an outlay of capital far in excess of what they had been accustomed to, or what the heretofore limited holdings of a few mining areas would warrant and hence a number of individual operators, whose only capital was their labor were forced out of commission, while their successor, the capitalist acquiring extensive areas and bringing to his aid improved appliances, skilled management, and extensive operations had not arrived to take their place, or at least to but a very limited extent—not half a dozen instances in the whole Province, while the small operators who had dropped out might be counted by the scores.

In evidence of this, and that our people are recognizing this condition of things, I may refer to the fact that for some three or four years past there has been a tendency or movement toward concentrating the numerous small properties into large compact blocks of ground which should include a majority—or if possible all—the known veins in a given district so as to thereby warrant the erection of efficient plant and extensive operations from one central point on a scale which would command competent ability and economize management to a minimum; and this concentrating of interest; and the investing and introducing of capital; and equipping under a new regime has absorbed and necessarily further absorb much time during which time there is but little gold forthcoming.

Our facilities for obtaining the most approved and efficient machinery, together with an abundance of ordinary and skilled labor, and all these at prices which defy competition anywhere in the world, place the mines of Nova Scotia in an exceptionally fortunate position, and our most pressing need is more capital judiciously invested under more advanced management.

I would not wish to be understood as undervaluing the native talent amongst our mining men. Many of them are capable of a good deal more than they have an opportunity to display, and they have not been without opportunities to criticize some object lessons of extravagance and incompetency presented by some imported "able management;" but if we are thus indebted for examples of some of the most stupendous failures in the country, it is only just to acknowledge ourselves also indebted to foreign brains and ability, as well as capital, for other examples of unqualified good management and successful demonstration of what our mines are capable, and educated by the failures on one hand and successes on the other we are beginning to appreciate our mines at their true value and recognize their wants, and comprehend how much money we have unadvisedly and uselessly spent, how much gold we have unwittingly lost in our treatment of the ores, and how extravagantly expensive has been our mining practice and business management.

Wherefore I do not attribute the decreased yield that has occurred during the past three or four years to any exhausting of the mines, to any decreased average of gold in the ore, or to any inability to make the industry as remunerative as heretofore, but rather to the gradually altering conditions of the business during that time—to that inevitable transition period, if I may so express it—the interim of transference from circumscribed areas, and limited, if numerous, operations, to the rehabilitating under a new regime, with larger properties, improved management and plant and more extensive working, under more systematic and thorough mining practice.

And I have every confidence that under this reorganizing of the industry which is being initiated, with the infusion of a little more *esprit de corps* among our people, a generous interchange of ideas, ignoring all jealousies and lending a helping hand in the many inexpensive ways which a fraternal feeling will suggest, and particularly with the infusion of more capital, placed less as a speculation and more as a business investment, to be systematically and judiciously applied with the same rigid adherence to business principles as applies to manufacturing or other legitimate enterprises, that gold mining in Nova Scotia will be not equally but more remunerative than in any other country of like magnitude in the world, and that the annual yield will go up far beyond what it has ever been, and what is more, keep up—for with all these favorable conditions, and the mines and the gold in them, how can it be otherwise?

I may be permitted to draw attention to certain side influences which have an indirect tendency to reduce the output of gold to some extent, and for which neither the mines nor the management are responsible. I refer to that litigious propensity which seems to have crept into practice of late and for which we are perhaps equally indebted to foreign and native talent, and as it usually follows that the mine stands idle while the legal fight goes on, the absence of gold returns in such instances is commensurate with the law's delays.

It is regrettable if any indefiniteness in our statutes tends to foster contention. We are assured there need be no misapprehension, yet in practice there has arisen a wide divergence of construction, and recently an individual facetiously defined a government lease to a gold mine as "a quit claim deed which guaranteed the owner in peace-

able possession so long as the property was of no value." But, seriously, considering that the miner has to pay the government as much for 17 acres of gold mining areas as does the agriculturist or the lumberman for 100 acres, and then has to keep on paying rents and royalties eternally, it is but reasonable that he (the miner) should expect to find that government as anxious to secure him in an incontestible title as to receive his deposit, or if need be, put him in possession without recourse to the courts.

But perhaps such is not the case and the evidences of contention which have arisen are rather the result of neglect, and an easy confidence in it turning out all right in the end, when a careful observance and following out of the details of the statutes at the outset would have obviated it.

Mr. G. W. STUART.—I am sorry that Mr. Wilson did not remain to read his paper; not that I can find any fault with the manner in which that office was performed by the President, but I would have liked to ask Mr. Wilson a few questions. One of them is this: Whether or not he has taken it for granted that all the gold raised in the Province is returned? I speak feelingly on that matter. It is only a short time ago I was called upon to pay a forfeit of \$500. I happened to be bondsman for a company for its mill license. The fact had slipped my mind. I had long since lost all confidence in the management, but had entirely forgotten that I was on their bond. The mill ran for several years all right. They finally ceased to pay dividends or royalty. After a couple of years the manager left the country. I was called upon to pay up the money. That is all because the returns were not made. If we made a determined effort I think we could get the government to remove the royalty on gold. The old clause in the law about working was practically a dead letter. Practically, all we had to do was to pay two dollars per area. Since 1891 the law has been changed. We have been obliged to pay fifty cents per area rental as well as the two dollars per area, when we acquire them. That fifty cents is more than equivalent to the royalty. The government could consequently very well relieve us from that tax. I would suggest that we take the matter up at our next meeting. If the government would establish an assay office and make it compulsory to bring gold to that office to have it assayed, valued and stamped with the government stamp, it would become legal tender. The charge could be a nominal one, merely enough to support the office. If that were done I think you would find the returns larger.

Mr. POOLE.—Years ago there was on the Dominion statute book an ordinance requiring every purchaser of gold bullion to make a return of his purchase. I never was aware that that statute was repealed.

THE PRESIDENT.—That statute is still in existence.

Mr. T. R. GUE.—It should go one step further. If a man is dishonest enough to buy gold of a thief he is dishonest enough to make his receipts very much less than they actually are. There is another case in which it is pretty well established that fifty or sixty thousand dollars worth of gold went out of the Province. I speak feelingly because I was left in the lurch in that case. Could we not have an office where the gold could be weighed by a proper officer?

THE PRESIDENT.—Referring to one of Mr. Stuart's suggestions that the government were getting enough out of the rental and could abate the royalty, that royalty is about one-half of the revenue derived from the gold fields. Under the Spanish code, in lieu of royalty, the yearly rental is made a larger sum, equivalent to about two dollars. The royalty is abated and the returns made to the government are merely sufficient to show the government that labor is performed. The unit of measurement is a hectare (about two acres.) Suppose a man has a hundred acres for which he pays rental, he can pay it for as many years in advance as he likes. He pays no royalty. If a man should get into difficulties, under the Nova Scotia law he is liable to have his property forfeited. Under the Spanish law it is put up at auction, and the sum received from the highest bidder, after deducting the charges due the government, is turned over to the owner.

Other Papers.

During the afternoon Mr. H. McInnes, Barrister, Halifax, delivered an interesting address on the Provincial law respecting Employers' Liability, citing a number of decisions of the courts bearing upon the subject. Mr. R. E. Chambers, Mine Superintendent at Ferrona, also contributed a valuable paper "On the Value of Blast Furnace Materials." We regret, through pressure upon our space to be unable to furnish our readers with the reproduction of these in this issue. The remainder of the afternoon was taken up with a discussion of the advisability of securing larger accommodation for the Society. It is not unlikely that in the near future some action may be taken in this matter.

The meeting adjourned at six o'clock.

Third Annual Dinner.

The third annual dinner of the Society took place in the evening in the St. Julian dining room, Halifax Hotel, some thirty members and guests being present, Mr. John E. Hardman, S.B., President, in the chair. After dinner had been served and the usual loyal and patriotic toasts duly honored, an informal programme was carried out, the opening feature being "the health of our most distinguished fellow citizen, the Premier," proposed by the

chairman and received with all honors, the company joining heartily in "He's a Jolly Good Fellow."

HON. W. S. FIELDING, on rising, was greeted with loud applause. He said that he enjoyed an unexpected pleasure in being present. He had been one of the party at Montreal, and had many pleasant recollections of evenings spent around this board, and when he received the invitation to be present this evening it was with much regret that he thought he would have to decline. He was absent in a distant part of the county engaged in business which was occupying public attention at the moment and it seemed impossible that he could get here in time. Some years ago there was a governor in this Province named Sir Hastings Doyle, and, at the same time there was a very popular clergyman here, who was a neighbor and a warm personal friend of Sir Hastings. They were in the habit of meeting together frequently in an unconventional way and enjoying the pleasures of the table. One day Sir Hastings had some particularly fine soup for dinner that he knew his friend the clergyman would enjoy, and sent his servant over with an invitation to come and dine with him. The clergyman reflected with much sadness that it was a fast day, and sent word that he would not be able on that account to accept the invitation. But the attraction was too strong to be resisted, and before the servant had quite got out of the house the clergyman called him back and said "Never mind; tell Sir Hastings that I will grant myself a special dispensation and come." And so, after he had sent off the telegram to Mr. Bell, expressing regret that he would not be able to be present this evening, he concluded that he would grant himself a "special dispensation" and come. (Applause.)

This was an age in which co-operation in every department of society was necessary, and if co-operation was necessary in other departments why should it not be made use of in respect to the many important interests to promote which this Society was formed. The formation of the Society was a wise step. Already the members had good results to look back to and no matter what government might be in power in the future, as the years rolled on the Society would find a large field of usefulness and as the result of the exercise of its legitimate influence upon public affairs there might be a development of the mineral wealth of the province that would be a source of profit to investors. Both as respects gold, coal and other minerals, which, perhaps had been too little considered, he believed that there would be a development of our mineral wealth which would be a source of pride to the province, of revenue to the provincial treasury, and, what was of equal importance, of profit to the pockets of the men who worked the mines. For years men had been boasting of the mineral wealth of the province and had been crying for capital to develop the mineral wealth and trade of the province. Now a time had come when, more than ever before, capital was being drawn to the province, and though there might have been differences in the past he was persuaded that the members of the mining fraternity, united and working together, would be able to so influence legislation that capital would be attracted, justice done to all concerned, and the mineral wealth of the province be made a blessing to all who were interested in the country. (Applause.)

Here Mr. W. R. Thomas contributed an excellent song, which was followed by a duet from Messrs. Bell and Sword, "Drill Ye Warriors, Drill," with banjo accompaniment, the chorus, as usual, being very much in evidence.

Mr. W. L. BLAKEMORE, in responding to "Our New Members," said he was pleased to hear the Hon. Mr. Fielding expressing so cordially his appreciation of the importance of the mining industries of the province, and Canada as a whole. He (Mr. Blakemore) did not profess to know much about Canada, but, so far as he had been able to observe, the wealth of this province lay largely in the development of its mines. In saying this he did not lose sight of the agricultural possibilities which had been well illustrated recently at the World's Fair at Chicago. The possibilities of the mining industry were enormous. The value of the known mineral deposits was so great that they had only to be developed to bring enormous wealth not only to investors, but to the people. So far as the coal mines were concerned, one could not find in England a series of coal measures which for convenience of access, cheap working and ease of transport, could be compared with the mines in the Island of Cape Breton. There were, of course, differences of quality and adaptability, but for the cheapness with which the coal could be worked and the ease with which it could be put on ship board, there was nothing in England to compare with the mines of Cape Breton. (Applause.)

Mr. JAMES BAIRD having done ample justice, in a few humorous remarks, to the charms of the fair sex in responding to "The Ladies," songs were given by Messrs. Ernie Wyld, R. G. E. Leckie, Thomas and Sword. The health of the retiring President, Mr. H. S. Poole, was given by the chairman. Mr. Hardman dwelt on the fact that the existence and prosperity of the Society was mainly due to the work that had been accomplished by Mr. Poole. (Applause.)

Mr. H. S. POOLE expressed pleasure that his efforts on behalf of the Society had been such as to merit the approval of his fellow-members. Knowing this he was fully repaid for any labor he had performed. As a substitute for a speech he would submit the following lines, being a revised version of an old and familiar song:—

OLD KING COAL.

Old King Coal was a jolly old soul,
And deep underground lay he;

On a fire-clay bed he had pillowed his head,
Under strata three thousand and three;
Till at last a mining man laid a deep and cunning plan,
And he says to his mates says he,
Let us dig a deep hole and get up this King Coal,
For a jolly old soul is he.

Chorus.

Then this man set up a whimsey, got a banksman
and a bailie,
And a stout lot of sinkers got he.
They began to dig and bore, then they blasted, then
they swore.

But they sank all the way jollily,
Through clunch and binds they knocked, black bat
and pelton rock,
Through the gubbin and the balls d'ye see,
Then they drove out a big heading, just to search
among the bedding,
For the place where King Coal should be.

Chorus.

So they found old King Coal at the bottom of the hole,
And his face they were glad for to see,
Though with thumb to nose it bore, the strange
legend not of yore,
Pay up increasing royalty!

Then in all the country round, in every house is found,
Old King Coal smoking jollily,
And many a good fellow sits by him and gets mellow
As all jolly fellows should be.
For old King Coal is a jolly old soul,
And a jolly old soul is he,
And many a good fellow sits by him and gets mellow
As all jolly fellows should be. (Applause.)

Mr. B. T. A. BELL responded to the toast of "Our Sister Societies." He thought that the attractive programme outlined by Mr. Blakemore at the afternoon Session would be certain to attract to Cape Breton a good representation of the members of the sister Association in Quebec. It was a great source of satisfaction, and it might be taken as fair indication of the advancement of mining in Canada that these organizations of mining men were springing into activity and were accomplishing good work for the country. He commended the Mining Society to the government as an institution which merited their support, inasmuch as there was no better means of advertising the wealth of the province than the Society's publications. He concluded by reciting the following humorous composition on the present system of examination for a certificate for workers in coal mines, which was respectfully dedicated to their good friend the Hon. Mr. Fielding:—

"OUR CERTIFICATE."

In learned professions, to carry more weight,
An expert should have a good certificate.
Now, all sorts of miners must hold one as well,
And how they regard it this chorus will tell.

I'm only a trapper and need no book lore
To teach me to open and shut to a door;
Still, I have to study and addle my pate
Before I can pass for a certificate.

And I am a driver, I cannot go wrong,
As o'er the gate roads I pass carelessly on.
A very poor scholar can drive a horse straight,
Yet I must read up for a certificate.

And I work a windlass, it does not need brain
To turn a crank handle again and again;
Still, I'm not exempted; I hear 'tis my fate
That I, too, must pass for a certificate.

And I am a cutter, unpaid if I shirk
(The strongest of motives to keep me at work),
But yet I must grind all new theories to date
Before I can handle a certificate.

And I am an overman, high up the tree;
Good practical mining is expected of me,
Which I learned, with much more, I now beg to state,
Before I was crammed for a certificate.

And I'm an Inspector from nondescript trade,
Without special training, and fairly well paid.
I criticise freely, yet, strange to relate,
I cannot produce a certificate.

(Laughter and applause.)

Mr. J. D. SWORD, a member of the Quebec Association, also replied on behalf of that organization, concluding with an excellent comic song and banjo accompaniment. Mr. R. G. Leckie also sang "Bonnie Dundee" in capital style.

Mr. HECTOR MCINNES, replying to the toast of the "Legal Profession," emphasized the necessity of technical education. He thought that the demand might be in part supplied by lectures of a popular character in various localities. If facilities were afforded for obtaining technical education in matters relating to mining the mistakes of the past might be better avoided, the experience gained in the past made use of to better advantage, loss of capital in unprofitable operations avoided, and more confidence given to investors.

Mr. H. S. POOLE expressed his regret that the head of the Department of Education of the Province was not able to be present. From conversations which he had had with that gentleman he believed that he was of the opinion that the day when a classical education was con-

The Gold Hill, or Northern Gold Co., is in the same formation as the Sultana. The main or Ada G. shaft is down to a depth of 66 feet, while the Pearl shaft on the Pearl lode is 61 feet deep, with a drift commenced in a 4-foot vein at this depth. These veins run parallel with each other, their strike being N. E. and S. W.; average width of veins, 4 feet; dip, 10° S. The shafts are 8 x 5 feet; average assay value of ore from both shafts, \$17.50 per ton of 2,000 lbs. A ten stamp mill has lately been erected. This and the Sultana are the only mines in the district that are really getting into fair working order. They have 25 men employed systematically in sinking and drifting on both veins with an additional 5 men employed in attending to their mill and reduction works. The results in the way of gold products are, I am assured, most encouraging. This property is situated on the east shore of the lake and about 4 or 5 miles from the Sultana.

The Bull Dog adjoins the Gold Hill mine. It has a shaft sunk 80 feet, with some drifting east and west along the vein, which is 3 feet 6 inches wide, and the ore assays from \$10 to \$70 per ton of 2,000 lbs. This mine owns and operates a steam drill, hoist and pump. Hitherto they have had a Crawford mill, but as this machine has proved a complete failure, it has been removed to make way for the old-fashioned but reliable stamps. The shaft is 5 x 8 feet. This is a promising property, and one that has every likelihood of turning out a paying concern. Near the Bull Dog is

The Winnipeg Consolidated, a property that has been shut down for years owing to work having been commenced before a title to the land had been secured; they sunk a shaft to a depth of 104 feet and put up a 5 stamp mill on the property. The vein measured only 8 inches at the surface, but at the bottom of the shaft it was nearly 8 feet wide. The ore averaged over \$22 per ton of 2,000 lbs. Of course no Company could possibly last without some prospect, no matter how remote, of some day obtaining possession of the land on which they were operating. Consequently the Company collapsed, and the property has fallen into the hands of parties who want a good price for it, and who are likely to continue to want it.

The Pine Portage is about one mile east of the Sultana, on the mainland. It is one of the strongest and best defined veins on the lake. The vein is about 6 to 7 feet wide. The shaft is sunk at a junction of an east and west vein with a north and south fissure vein, the drifting being done on the fissure vein. The ore is black in color, and is extremely refractory; it averages \$12 per ton of 2,000 lbs., although some assays have gone as high as 22 oz. or \$440. The shaft is 120 feet deep, and the drifts and crosscuts amount to 150 feet. They have erected a 10-stamp mill and frue vanners. The work was done at the same time as the Winnipeg Consolidated, and had the ore been as suitable as the others that I have already mentioned for economical working, it would probably have been a working mine today. Unfortunately as a result of this mine closing down, chiefly owing to the presence of tellurium in its ore, the public generally seem to have come to a conclusion that the Lake of the Woods ores are generally full of tellurium, and are consequently very refractory. This conclusion is, however, not borne out by assays and subsequent developments. Generally speaking the Lake of the Woods ores are comparatively free milling for some distance down from the surface, after which they are mostly affected with iron, sulphur and copper only, thus necessitating the use of some concentrating process, but not by any means such an expensive process as the presence of tellurium has hitherto demanded, and which in the case of Pine Portage resulted in the closing down of the mine.

The Treasure has been sunk 53 feet 6 inches with a crosscut of 10 feet; average width of vein, 3 feet 3 inches; average value of ore, \$16.25 per ton of 2,000 lbs. It is a promising prospect.

The L' Di Vere is owned by the same party as the Treasure; has been sunk 100 feet, the average assay being from \$10 to \$20 per ton of 2,000 lbs. There is a steam hoist on this property. The width of the vein is about 3 feet.

The Wild Rose is situated near the L' Di Vere and the Treasure. It contains a very promising vein 3 feet wide, of good looking quartz, yielding from \$10 to \$27 per ton of 2,000 lbs. It is a property of considerable promise, situated as it is in the heart of the auriferous mining belt.

The Bad Mine is another favorable prospect, on which active development is now going on with the view to purchasing it should the present developments warrant it. One interesting feature of this property is that the vein occurs in the Laurentian formation instead of the Keewatin, or at the junction of these formations. Consequently the developments on this property are extremely interesting from a geological standpoint. These last four prospects are situated near Rossland station on the Canadian Pacific Railway about 8½ miles east of Rat Portage, and I have selected them as fair samples of many prospects which exist on the Lake of the Woods, such as Britannia Island, Cariboo, Woodchuck, Argyle, Regina, etc.

In conclusion I may say that I regret that I was only a comparatively short time at Rat Portage last year, and that during that time I was extremely busy, or I have no doubt that I should have been able to have gathered together more data of this very interesting gold field, which is still very much in its infancy. Enough development has, however, been already done to prove the existence of gold in paying quantities, and also to prove that there are many really good claims that are still undeveloped, and that in order to secure a paying mine it is not necessary

to invest in and develop one of the most ancient mining locations, which appears to have been the general practice so far; but that it is equally safe to invest in and develop recent mining claims, which if carefully selected are just as likely to turn out well. It will thus be seen that the Lake of the Woods is a very promising locality for anyone who may desire to experience the pleasures and profits of gold mining. The ores are generally easily milled, the veins are of fair width, and although so far none of them have proved very rich, good paying veins can be secured that will carry on an average of from \$10 to \$17 per ton of 2,000 lbs. The known gold area is constantly increasing, promising free gold finds having been found on Manitou Lake, La Seine River, and the south part of Rainy Lake. In fact, owing to the rich discoveries of gold, and also coal, on Rainy Lake, our American cousins have not only already laid out a town site on the American side in the state of Minnesota, about 14 miles east of Fort Francis, but they intend building a railroad from Tower and Ely to Rainy Lake. In fact the country may be considered as almost entirely unexplored, the few properties now under development having been found more by accident than as a result of systematic and careful search. So that there is ample scope left for the explorer and miner to win for themselves the profits, which properly belong to the careful and assiduous searcher in nature's laboratory.

Kingston School of Mines.

The short course of study which has for the past eight weeks been in progress at the newly established School of Mines in connection with Queen's University, was brought to a close on Tuesday evening, the 6th inst. Mayor Herald, of Kingston, presided, and there was a good attendance of ladies and gentlemen interested in the work.

MAYOR HERALD in opening the proceedings said that he was proud of his official connection with a Council which had recognized the worth of the School of Mining. He referred to the action taken on Monday night. He believed that as inhabitants of a young country we Canadians should look about us and see what resources we have to depend upon. Among these would be found fisheries, timber lands and mines. The Dominion Government should assist schools of mining, as a means of properly developing our mines. He then read a letter from Mr. B. T. A. Bell, editor of the CANADIAN MINING REVIEW, expressing regret at being unable to be present at the exercises.

PROFESSOR GOODWIN gave a brief review of the work done during the term, which, he said, was necessarily of an outline character, but had been very thorough and practical. There had been an introductory course consisting of ten lectures on chemistry, delivered by Dr. Goodwin, with the object of giving the students such a knowledge of the subject as would enable them to go on intelligently with the study of mineralogy. The work in mineralogy had covered the remaining six weeks, Professor Nicol leading his class rapidly through the general principles and then plunging into the identification of minerals by simple tests. The blow-pipe class had made very satisfactory progress, every member having become fairly efficient in the use of the blow-pipe. A good deal of practice in assaying had been given the class, by means of the charcoal, gas and the portable coke furnace. In geology the work had been of an equally practical character. Professor Miller had had charge of this branch of study, and the results of his teaching were very satisfactory. Mr. W. H. Merritt had attended to the "Discovery and Mining of Ores," and had been very successful in his teaching. Only one member of the class had found time to attend Mr. Mason's lessons on mechanical drawing, and his work had been so neatly and carefully done that it was placed on exhibition.

At the conclusion of Dr. Goodwin's address the Mayor presented certificates, stating that certain work had been studied by the student during the term, to the following named members of the class: F. Broome, J. Donnelly, R. J. McDowall, C. G. Rothwell, W. H. Stevenson and E. M. Morgan.

J. Donnelly, on behalf of the class, read the following address to the teaching staff:

Kingston, March 6th.

The Staff of the School of Mines:

GENTLEMEN,—The students of the special course, on the completion of the session, desire to show their appreciation of the work of the course, and to testify to the great benefit they have derived from it, due principally to the plain and practical teaching which has characterized the lectures and work. You have taught us where to look for minerals, and having found them, to test and prove what they are, to open and work the mine in the most improved and modern methods, assay the minerals to determine the economic value of each, to make a mechanical and freehand sketch of the mine and its vicinity, and in short to do everything pertaining to the work of mining and prospecting.

No other class could have had more painstaking and earnest teachers, and we hereby tender our sincere thanks to Professors Goodwin, Nicol, Millar, Merritt, Mason and Walker for the kindness and consideration shown us, with the hope that you may long be spared to continue the good work.

We commend the Ontario Government for the assistance given this school, and trust it will see the wisdom of increasing the grant.

Our thanks are also due Representatives Harty and Metcalfe and Mr. Blue, Director of the Mining Bureau, for their kindness in sending the students valuable reports and supplies. Wishing the school prosperity, we remain,

On behalf of the class,
W. H. STEVENSON,
F. BROOME,
C. GARNETT ROTHWELL,
JOHN DONNELLY, JR.,
Committee.

Several of the students spoke in high terms of the ability and carefulness shown by the teachers.

Inspector Kidd and A. J. Macdonell, manager of the Ontario Bank, each made a brief but practical address. Mr. Macdonell suggested that students in future be taught enough of the law regarding mines and claims to serve their purpose, and also that the mechanical work connected with the prospector's profession be taught. He said that in the Rainy River district the people do not favor the Ontario Government's laws regarding mines. They were afraid to open a mine lest they should have to pay a royalty. The Geological Survey was doing good work, and he suggested that a limited number of the students of the School of Mining be attached to the Survey.

PROFESSOR MILLAR asked why there should not be a Geological Survey in connection with the school.

C. F. GILDERSLEEVE and H. A. Calvin, M.P., also spoke. Mr. Calvin said that he would be happy to do all in his power to further the interests of the school, but as he was not the Finance Minister, he could not definitely promise much.

PROFESSOR FOWLER made a humorous address, in the course of which he said that it was a good thing to have a number of men who knew where to look for mineral deposits, and know also where such deposits would not be found.

PRINCIPAL GRANT spoke of the need of a community such as this, doing something in aid of this branch of education. The seven students who had been given diplomas were not the only special students in connection with the school. There were in all 48. The object of the special courses was to bridge over the gap that exists in every country between the practical miner and prospector, and the School of Mining. These special classes are now held in connection with all the great schools in Europe. In the United States they have instituted the correspondence system to impart knowledge on subjects connected with mining. This system would be investigated, and if any merit should be found in it, advantage would be taken of it. One of the first additions to be made to the School would be a department of mechanism. The speaker expressed his satisfaction with the action of the City Council in giving a grant to the School. If that body had done this last year \$1,000 would have been saved, for the Dominion Government had offered that amount provided the school were established before a certain time. The citizens of Kingston would not lose a cent on account of this grant, for the property that had been so long an expense to the city would begin to pay as soon as the Governors took hold of it. There was a standing offer on the part of the Dominion Government to assist schools of navigation, and such a school would be instituted here as soon as practicable.

The meeting closed with a vote of thanks to the Mayor.

Specimens of various kinds of quartz and a number of instruments used by prospectors and miners were exhibited, and the students performed several experiments to illustrate the studies upon which they had been engaged during the course.

Mechanical Appliances for the Shipment of Coal.*

BY MR. S. W. ALLEN.

Great care and much ingenuity has been from the earliest times displayed in order to bring into the market the coal in as large and unbroken masses as possible. Notwithstanding all the care that can possibly be bestowed, a very large proportion is broken up into small particles, and thereby reduced considerably in value. The small coal at one time being almost unsaleable, and at the present time—even when there is a large market for it in the manufacture of patent fuel and coke—the loss entailed in bringing it to the surface, and the small price that can be obtained for it, only serves to emphasize the fact that the greatest care should be taken that the lump of coal hewn from its bed shall be transferred through all its varied travels to its destination in as near as possible the same state as it left the collier's hands in his stall in the depths of the coal mine. Many of the most important colliery districts are situated a considerable distance inland, and as the coal trade of this country depends to a great extent upon foreign shipment, it follows that the coal must be carefully conveyed by railway, canal or other means to port of shipment, and various systems have been in use for this purpose. In some places, such as on the River Tyne, the trams, or corves, in use at the colliery are taken direct from the mines and deposited in the vessel's hold, without any intermediate handling; but this system is only available in such places where the colliery is situated in close proximity to the dock or river where the shipment takes place.

* From a paper read before the Institute of Marine Engineers, February 24, 1894.

SUPPLEMENT TO CANADIAN MINING REVIEW.



Group of Members of the Mining Society of Nova Scotia, taken from a Photograph for THE REVIEW at the Halifax Hotel, 9th. March, 1894.



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As it is the purpose of this paper to deal especially with the coal-shipping side of our subject, we will not enter into the various details in use at the collieries, for or the transference of the coal from the trains to the waggon, or other receptacles; but suffice it to say that the tram is generally discharged into a shoot or screen, the small passing into a hopper, or what is called a "Billy Far- play," placed underneath to receive it, the large sliding out at the other end and falling into the waggon ready for conveyance to the port of shipment. In some cases the coal was deposited in barges or keels, as they are called in the neighborhood of the Tyne, and were then brought to the side of the vessel and loaded by hand through ports in the side; this was, of necessity, but a slow method of procedure, and the growth of the steam coal trade within recent years soon demanded some mechanical methods, in order to keep pace with the times, and to do this efficiently much ingenuity and scientific skill has been displayed in devising means to meet the requirements of different localities and varieties of coal. It will be sufficient for our purpose to divide the various kinds of coal into two classes—viz., coal with a close, dense and compact structure, such as that found generally in the north of England, and the coal with a porous or loose structure, breaking with an uneven fracture, the angles of which point in all directions, such as the celebrated steam coal of Glamorgan-shire and Monmouthshire. The class of coal first mentioned will slide freely down an inclined plane, of small angle, and its natural smoothness and evenness of fracture allows it to be very easily handled, and transferred from one receptacle to another with comparatively little loss from breakage, whereas the latter, or Welsh steam coal, requires an inclined plane of considerable angle before it will descend with its own gravity, in consequence of its uneven fracture and open and porous texture, whilst its angle and tender structure necessitates that special means shall be employed to allow it to slide easily, and to prevent its falling any considerable height when being loaded either into waggons or the holds of vessels. The early history of coal shipping is more particularly identified with the north of England and Scotland than any other part of this country; and to the neighborhood of the River Tyne or the Wear we should repair in order to commence our review of the principal machines in use in days gone by. Some of the oldest of the mechanical systems on the Tyne may be seen still at work in that neighborhood. In some places where the colliery was situated close to the river side, the waggons were taken direct from the mouth of the pit and run down an incline, the descent being governed by a rope passing over a pulley at the head of the incline, the descent of the fall waggons pulling the empty waggons back again and, in other cases, by a winding engine hauling the empty waggons back, and allowing the full ones to descend. The vessels at this time were comparatively of small dimensions, and in order to deposit the coal on board, the height of the staging had to be sufficient, in order to allow the coal to fall by gravity into the vessel's hold. In other cases the coal was deposited in lighters, or keels, and then conveyed alongside of the vessel, the keel men shovelling the coal into the hold, and then filling the basket. The system of allowing the coal to fall by gravitation has been brought to very great perfection at the north-east ports, and it will not be out of place here to describe the principle on which this system is based. A staging or staitis is erected on the river or dock side, on to which the waggons run, an opening is made in the platform, of considerable length, and sufficiently wide to come in between the rails, and over this opening a hopper is constructed, into which the coal falls, and here an opening is made, and connected up to a wooden tube or spout, down which the coal runs into the hold of the vessel, the speed of its descent being governed by an adjustable door in the spout. The hopper is always kept full, and as the coal runs out of the spout in a steady stream, the waggons are being constantly emptied into the hopper. These waggons are invariably constructed with doors fitted into the bottoms, through which the coals fall vertically, and the sides and ends made sloping outwards, the top being considerably larger than the bottom. No arrangement was made for the varying height of vessels, or the amount of rise and fall of tides. It soon became necessary to adopt means to meet these circumstances. The staitis had to be increased in height, and the spouts were set to rise and lower, and the openings in the top were provided at various heights each governed by a regulating screw. And owing to the narrowness and length of these spouts it has been rendered possible to allow of a considerable latitude for swinging the point in a horizontal direction. This has been found of very great advantage in loading into hatchways that do not come exactly opposite the centre openings in the staitis, thus allowing, in many cases, the coal to be shipped into two or more hatchways at the same time. Probably the most elaborate system of staitis erected on this river may be seen in operation at the Hendon Dock, Sunderland.

It will readily be seen that coal only of a certain class can be sent down that is, coal that will slide at a comparatively slight angle, and of sufficient strength to hold together under such treatment or when very large lumps have not to be dealt with, in which case various means were adopted to lower the waggon bodily on to the deck of the vessel when the doors were released, and the coal allowed to fall direct into the hold. Several of the original and very ingenious machines may be seen still at work on the Tyne, and there are a number in the neighborhood of Wallsend which is, I believe, still in use. It is a combination of the spout and the drop system, and although there is no arrangement for

regulating the height of the spout, the drop has a very considerable range. The waggon is brought to the front of the tip and is loaded on to a swinging cradle, or platform, with an aperture in the middle; this platform is suspended by four rods to a crossbar, aligned to the ends of two upright poles or ribs, the bottoms of which are hinged to the upright posts of the front part of the staitis, so that when the cradle with the poles is allowed to fall forward and descend in a radius of a circle to the depth required, it became necessary to apply an arrangement to regulate the necessary, and to bring back the empty waggon and cradle to its original position. This is effected by attaching a wire rope or chain to the top of each of the poles, the other end of the rope being made fast to a barrel fixed up a horizontal shaft placed at the top of the staitis, and at the other end of this shaft were also fixed other barrels to which were attached wire ropes, one end of the ropes being securely fastened to the bottom of a long pole or pendulum, the top of the pole being attached to fixed angles, and the lower end being free to travel as the rope was being wound on to the barrel by the descent of the loaded cradle; a large cast iron weight attached to the lower end of the pendulum brought it back to its vertical position, and correspondingly the cradle with the empty waggon to its proper level, in order to have it replaced by a full one. The regulation of the descent and the return of the cradle was governed by a large wheel on the transverse shaft, and the lever being in charge of the brakeman. A man usually descends with waggon and cradle to release the door fastening, and frequently to hammer away with a sledge on the sides of the waggon in order to persuade any obstinate coal that may have remained behind, that an evulsion was necessary. This system is still largely in use in the north of England, and has been elaborated to a considerable extent on the Wear and in Sunderland Docks, where we may find many excellent examples. In most cases the waggon comes on the staitis also, on a high level, and is transferred on to a cradle, as before described, but instead of wire ropes and poles being used, the side supports are after the fashion of a portion of a huge beam or cantilever, one end of which is attached to a very strong shaft, and to the other is suspended the cradle for sustaining the waggon, the shaft being considerably below the level of the platform, or railway. In one or both sides of this shaft, and to the supporting beams, are attached immense brake wheels with large balance weights fixed to their lower ends to govern the descent and return of the waggons. These drops are capable of loading coal into very large-sized vessels. Another method adopted was to run the waggon on to a suspended platform directly over the vessel's hatchway; the cradle and waggon were then lowered vertically by the means of chains fixed at one end of the cradle and other chains to sheaves on to a brake wheel shaft situated overhead, the descent and return being governed by balance weights. A somewhat similar plan was also in use at the port of Cardiff, at the West Bute Dock, then called the Bute Ship Canal. The waggon in this case was not lowered vertically, but the front part was made to ascend in order to get the waggon to the top of the end of the cradle, the doors being placed at the end in all coal waggons in the South Wales district. This system worked very well in all cases where the vessels were small, and consequently little variation in height occurred, but the constant increase in the sizes of vessels, and the amount of damage the coal suffered in falling into the hold soon necessitated other methods being adopted, and consequently they have since been replaced by modern appliances. On the River Usk, at Newport, may still be seen many ancient contrivances for lowering the front ends of the waggons and lifting the back ends when shipping into vessels at the top of high tides. In all the methods adopted on this river the waggon is tipped into shoots, the front end of which is lowered on to the hatchway, and is ingeniously arranged so as to be easily pulled back out of the way, and prevent its projection into the river when not in use.

In the early part of the present century, and down to a recent date, tubs were largely employed on the River Wear, at Sunderland. These tubs fitted into a barge or keel, the trams were lowered immediately over the keel, and the coal then dropped into the tub; the barge was then taken and placed between the wharf and the vessel, and the tubs lifted out and lowered down into the hold, the bottom of the tub being made to open, the coal being deposited with as little breakage as possible. One of the most elaborate systems for tipping tubs consisted of a large beam supported on central trunnions, a sheave was placed at each end, and a rope or chain was passed over them and connected at one end to the barrel of a winding engine. The tub was first hoisted in a vertical direction, and on continuing the revolution of the engine the beam was caused to rotate upon its axis until the tub was over the hatch, when the engine was stopped, and the tub lowered to the hold. Various other methods were in use at that time for lifting the tubs from the barges, and a floating barge, fitted with a steam engine and machinery by which the tubs were transferred from the keel to the ship, was also employed, but on account of its unwieldy nature was soon rendered obsolete.

In dealing with South Wales steam coal, very special means have been adopted, and very much employed, and we return to the enormous demand for what is generally admitted to be the best steam coal in the world, the ports of Cardiff, Barry, Newport, and Swansea in particular vie with each other in providing ap-

pliances to rapidly and carefully ship this valuable commodity with the minimum of breakage and maximum of speed. The steam coal trade is of such a recent date that the history of its development for this purpose, but of the steam engine and steam shipping. Thirty years ago very few of these steamers came to these ports for coal, and the majority of vessels were small craft, with an occasional full-rigged ship or barge, with small hatchways and a long distance for the men engaged in the hold to trim the coal into the far end of the vessel. No mechanical contrivances, as far as I am aware, have ever been used in the Welsh ports for this purpose, but I find that considerable attention was given to this point in the neighborhood of Liverpool and the north of England, and I also find in a specification, dated 1850, by Messrs. Wm. Laird and Alfred Edward Cowper, that several very clever contrivances were proposed for this purpose by them, and as the question of breakage is at the present time of so much importance, I have no doubt that reference to their invention will not be out of place here, and I therefore append an extract from their specification—"We claim, as our invention, the application of an endless chain of buckets or blades for the purpose of lowering coal and similar descriptions of cargo into ships and other vessels as herein described. We also claim the application of an endless web or chain placed horizontally, or nearly so, for the purpose of conveying and distributing coal and similar cargo into ships and other vessels, by means of a trunk kept constantly filled, so that the coal may gradually descend as it is withdrawn from below instead of dropping unchecked to the bottom. We also claim the application of a railway suspended to the deck beams for the purpose of loading and discharging cargoes in ships and other vessels."

I am not aware whether these inventions were ever practically used, as I fear that owing to the amount of time required in order to erect and take down such a formidable structure, the time usually allowed for loading vessels in the present day would scarcely permit it, when it is a common occurrence for a 1,000-ton vessel to enter the dock on one tide and get loaded and away by the next tide.

The character of any mechanical contrivance for lowering the coal from the waggon into the hold and distributing it when there, is one that deserves particular attention. There can be no doubt that the old system of boxes, as employed at the West Bute Dock, Cardiff, up to about the year 1860, was as perfect a plan as could be desired for carefully shipping the South Wales steam coal without breakage, but owing to the small hatchways and want of more powerful machines, it soon became evident that other and quicker methods of work were an absolute necessity, and the old machinery was, at about the date mentioned, taken down and re-erected at the East Bute Dock, and was in use regularly, from that time until the last few years, discharging ballast. The machinery consisted of a long projecting jib, reaching out over the dock a distance of 30 ft., and hinged 35 ft. 6 in. from the ground, upon which worked a travelling carriage carrying sheaves, over which the chains passed, and a winding engine, backed in and out, was performed by a horizontal winding engine, with a single cylinder of 18 in. diameter and 3 ft. stroke, driven by a Cornish boiler 5 ft. 6 in. diameter and 18 ft. 3 in. long, working at a pressure of 25 lb.; the engine was reversed by a gab end on the eccentric rod being dropped on one or the other of a pair of levers attached opposite each other on the weigh shaft that carries the slide valve, and a similar arrangement was made for hauling off the steam for starting and stopping; a complicated arrangement of hand levers and treadle governed the various brakes, clutches and levers that were required to be used every time the box was raised, lowered, or backed in and out, the result being that the attendant was engaged in a kind of dance from one treadle to the other, while his hands were fully occupied with brake valve and eccentric levers, but notwithstanding all this complication, I do not ever remember a single accident happening to this old machine. The boxes were of iron, and contained about two tons of coal, and brought to the docks on a kind of framework on wheels, the whole having a very similar appearance to an ordinary coal waggon. The train of waggons were run on to the line of rails between the engine house and the hold, and the full boxes being lifted from there to the dock, and the empty returned again to the waggon, as before. I feel convinced that had this system been carried out with better appliances there would have been no necessity for the present method of tipping the waggons. The whole arrangement might easily have been mounted on wheels and made to traverse along the dock side to any distance.

At Cardiff and the neighboring ports, a system of balance tips has for a long time been in successful use, and where the coal is brought in at a sufficiently high level to ship into the largest vessels, it must be admitted that the present method is as rapid and efficient as can be desired, and with improvements in the apparatus for allowing the coal to pass gently into the hold, I have no doubt that as little breakage can take place with this method as with any other. The most perfect tips of this kind can be seen in the East and West Bute Docks, Cardiff, and at Penarth Dock. The level of the water in the East and West Bute Docks being constant, and not varying with the tide, as is the case at Penarth and other tidal docks, the distance therefrom from the rail level to the water always remaining the same, the highest tip being 28 ft. from the water to the rail level, it will be seen that when a modern steamer, measuring, say, 30 ft. from the

water's edge to the top of the bunker hatch, is to receive her bunker coal, even the level of these tips is much too low for such a purpose, and in order to increase this height various methods have been adopted which we will endeavor to describe in due course. The principle of the Bute Docks balance tips may be described as follows: At a sufficient height a train of loaded waggons are brought in and shunted as close up to the tip as to allow of each waggon being detached and accurately weighed, it is then brought forward by either horse power or hydraulic capstan on to a turntable, where each waggon is turned round, the door being invariably at the back end in this district, in order to prevent the doors from being strained during its transit by rail from the collieries to the docks. The waggons are then hauled on to a cradle suspended by wire ropes passing up overhead, and attached to heavy balance weights governed by a large pair of brake wheels and powerful lever, the weight of the coal causing the waggon to descend and the balance weights bringing back the cradle to its original level. When the height of the tip is insufficient to ship into a very large vessel, it is usual to lift up the tail end of the waggon, and if necessary, also lower the front end. The lifting was formerly done by hand, by means of a powerful crab crane, but this has been done away with for some years and a hydraulic ram has taken its place, the winch only being used for hauling up the slack when tipping by balance alone. In working these tips, counter weights are used in nearly every operation; thus in raising the butt or point of the shoot the labor on winch handle is very materially reduced by their assistance, while the clever anti-breakage arrangements can scarcely be improved upon in this respect. At the commencement of loading a vessel the coal is allowed to slide down a shoot into an anti-breakage box. This box holds about a ton of coal, the weight of which causes the box to descend, and is governed by a rope, one end of which is brought on deck and the other is attached to a brake lever, so that the whole arrangement is perfectly under the control of the man on the deck of the vessel. When the box is empty, the brake rope is released, and the box is thereby brought back to be filled again, and so on until a cone or pyramid of coal is formed in the hold, after which the box is allowed to rise out of the way. The remainder of the cargo is allowed to slide down the sides of the cone into the distant parts of the hold where the trimmers are employed to place the coal where required. Most modern steamers engaged in the coal trade are now built specially for this purpose, and very little trimming is necessary. The amount of manual labor to handle waggons containing 10 tons of coal is by this system reduced to a very small amount. The incline down which the trains of coals are brought to the tips is very slight, being only sufficiently steep to allow of the capstan drawing about twenty or thirty waggons with ease, and $3\frac{1}{2}$ in. in 100 ft. has been found to answer this purpose admirably, being just enough to enable the men to start the waggon with the aid of the capstan, while with the momentum thus obtained they can be run on to the weighing machine, and then easily stopped without applying very great pressure on the brakes, the hydraulic power being only required to give the waggon a start; each waggon, therefore, is weighed, turned around, tipped, turned around again, and is then sent down an incline of about 1 in 70, this being sufficient to allow them to run down quietly by their own gravity. In consequence of the continued increase of the height of vessels coming to this port to be loaded, and especially for bunkering into steamers when light, tips have had to be specially constructed, the existing levels being insufficient. The tips for this purpose are capable of raising a waggon 12 ft. above the ordinary height of the high level railways. These tips are worked entirely by hydraulic power.

At Penarth the tips are entirely on the high level system, and the dock being tidal, a much greater height can be obtained from the water level to the high level railway than in Cardiff, except on the top of spring tides, when the loading has to be stopped until the tide recedes sufficiently, and thus any required depth can be obtained. The principle of these tips is practically the same as those at Cardiff, but with the exception that hydraulic power is used for working the anti-breakage box, and the details of the machinery are slightly different. The manner of bringing in the loaded waggons and taking away the empty ones is sufficiently different to warrant our giving a description of it. The dip sidings are parallel with the dock and the train of loaded waggons is shunted down an incline, until it is arrested by a stop block at the safety catch, each waggon is then separated from the trains as required and the catch allowed to fall back, the remaining waggons following on down the incline as far as the catch or stop, entirely by gravitation, the incline being sufficient to allow of their doing so without any other assistance. The waggon being detached is then pushed by hand on to a turntable and then turned at right angles, and pushed off to a short incline leading to the tip. After the waggon has been tipped, an operation identical with that performed at Cardiff, it is pushed on to a return incline, at the end of which is another turntable, and upon this the waggon is again turned at right angles, in order to transfer it on to the empty road incline, from where the train of empties is taken away by the shunting engine when required. It will be seen that no horses or hydraulic capstans are used, but there is a very large amount of manual labor required in order to bring the waggons from such a considerable distance to the tip and then to return them again to the empty road. Gravitation has been employed to its

fullest extent in each of these operations. These tips are built upon projecting jetties, and thus enable ships to lie at an angle to each other, an accommodation that is of very great advantage when shipping into long vessels, as it allows the tips being built closer together than would otherwise be the case, thus considerably economising the room in the dock.

Having now so far described some of the appliances in use during the early history of coal shipment in South Wales and the North, together with the excellent modern balance tipping arrangements in the neighborhood of Cardiff, we will turn our attention to some of the various systems of coal shipping by hydraulic power; and to Cardiff, Barry, Newport and Swansea we should repair in order that we may see to what perfection hydraulic power has been applied for this purpose. Probably the first use to which this power was applied for coal shipping was the old arrangement in use many years ago in the Glamorganshire Canal at Cardiff, the old sea lock where the coal was brought down in canal boats, fitted with large iron boxes, similar to the system formerly employed at Sunderland, to which we have referred. The boxes were lifted up out of the boat by a vertical ram and two horizontal rams pushed them out over the vessel, a gantry being fixed above for that purpose; this system has been for very many years obsolete, but as far as I am aware I have no doubt that it was the pioneer to hydraulic coal shipping.

The hydraulic tips made from the port of Cardiff, by Sir William Armstrong, are all on the low-level system and consist of a central ram and cylinder fixed below the level of the dock wall. The top end of the ram is attached to a strong iron cradle working between a pair of upright guides of sufficient length to allow the ram and cradle to be raised to the required height; upon this cradle is fixed a tipping platform hinged at the front ends by means of strong gudgeons, the back being attached to another ram working in a cylinder 9 in. diameter and fixed by oscillating trunnions to the main cradle. The waggons are weighed, turned and brought on and taken off much in the same way as on the high-level balance system. When the loaded waggon is brought on to the cradle, the pressure water is admitted to the main cylinder by an attendant perched up in a house at the top of the tip from where he can watch all the movements of the machinery under his control. The cradle being raised to a sufficient height, the door of the waggon is loosened and the tipping ram at the back of the platform is brought into play, causing the back end of the waggon to rise and the waggon to assume an angle of 45 degs. in order to allow the coal to slide out in the shoot. The pressure water for the tipping cylinder is taken from the main cylinder, the valve being situated on the rising cradle, and actuated by the attendant turning around a long square bar running the entire height of the tip and passing through an opening in the cradle. Upon this bar a valve lever with a square hole is allowed to slide freely; the other end of this lever is connected up to the valve levers, so that upon the bar being turned in one direction the pressure valve is opened and the exhaust in the opposite direction. The raising and lowering of the shoot is also performed by the motion of the cradle—thus, when the butt of the shoot is required to be raised or lowered, two arms are made to project from the front of the cradle, and upon the pressure being attached to the main cylinder the cradle rises with the shoot to the required position, the lowering being accomplished by simply opening the exhaust valve, allowing the water to escape. A vertical rack is fixed each side of the main uprights, and a self-acting catch is fitted to the butt of the shoot, so as to hold it any height required, the point of the shoot being caused to rise or lower by means of a pair of chains attached to each side of the point, and passing over four sheaves at the top of the tip and down each side near the central guides. A claw to fit the link of the chain flatways is pushed between an oblong slot in the cradle at any point desired, the rise or fall of the cradle causing a corresponding rise and fall of the point of the shoot, and a similar claw is fixed each side near the top of the tip in order to keep the point in any desired position.

At the Alexandra Dock, Newport, and the Prince of Wales Dock, Swansea, the coal is brought in on the low level and the train of waggons run down an incline entirely by their gravity. They are then weighed and turned round and brought on to the cradle of the tip, being hauled on by means of an hydraulic capstan. The waggon is then raised to the required height and is then tipped up by the ordinary tipping ram as before described: the waggon being emptied, is run on to a high-level incline overhead, down which they descend by their own gravity and are taken away by the dock locomotives. The advantage gained by this system over the ordinary low-level is that a full waggon can be brought up in readiness to place upon the cradle while the other is being tipped and run on to the incline, and thus very little time is lost in each operation. The perfection to which hydraulic power has been utilized in the shipment of coal by Sir William Armstrong has left very little for outsiders to do in this class of machinery, and consequently very few firms have turned their attention in this direction—among the latter, Messrs. Brown Bros., Edinburgh, whose low-level tips at the East Bute Dock are excellent examples. In these tips the central ram hitherto universally adopted in hydraulic tips has been entirely replaced by suspending the cradle by means of a series of six round wire ropes, 1 in. diameter; these ropes pass around sheaves fixed under the cradle and up over similar sheaves fixed at the top of the structure, and down again on each side, one ram being placed at each side of the tip working downwards, the

ropes being passed around sheaves at the head of each ram and the ends fixed to the cylinder; large weights are also attached to the head of the rams, and assist in balancing the cradle, &c., so as to economise the water power as much as possible. The wagon is tilted by means of wire ropes, attached to the tipping cradle, and passing overhead and down one side and around a ram placed underground at the back of the tip, the other end being fixed to the bottom of the cradle, so that the latter is free to travel up and down, and upon the ram being brought into play, the tipping cradle is raised or lowered as required. A crane is fixed at the side for use in working the anti-breakage box and other work as required, and the whole is under the control of a topman, situated in a small house fixed high up on the side of the structure. The method of working the shoot, &c., is very similar to that employed on the Armstrong tips.

Thomson's patent coal tips, as used at the Leith Docks, Edinburgh, next claim our attention. These machines, as hitherto made with a separate tipping ram, require a man stationed aloft to work the hydraulic apparatus, and who stops the rise of the platform at the proper place, and then tips the waggon by hand-gear. The cost is thus incurred of the constant attendance of a comparatively skilled man, the most expensive of any employed in the operation, and unless he stops the ascent of the platform and waggon at the precise moment required, which he can seldom do, the coals are exposed to a considerable fall when they leave the truck, the waggon being necessarily higher than the shoot. This, as all coal merchants know, causes an amount of breakage that is most detrimental to the marketable value of the coals. In Thomson's patent coal tips these various disadvantages have been obviated by the invention of a simple and effective means of tipping the waggon by the action of the same ram that raises it. This operation, also, is performed at the exact height that is required by a simple automatic apparatus, and without the least attention or interference of the men working the tip. The greatest perfection to which hydraulic coal tipping has attained up to the present may be seen at the newly constructed docks at Barry and at Cardiff, where the latest developments of tipping arrangements are now employed. The high-level tips at Barry are on the hydraulic principle, and are built by Messrs. Tannett, Walker & Co., of Leeds, the height of the ordinary tipping level being sufficient to meet the requirements of most vessels at H.W.S.T., but where it is necessary to ship into the bunker hatches when light upon the high spring tides, it becomes necessary to raise the waggon still higher. These tips are arranged so that the platform can be lowered right down to the level of the coping, or raised to the height of 37 feet from the coping, thus enabling the shipments to be made into the largest vessels afloat. The hydraulic rams for lifting the cradle are arranged so that when the loaded waggons are run on from the high level, the whole of the pressure water is forced back into the hydraulic mains by reason of the weight of the coals in the loaded truck, the empty waggon being lifted by the pressure water being only admitted to one of the rams, there being a series of four rams attached to each cradle, so that either or all of the rams can be used simultaneously; but it is never necessary to admit pressure to more than one of them for lifting the empty waggon and cradle, but where the loaded waggon has to be lifted the other rams are brought into play. The ram for lifting the cradle is suspended on trunnions in the usual way, but the pressure water, after being used, is conveyed to the return mains through a system of pipes that rise and fall with the cradle. The whole of the water used at Barry Dock throughout the hydraulic system is returned through a series of pipes back to the hydraulic engine house, to be again pumped under pressure, and a portion is returned back into the pressure main when the full waggon is descending.

In this paper, up to the present, we have only dealt with machines of a fixed description, so that ships can only be loaded at fixed points. In these days, where rapidity of loading is of the greatest consequence, it is necessary, in order to get sufficient despatch, that the coal should be tipped into two or more hatches at the same time. Many and various schemes have been devised for this purpose, and a great number of patents have recently been taken out. The first practical machine of this description that I am acquainted with was used at the old dock at Newport. The waggons were run on to the cradle from an inclined way. There were two fixed positions that the tip could be fixed in, each of which had an inclined bank, up which the loaded waggons were drawn in order to raise them sufficiently high to run on to the cradle. A winding engine and boiler was placed inside of the structure, for hoisting the cradle with the waggon sufficiently to be tipped into the shoot.

I will just notice here the design of Mr. Butler, which is sufficiently novel and practicable to engage our attention. He proposes to use an ordinary balance tip, constructed after the lines of the Bute and Penarth tips, but mounting the whole upon wheels; and in order to convey the waggons on to the tip from the high level, a bridge is constructed of sufficient length to connect up the back portion of the tip to an abutment some distance away, in order to allow the tip being traversed along the dock wall, the girder or bridge having an arrangement at each end to allow of its movement.

Mr. George Taylor, of Penarth, has devoted a considerable amount of time in developing schemes for moveable tipping arrangements, the most notable of which are the moveable tips at the Roath Basin, Cardiff, and built by Sir William Armstrong, Mitchell & Co. The waggons are brought on to the cradle from a series of curved lines,

each communicating with a turntable, and from which each curve line radiates. This system has proved highly successful, and is in daily operation at Cardiff. At the Alexandra Dock, Newport, Messrs. Tannett, Walker & Co., of Leeds, have erected a movable tip on a somewhat different principle. The waggons in this case are brought in at right angles to the dock, where they are run on to a traverser, this apparatus being traversed along with the loaded waggon until it comes opposite the position where the tip is placed. It is then run on to the cradle, raised by hydraulic power, and tipped, the empty waggon being then transferred on to another traverser, which travels upon an elevated way, extending the whole length of that portion of the dock that the tip is capable of travelling over; the empty waggon is then run down over an incline, the upper end of which is fixed at a certain position on the elevated way. Lifting the waggon up bodily, by means of a crane, and swinging it out over the vessel has been in use at several ports for a long time, worked by hydraulic and steam power, but the employment of a movable crane for this purpose, I think, is confined to the Bute Docks, Cardiff, where a very powerful crane is in use, built by Sir William Armstrong, Mitchell & Co.

An ingenious arrangement has been devised by Mr. Charles Hunter, of the Bute Docks, for preventing the breakage of coal in its descent into the hold of the vessel. A large hopper is placed over the hatchway, and a kind of telescopic vertical tube is attached thereto. An inverted conical bottom, connected with the central chain, governs the exit of the coal and assists in trimming it in the hold.

We will now refer to the elaborate arrangements presently in use at the New Roath Dock, at Cardiff. In this system the coal is first deposited into a large box, which is placed in a pit that runs parallel with the dock side. This box is carried upon a low carriage which runs on rails at the bottom of the pit. Powerful hydraulic travelling cranes are then used for lifting the loaded boxes up out of the pit, then swinging them around and lowering the box and its contents into the hold of the vessel. The bottom of the box, being made conical, is then by a separate gear lowered and the coal deposited in the hold. Several of these cranes and tipping arrangements are employed at the Roath Dock, and are capable of shipping into the largest vessel afloat. Messrs. Tannett, Walker & Co. have erected at Barry Dock one of their patent movable tips. The cradle of this tip is lifted by means of four cylinders with pistons and rods attached to each corner of the cradle. A very powerful jib is projected from the centre of the tip out over the hatchway, to which is suspended a 5-ton anti-breakage box, into which the coal is allowed to descend and then lowered into the hold in the usual way. To get the coal on to this tip, movable turntables travel along a prepared way and are always fixed in the position that the tip is required to work. Short inclines of movable rails are laid down to connect the main line up to the turntables. Messrs. Fielding & Platt, of Gloucester, have supplied the Barry Company with one of their patent movable tipping arrangements. This consists of a powerful travelling crane running parallel with the dock wall. A bridge, connecting the high level railway to its main structure, is at a considerable height above the roadway below. This bridge is made so as to allow the front or crane portion to travel 1,000 ft. along the dock wall, so as to suit the varying positions of ships' hatchways. The shore end of the bridge is provided with a series of movable rails, to drop in the gaps occasioned by the varying positions of the bridge. The tip is used exclusively for tipping the waggons of coal in specially designed boxes, which are lifted up vertically, and then jibbed out as far as the hatchway of the vessel. The box is then lowered into the hold, doors in the bottom and sides being then opened by hydraulic gear, and the contents deposited as desired.

Having now described and shown the leading features of the various forms of coal-shipping appliances that have been used for a considerable time back, and some of the modern contrivances introduced within the last few years, I have come to the conclusion that no better system has ever been employed for shipping the very fragile South Wales steam coal than the system of boxes introduced from twenty to forty years ago, but as long as the demand for rapid shipment is so universal, I am afraid it will be impossible to return to this very excellent arrangement. Next to this, however, must be given the preference to the system of shipping into a large anti-breakage box placed at the mouth of the shoot. It makes very little difference whether the shoot is a long one or a short one, as the coal sliding down it suffers no injury. It is the sudden fall that the coals get when being emptied from the waggon and the long drop that does the mischief. The shoot should always be kept full of coal, and the anti-breakage box as large as possible with sufficient strength in the machinery for carrying the weight. Modern hydraulic cranes for lowering the full anti-breakage box are no advance upon the old system of balance weights, unless the ram is made use of for pumping water into the pressure mains upon the descent of the full box. Movable coal tips certainly are the ideal method for rapid shipment, as by this arrangement coal can be loaded into every hatchway of the vessel at the same time, but it has been found in practice that with the best system of fixed tips, placed at sufficient distances apart, the coal can be shipped quite as fast as is required, and when proper care is taken in using the anti-breakage boxes, as little breakage occurs as in any other arrangement.

The Pictou Coal Field.

Of unusual interest in the present expansion of the coal trade of Nova Scotia and one of the most valuable contributions yet made to the practical or mining geology of the Dominion is the paper on the Pictou Coal Field, published in the Transactions of the Nova Scotia Institute of Science, by Mr. Henry S. Poole, M.A., F.G.S., A.R.S.M., Superintendent of the Acadia Coal Mining Company, and retiring President of the Nova Scotia Mining Society, whose skill as a structural geologist the REVIEW has before had occasion to notice.

It is now more than twenty years since the officers of the Geological Survey examined and reported on the Pictou coal field, giving in detail much of the important information thereon that had been collected by them and previous observers. Their report has been accepted ever since as a fairly correct delineation of the structure and salient features of the field. It contains two papers by independent observers, Sir William E. Logan and his assistant Mr. Hartley. Sir William took the least known portion of the field on the eastern side of the East river, leaving with Mr. Hartley that lying on the western side and both banks of the river.

Sir William, in his report, refers to the broken character of the field, the depth of the superficial deposits, to the numerous dislocations and the absence of rock exposures in many parts preventing a perfect series of the measures being built up; and he goes on to say, "what is now offered is to be considered as only a distant approximation to the truth, to be improved hereafter as occasion may serve and further developments may occur."

Additional facts which further working in the mines and later explorations in the field have brought to light now suggest certain modifications of the conclusions then reached. This review of our present knowledge of the subject is submitted as supplementary to the Report of Progress, for 1866-9, with a map drawn by Mr. J. G. Rutherford from mining plans and other correct data. On comparing this revised map with that of 1869 it readily will be seen in what respects structural modifications have been suggested especially in that portion of the field which Sir W. Logan was careful to refer to as "wholly committed to Mr. Hartley." For many years the Survey map had been accepted as correct and no one thought of seriously questioning its accuracy. It was not until in the ordinary course of working one of the Albion seams of coal that it became a matter of moment to the writer to verify the assumed position of one of the known faults, and then on a comparison of several mining plans and reports being made it became apparent not only that the Survey map was incomplete but that it had inaccuracies which a full acquaintance with the records available at the time of its preparation might have avoided. This awakening of doubt led to further study and independent investigation stimulated by Mr. Hugh Fletcher, B.A., of the Geological Survey of Canada, who working in the neighborhood took a deep interest in the questions at issue, and to whom an indebtedness is due that only those who know him well can fully estimate. As investigation proceeded it became evident that some local knowledge of the structure surrounding the coal field was desirable for the better understanding of the conditions which effected its partial destruction, or if preferably put, its partial retention. But it was not realized until the field of observation was thus widened how much of geological interest there is to be seen within an hour's drive of Stellarton.

Within that limit rocks of several ages can be studied. To the south rise peaks of great antiquity, yet composed of slates and sandstone with coarse grits, veined and contorted, derived from the destruction of still older formations of which no remains are now to be seen. These rocks are barren of fossils and for lack of more accurate knowledge of their age, they are classed as Cambro-silurian. On the flanks of these higher hills rest slates of exceeding fineness, which owe their origin to deposits in deep Silurian seas and they have retained remains of the life of that epoch, of crinoids, mollusks, corals and trilobites. In their turn as time rolled on these slates became exposed, suffered disintegration, and supplied material for the growth of succeeding systems. The ephemera of to-day can stand on the very bed they gave to ocean on the cradling of the oldest members of the Carboniferous. On other sides of the field lie the equivalents of those deposits of later date, made of household interest by the writings of Hugh Millar, that are brought by great convulsions in contact with the coal measures.

While these cycles were proceeding, but prior to the later changes the region had been the seat of frequent volcanic activity, the strata were rent, lava had flowed and heat had altered the character of the deposits. And again when time had built up thousands of feet of Carboniferous strata, thick beds of coal, of sandstone, of shales and fireclays, and consolidated them under the weight of their own accumulations, had broken and uplifted them when no longer able to bear the strain of seismic movements and then exposed them to the denuding influences of air and sea, they in their turn made a floor, now once more visible, on which a new epoch piled up a new series of deposits widespread along the coast. These brought to the surface remained exposed, while elsewhere secondary formations were adding to their records, and they so remained contributing their quota of disintegrated material until the glacial epoch came and spread its coating over all.

Subsequent to the deposition of the strata that have the red New Glasgow conglomerate as their base there are no

remains of any other system until the Glacial epoch, and it would seem that since the disturbances that in mesozoic times defined the general outline of the country erosion has been continuous. Small deposits of peat, silt and river gravels are additions in modern days; the former only has been partially mapped, while no attempt has been made to show the glacial drift which covers so much of the coal field and the surrounding formations at low elevations and on the northern slopes of the hills, the lee side of the drift in this part of the Province.

This deposit greatly interferes with the study of the subjacent strata and leaves much conjectural in the disturbed portions. It is so often foreign to the composition of the underlying rocks that it is very misleading to the prospector. In this field the sinker of trial pits more speedily reaches the metals in the hollows than on the ridges of the land.

The tops of the hills in Pictou County are not so rounded as to suggest an erosion at all comparable to that which gave form to the crests of the Atlantic ranges of slate quartzite and granite, nor does the general contour of this field indicate that it owes its present form principally to the erosion of this period. Rather that its hills and valleys are the result of long continued preglacial denudation directed by the texture of the measures and the faults which traverse it, the subsequent glacial erosion playing but secondary part. The preglacial water courses seem to have had the same direction as those of to-day, and to have been filled in with till which in many parts still remains, as for example in the valley of McCulloch's brook, at lower levels than the beds in which these streams now flow.

In parts the composition of the till is irregular, notably in the neighborhood of the present streams. Heavy deposits of sand occur in it near the East river and near the mouth of McLellan's brook high above the bed of the stream. In the sand are layers and balls of clay, boulders of foreign stone and occasionally a pocket of fragments of black shale torn from the adjoining banks. In other parts clay predominates and the sand is in streaks and layers.

This irregularity has suggested that these deposits may in part owe their origin during the ice age to summer floods having had their strongest flow approximately along the course of the drainage of to-day. With the material of local origin are striated fragments of the neighboring Lower Carboniferous and older rocks, and occasionally great boulders brought from the Cobequids and even more distant localities. To the south on higher ground, the major part of the deposits is of shattered fragments of local rocks, with sharp edges like the refuse of a quarry.

Red Rocks—When after 1858 the mineral rights other than those reserved to the General Mining Association were thrown open to the public and explorations became general, the coal prospector who in his search met with rocks of a red color, stopped working in that direction convinced that he had reached a horizon beyond the coals of workable thickness. In practice he was right; no good seams are immediately overlaid by red rocks in this field. This experience of the miner perhaps led the geologist who followed to infer that all the red rocks, so called, of the district are necessarily older than the coal measures; at any rate they were so classed, except by Sir William in McBean's areas.

The red rocks immediately south of Stellarton railway station and those about French's tunnel on the Middle river are so given by the Survey, but they are now believed to be of the same horizon as beds in undoubted coal measures, and the faults necessarily assumed to separate the two divisions have been proved, it may be said, to be non-existent.

In 1852 Mr. H. Poole mentioned the radical change that takes place in some of the strata when traced but a short distance; a change the more noticeable when the beds are followed from the centre to the margin of the field. Shales become more and more arenaceous until ultimately they pass into beds of sandstone even with intercalated conglomerates; black fireclays become brown and ultimately cold grey; and coals become coarse, then black fireclays and finally thin out. Boreholes at Westville put down from the upper to prove the quality of expected lower seams passed through into red rocks without finding the equivalents of seams underlying in order to the eastward at equal depths.

The coal of McLeod's pit on the east side of the East river, which is on the attenuated extension of the main seam, it is said directly overlies red rocks. This change of color and character accompanies an approach to the margin of the basin; and if the present margin approximates at all to the margin of deposition, which is the present conclusion, a very decided difference in the appearance and quality would naturally be expected in those portions of any beds which bore this relation to one another.

Red rocks occur in strata both above and below the coal measures, and slight exceptions have been seen in these measures where they are barren of workable seams. There is a group of beds some 40 feet thick under the Marsh pit series and overlying the widow Chisholm seam on McLellan's brook that were cut by No. 2 borehole of the Acadia Coal Company in 1878, which are mottled with red somewhat similarly to the sandstones at the New Glasgow athletic grounds and other spots along the northern margin of the field, believed to be of other age. There is also a small local band overlying the Deep seam on the high ground approaching the McCulloch brook fault where that seam begins to become inferior in quality, and some of the sandstone bands thrown out on sinking the Forster pit became red on exposure to the weather.*

*Logan's report p. 34.

The red rocks are found of many shades, varying from the high, brick color of the metamorphic beds at Fish-pools, Riverton, and the purple grits of McLellan's mountain to the dull and chocolate reds of the Lower Carboniferous and the Millstone Grit, and the fresher tints of the Permian with their local and characteristic metallic sheen. As it were a forecast of the latter, there seems a general resemblance to them in certain beds that lie on the northern limits of the field. These beds are classed as Millstone Grit, but it must be confessed there is an inability to trace a similarity either in structural character, cleavage or appearance with rocks taken as typical of that system in this belt; for instance, with those of McLeod's brook and those on the East river above the brick-yard unmistakably of the same age. The relative age of the red rocks in the several sections of this field has been so differently regarded by independent observers that in offering a new arrangement there is here no singularity. What the proper horizons are is of course still open to question, but in the recognition of distinct groups in series hitherto classed as identical an opening is made for future closer comparison and proper classification. The upper division of the Fish-pool beds put as Millstone Grit in section 1, p. 60. of the Report of Progress, will no longer be classed with those of McLeod's brook, or of Smoky-town, or of McLean's brook, or of Pine-tree. There can be no doubt that had Sir W. Logan himself compared the rocks below the Coal Measures of Mr. Hartley's divisions with those of his own much of the re-arrangement which now seems called for would have been avoided.

In the study of the relative position of these barren measures, a scale of hardness in the red argillites perhaps offers a rough and ready test of the age of rocks that otherwise may look identical. On exposure to the atmosphere the harder rocks, for instance, of Oliver's mill dam, present a slaty fracture, those of later origin associated with Carboniferous Limestone of McLellan's brook crumble into rhomboidal form; while in the Millstone Grit the particles have rounded edges, and in the Upper Coal measures the slickensided fracture of the marls facilitates their conversion into plastic clay.

(To be continued.)

CORRESPONDENCE.

Mr. J. Lainson Wills and the Walker-Carter Process.

Editor Canadian Mining Review.

DEAR SIR, A letter from Mr. J. Lainson Wills, M. E., dated New York, February 22nd, and published in your February issue, requires to be answered—not from any effect which that gentleman's name or opinion may have, as the one is scarcely known and the other simply worthless—but on account of the publicity which your all-known and admirable journal has given to the communication.

I need hardly point out the impertinence and presumption of a self-termed expert venturing to publish an opinion on a subject to which he has given "much study and attention during the past season of 1893," when chemists and experienced mining men have spent twenty-five and thirty years studying the same problem without satisfactorily solving the question. Probably, if Mr. J. Lainson Wills, M. E., spends five or six years longer at the task, he may, if he is wise, discover that he really knows nothing about it. It requires often considerable knowledge for a man to learn how ignorant he is. The serious part of Mr. J. Lainson Wills' letter is where he confesses to having "clandestinely obtained a sample of the tailing, by catching a few buckets of slimes outside the mill at various intervals of the operation of running off the overflow." Now, this confession is bad enough, especially when he could have gone directly into the mill and panned to his heart's content, instead of having to resort to such an underhand method of forming an opinion. The mill has been open to any and everyone for inspection for months past, and they were welcomed to pan on the tailings, the amalgamated and the roasted ore, and obtain all the information they desired. The process is no secret; it is free for examination by anyone.

The Superintendent and mill workmen inform me, however, that the tailings run out of the mill into deep water, and it would be impossible for any one to catch "a few buckets" without using a boat; and as there were no boats handy, it appears that Mr. J. Lainson Wills' confession is, after all, a bogus one.

In looking over certain correspondence with the Hastings Mining Co., I find, however, that Mr. J. Lainson Wills, M. E., was not always of the opinion regarding the Walker-Carter process that he is now.

The following letters explain themselves.—

206 ALBERT STREET,
OTTAWA, Sept. 20th, 1893.

F. B. ALLAN, Esq.,
Pres. Hastings Mining & Reduction Co.,
Toronto Street, Toronto:

DEAR SIR,—I was very much interested when I had the opportunity of seeing the work of your plant and process for gold ore working at Marmora, and regret that circumstances obliged me to return to Ottawa without

having more time to talk over details with you. Having had considerable experience in ordinary gold mill work and amalgamation, and followed up the later improvements and processes, I was able to appreciate sweet roasting effected by the Carter-Walker furnace, and the advantages to be obtained by the volatilisation of mercury in attacking the gold, and it appears to me that with certain improvements or modifications to your present plant the process may be rendered almost perfect for a certain class of gold ores. I would desire to know what is the cost of a calcining furnace of the various capacities, and what arrangements could be made for employing your patents in Canada. I should be glad to have any other information of details and record of results attained which may be useful to me in deciding the adoption of your plant in the development of a property now under consideration.

I thank you for this information in anticipation, I am, dear sir,

Yours faithfully,

JOS. LAINSON WILLS

OTTAWA, Oct. 11, 1893.

F. B. ALLAN, Esq.,
Toronto.

DEAR SIR, I beg to thank you for yours of the 6th inst. and the information regarding the Walker-Carter furnace and amalgamator. I have been engrossed during the past four days with the work of (removing) changing residence and office. (My new address is 106 Sparks Street.) Hence my delay in replying to your letter. My first idea referred to British Columbia gold fields as locality, but a property in Lake of the Woods district is also under my consideration. I leave to-morrow (Thursday) for Marmora where I expect to be until Sunday night. I may have the good luck, perhaps, of meeting you there; if not I will endeavor to come to Toronto shortly.

Yours faithfully,

JOS. LAINSON WILLS.

It seems that this gentleman first bargained for working a territory under the Walker-Carter process, and was desirous of getting the company to adopt "certain improvements or modifications of your present plant," which emanated from his great intellect, and that failing in both he seeks to "get even" with the company.

I leave your readers to judge of the value of the opinion of such a man. So much for Mr. J. Lainson Wills, M. E. By the way, I would suggest to Mr. Wills that he change the personal pronoun "M. E." to "I," and place it at the front instead of at the rear end of his name, so as to read I, Mr. J. Lainson Wills. It would be more in harmony with himself and decidedly more grammatical.

Regarding other processes mentioned in the letter, everyone knows that chlorination was tried under the very best conditions at the Delora mine and was a decided failure. The cost of such treatment was far in excess of the gold obtained.

As to the cyanide process, although useful with auriferous sulphides, has not been successfully applied to the treatment of mispickel ores. The best known cyanide process is now being used in Africa, but I am informed by the superintendent of one of the principal mines controlled by the Kothschilds, that they average only 70% of the assay value of the ores in gold.

The Walker-Carter process as it now stands is the result of years of hard and patient study, and of thousands of dollars of experimental work. It was in 1875 that Mr. Walker first commenced the investigation which has culminated in what is conceded by those qualified to judge, to be the only process capable of successfully and profitably treating the Hastings county ores.

The process was examined and endorsed by the late Professor Genth, probably the most able and experienced mining chemist in the United States. Prof. Riotti, of the New York Metallurgical Works, used a small Walker-Carter plant in his laboratory for several months, and stated to the writer that it was not only the best, but the only process that would treat satisfactorily arsenical ores and recover float gold.

Prof. Ricketts, of Ricketts & Banks, the best known chemist in New York, made several tests and has fully endorsed the process. The result of the last test is that a large plant is now being erected in Blacksburg, S.C., to treat the pyrites found in that district, and recover the gold, iron oxide and sulphurous acid. Acid chambers are being erected for the manufacture of sulphuric acid in connection therewith.

The following is from Walter S. Bates, a well known assayer and mining expert of Denver, Colorado, who spent two or three months at the mill at Marmora:

PHILADELPHIA, Pa., 3/19/94.

Mr. ARTHUR KITSON,
Provident Building, City.

DEAR SIR,—In response to your enquiry regarding results of the mill run of the Walker-Carter mill at Marmora, Ontario, last summer, I state: The ore treated was principally from a mine called the "Gatling Mine," adjoining the Delora, in Hastings County. The ore furnished was arsenical pyrites, or mispickel. The average assay value in gold of this ore as taken from the regular mill samples was \$8.50 gold per ton. The tailing samples taken daily from the settler discharge averaged \$1.32 per ton in gold. The average saving was 84% of the gold contained in these ores. The arsenious acid gases set free in the oxidizing furnace were perfectly condensed as arsenious oxide. Owing to the coarse pulp furnished by

the machine used, it was impossible to obtain higher per cent. With uniform pulp, say 60 or 80 mesh, from 90% to 95% of the gold would have been recovered.

Yours respectfully,

WALTER S. BATES,
Assayer.

I do not wish to burden your columns unnecessarily, otherwise I could furnish your readers with expert opinions and tests regarding the Walker-Carter process, voluminous enough to fill the entire journal.

Regarding Mr. Harvey Beckwith's report, published in your January issue, this was not written for publication, but for some capitalists who desired to invest in the process. Mr. Beckwith had examined the process elsewhere and several times before going to Canada, and hence did not need to make as exhaustive a report as he otherwise would have done.

I would say in conclusion that the plant at Marmora was merely an experimental one, put there for the purpose of demonstrating the success of the process in handling these ores. It is our intention to erect plants in various parts of Canada for recovering gold, silver, and manufacturing iron oxide, sulphuric and arsenious acids.

Yours respectfully,

ARTHUR KITSON.

Philadelphia, 29th March, 1894.

CANADIAN COMPANIES.

Bell's Asbestos Co., Ltd.—The Directors' report for the year ended 31st December last, shows that the result of the year's operations is a net profit of £4,683.12.8, to which has to be added the amount brought forward, £3,047.12.9: leaving for appropriation £7,731.5.5. The Directors recommend the payment on 19th March of a dividend of 5s. per share, being at the rate of 5 per cent. per annum, and £1,731.5.5 is carried forward.

United Asbestos Co., Ltd.—The Directors recommend the payment of the following dividends for the past year: 10 per cent. on the £10 preference shares, 6 per cent. on the £5 preference shares, 2½ per cent. on the ordinary shares, carrying forward a balance equal to 5¼ per cent. on the ordinary shares.

Harrigan Cove Gold Mining Co. has given notice of application for charter of incorporation with the object of carrying on mining operations in the County of Halifax and elsewhere in the Province of Nova Scotia. Authorized capital, \$60,000, in shares of \$100. Head office, Halifax: Directors, George Fawn, Halifax, E. Whidden, Halifax, A. Carter, Truro, J. G. White, Halifax, and J. N. White, Halifax.

Cariboo and Kootenay Prospecting and Mining Co. has been registered at Victoria, B.C., to purchase from the Vancouver Lardeau Mineral Prospecting Syndicate all their rights, title and interest in certain claims or mining locations in the Lardeau district, West Kootenay, B.C., and to work same. Head office, Vancouver, B.C.: authorized capital, \$100,000 in 50,000 shares of \$2.00. Directors, Walter H. Kendall, Benjamin J. Cornish, Edward E. Penzer, F. M. Robertson and John Williams.

Intercolonial Coal Co.—The new board elected at last meeting of shareholders is as follows: J. P. Cleghorn, President; H. A. Budden, Vice-President and Managing Director; H. S. Macdougall, W. M. Ramsay, Thomas Wilson, A. Gunn, E. G. Penny, A. W. Hooper, R. MacD. Paterson.

MINING NOTES.

[FROM OUR OWN CORRESPONDENTS.]

Nova Scotia.

Caribou District.

Mr. W. A. Sanders, having thoroughly tested the old workings of the Lake Lode Co., has purchased the property, and will open up the mine and fit up the surface plant the coming season. A large body of low grade ore has been shown, which will be opened up as rapidly as possible.

The Dixon Company will erect a new 10-stamp mill this summer, and will also make some changes in other parts of the mine plant.

The Caribou Gold Mining Company has amalgamated the Truro, Caffrey and Andrews properties, and will work

them vigorously this summer. Mr. Geo. W. Stuart of Truro, has been engaged as consulting engineer for the company.

Darrs Hill.

There is little new to report from this district. The manager of the Daffern is laid up with a broken leg and little is doing at the mine.

Harrigan Cove.

A small syndicate has been formed in Halifax to test some of the properties here which have been prospected during the winter. A small steam plant has been sent down.

Stormont.

Work on the Richardson, Amungosh and Country Harbor Co's properties is being pushed, and from yields already recorded, the output for 1894 will be a handsome increase on that for 1893. Extensive improvements are contemplated in some of the properties, which, when completed, will add greatly to the output.

Lake Catcha.

Reports from this district indicate that recent development in the Oxford property have shown new bodies of rich quartz, and that the output of the mine will be largely increased this year.

Oldham.

The companies operating here have all reduced their forces during the winter. The Rhode Island Co. now have their steam plant in running order, and a contract has been let to sink the shaft to the 400-ft. point. The Columbia Co. are driving in what is believed to be the Britannia lode, formerly very rich in pockets.

Ontario.

The Martha mica mine at Perth continues to yield a satisfactory output of mica.

The Leidyard gold mines are being opened up at Belmont. At a depth of 55 feet the vein looks up well, showing some fine gold and nice-looking sulphurets. The mill building is under construction and machinery is being put in at the mine.

Manitoba and N. W. T.

During the past year operations at Cannore and Antracite have been prosecuted with great vigor by H. H. McNeill & Co. At the former place the consumption of coal for the use of the Canadian Pacific Railway Company's locomotives was a great factor, as the slack of the mine has been utilized to a great extent and will be during the greater part of the year, except probably in extremely cold weather. The slack has been rendered much more valuable as fuel by washing.

Lethbridge Colliery.—Owing to the depression in the Western States caused largely by the silver crisis, the demand from this mine has been materially decreased. More than 50 per cent. of the output of this colliery has, since the opening of the line from Lethbridge to Great Falls, Montana, found a market south of the line. Now that the Canadian Pacific Railway has taken over the line from Lethbridge to Dunmore and widened the gauge to standard width, it is anticipated by the proprietors of this colliery that their market in Manitoba and the Territories will be considerably improved in consequence. The cost of labor and waste of material in transferring the coal at Dunmore will thus be avoided, which will materially decrease the cost of handling the coal, and the margin thus saved will probably be an important item in the profits of this colliery.

Knee Hill Mines.—The construction of the railway from the neighborhood of Calgary to these mines has commenced. This line, known as the Red Deer Valley Railway, utilizes the track of the Calgary and Edmonton Railway line for a distance of four miles from Calgary, where it branches off. When the road is completed it is probable that mining operations will immediately be instituted. From indications the quantity and quality of coal available at these mines appear to be most promising.

Considerable mining has been done at Edmonton on a small scale, chiefly to supply local consumption. A small quantity has been shipped to Calgary; but owing to the amount of moisture contained in this lignite, unavoidable exposure to atmospheric influences considerably depreciates the value of the same, except during very cold, dry weather. Several smaller mines, chiefly in the foot-hills of the mountains, have been operated in a very crude manner, supplying fuel for consumption in the immediate vicinity. The lignites on the Souris have not been developed as far as anticipated, no doubt owing to the financial stringency of the past season.

The revenue derived by the Dominion Government from the sale of coal lands was \$900, making the total revenue up to 31st October, 1893, \$141,983.27.

British Columbia.

Caribou District.

Mr. John Bowron, Gold Commissioner, writes:—"In referring to some of the principal mines now in course of development, I shall begin at the southern part of the district. On the Horseshoe River, the Horseshoe Hydraulic Mining Co., Limited, of which H. Albott, Esq., of Vancouver, is President, and Mr. J. S. Holburn is Manager, has acquired, either by location or purchase a large area of hydraulic mining ground, situated immediately above the Falls, having admirable dammage, which is of the utmost importance to hydraulic mining. This company, which kept a force of men employed during last winter in running tunnels, has well pleased with the prospects obtained, and as soon as the ditches are completed will bring in an immense quantity of steel piping, preparatory to commencing work on a scale of magnitude hitherto unknown in the district.

"I have much pleasure in reporting the success of Mr. A. D. Whittier in inducing a London syndicate to furnish the necessary capital to provide plant for working the lower part of Williams' Creek by hydraulic lift. The company is registered under the Imperial Statutes as the 'Whittier Gold Concessions Syndicate.' The Williams' Creek concession is the first property the Syndicate proposes to develop.

The Stough Creek Co. has been most unfortunate in losing two of its leading men. Mr. Magee, one of the contractors, and manager for sinking a working shaft, after visiting the works, had occasion to return to Victoria, where he was stricken down with diptheria, to which he succumbed in a few days; after which Mr. Gans, of Tacoma, was engaged as manager. While Mr. Gans was at Ashcroft making arrangements for the forwarding of two thirty horse power engines, boilers and apparatus (which had been purchased in the east), he met with an accident which proved fatal. The machinery, however, is now on its way to the mine, at which ten men are engaged preparing for winter work, and I am assured by Mr. Fife, of Tacoma, the president of the company, that notwithstanding these lamentable drawbacks they will persevere in their endeavors to prove the value of their mine.

On Shepherd Creek, the Di-Scovey Co. have devoted nearly the whole season to bringing up a drainage ditch, and constructing a dam to store water. This claim promises to be remunerative in the future. Other companies have located ground on this creek and are running tunnels or otherwise prospecting the ground, with fair chances of success.

The foregoing represents in brief some of the principal new mining enterprises started within the last eighteen months, the mention of which will at least serve to show that "Old Cariboo" is anything but a "played out mine," and, as some may remark, "From evidences afforded me in my official position, I am led to the conclusion that the district is entering upon a new and prosperous career, scarcely inferior and certainly more lasting than the famous golden days of the early sixties.

There is another source of wealth possessed by the district, to which I referred in my last report, the development of which has not as yet been undertaken. Upon having my attention drawn to an article in Chamber's Journal for February, 1892, upon "Dredging for Gold in New Zealand," I was more than ever impressed with the adaptability of our large streams for being worked by dredging, but as I hope soon to be in possession of all facts relating to the nature of the appliances used in the mining here referred to, I shall for the present only mention the fact of the presence in large quantities of fine gold in our river beds.

To speak of the paying claims, or those contributing to the gold product of the district for the year, would be but a repetition of my last year's report, with the single exception of Joseph Shaw & Son's claims on Hardacre Creek, which has paid for some time this season, with every indication of continuing to do so for many years to come. The Nason Co., on Antler Creek, after overcoming one misfortune after another, have at last succeeded in pumping out their diggings, and are just starting to prospect the mine, which, if perseverance merits success, should prove a "Bonanza."

The total output of gold for the season is, as far as can be ascertained, somewhat greater than last season, which must be regarded as highly satisfactory, as so many well-miners have been engaged in opening new mines and other non-productive works, that the Chinese have been much the larger producers.

Keithley Creek, Alexandra and Williams Lake Divisions.

Mr. Stephenson, gold commissioner, reports the mining season, although late in opening, has upon the whole been favorable for placer mining all through this section, as the supply of water during the summer was

above the average. The actual number of claims producing gold has been about the same as the preceding year, while the estimated amount taken out is slightly in excess, which shows that the regularly organized companies have done quite as well as last year. This always has a good effect, even on the Chinese, as it proves they can do better by forming into companies and opening up claims, which prove more remunerative than the haphazard individualist manner. On Keithley and Snowshoe Creeks there is very little change to report from last year; there have been no new developments that I am aware of, and but very little prospecting has been done on these creeks during the past season. On Harvey Creek there are still a few miners working, but nearly all of them are going over the old worked ground, and any prospects in the new finds are very slight. On the North Fork of Quesselle River and Spanish Creek operations have been light for the season, the greatest amount of work on the North Fork being done by the Victoria Hydraulic Mining Company in prospecting some gravel benches. As far as I could learn, the results so far are not satisfactory, and work was suspended early in the latter part of the mining season. The company on Spanish Creek still kept working ahead with their work during the whole year. They are running a drive up the hill looking for the old channel, and are taking out some gold, but nothing like pay for their work. Still they think the prospects are sufficiently good to continue on in hopes of finding something better.

From Quesselle Forks down the main Quesselle, about forty miles, all the work during the season has been confined to desultory mining. The Chinese working on the small gulches while the water lasted, and when the water falls in the river they go to places along the river where they can obtain dirt that will pay for roasting. During the latter part of the season there have been whites down the river looking for hydraulic claims in the vicinity of what is known as 20-Mile Creek (twenty miles below Quesselle Forks). The result of their work I see in notices of application for leases of several locations in that section, and, as I am given to understand, they really mean business and have the necessary means to carry on the work required, it is to be hoped they will get the ground they applied for. The expenditure must be considerable to any company that will bring water upon those benches in sufficient quantity to properly work them, therefore I think that any company with capital that wishes to honestly prospect and endeavor to develop the mineral resources of the country should be liberally dealt with. The means of getting down the river to 20-Mile Creek, or, in fact, anywhere down the river, are very poor, there being no trail, and a bearing on the Quesselle River is at times rather dangerous work. On the South Fork of Quesselle River the small hydraulic claims operated by Chinese have done about as well as usual, their limited supply of water necessarily making their work light for the season. The South Fork Hydraulic Company worked on an average ten white men in opening up their claim (lease) until August last, and still they remains an immense amount of work to be done before the claims will be in shape to get returns. The expenditure of this company on Horsely, I think, will amount to about one hundred thousand dollars before their mine is in thorough working order, while they estimate the purchase and the cost of preparing the South Fork of Quesselle property for working at about three hundred thousand dollars. A few such enterprises as these managed by thoroughly competent and practical men will all in a long time bring Cariboo once more to the front as a mining district.

West Kootenay, Southern Division.

Mr. Fitzsubbs, mining recorder, reports:—"During 1893 there were 161 mining claims recorded, 69 transfers, and assessment work has been done on 117 claims. Fourteen placer claims and five transfers of same were recorded. There are within the southern division 22 placer leases in existence, 15 of which are on the Salmon River, six on the Pen d'Oreille and one on Forty-mile Creek. One hundred tons of ore shipped from the Silver King mine, was shipped to Swansea which will yield over \$100 per ton.

Concentrating Plant for the Number One Mine.

—The construction of the concentrating plant at the Number One Mine, Ainsworth, is being rapidly pushed forward. Most of the machinery is at the mill, and the work it is expected will be finished early next month.

NOVA SCOTIA GOLD YIELD.

Comparative statement showing the quantities of gold won and rock crushed by the principal operators during the calendar years 1892 and 1893, compiled, by courtesy of the Mines Department, from official returns.

COMPANY.	DISTRICT.	1892.					1893.				
		GOLD WON.			ROCK CRUSHED.		GOLD WON.			ROCK CRUSHED.	
		Ozs.	Dw.	Grs.	Tons.	Cw.	Ozs.	Dw.	Grs.	Tons.	Cw.
Anderson Mine.....	Lake Catcha.....	282	11	6	344	.....	262	3	.....	156	.....
Antigonish Gold Co.....	Stormont.....	2191	18	14	3405	.....	1966	19	18	4681	.....
Boston Gold Co.....	Malaga.....	1607	18	19	1825	.....	248	15	.....	306	.....
Columbia Milling and Mining Co.....	Oldham.....	.....	.....	.....	.....	.....	117	2	18	437	.....
Cowan Gold Co.....	Kemptville.....	11	.....	.....	20	.....	2	8	.....	13	.....
Dixon Gold Mine.....	Caribou.....	1118	10	.....	730	.....	1014	.....	.....	710	.....
Dufferin Gold Co.....	Salmon River.....	1042	10	.....	4215	.....	965	.....	.....	3560	.....
Lake Lode Co.....	Caribou.....	.....	.....	.....	.....	.....	223	19	2	657	.....
Mooseland Gold Co.....	Mooseland.....	373	18	.....	893	.....	471	2	13	1323	.....
New Egerton Co.....	15-Mile Stream.....	1229	.....	.....	2350	.....	497	17	.....	1401	.....
Nova Scotia Gold Mines, Ltd.....	Montagu.....	2201	10	.....	1716	.....	810	14	.....	1219	.....
Oldham Gold Co.....	Oldham.....	3078	14	12	2233	.....	3285	11	8	2343	4
Oxford Gold Co.....	Lake Catcha.....	764	7	14	2124	2	765	9	.....	1566	5
North Star Mining Co.....	Isaacs Harbor.....	165	.....	.....	163	.....	957	5	.....	890	15
Richardson Gold Co.....	Stormont.....	.....	.....	.....	.....	.....	2237	18	10	6048	.....
Rossignol Gold Co.....	Whiteburn.....	146	15	2	147	.....	30	.....	.....	58	.....
Salisbury Gold Co.....	Montagu.....	.....	.....	.....	.....	.....	87	3	12	216	.....
Symon-Kaye Co.....	Montagu.....	.....	.....	.....	.....	.....	216	.....	.....	280	.....
Thompson & Quirk.....	Uniacke.....	1803	4	18	180	1175	6	11	115
West Waverley Gold Co.....	Waverley.....	1239	12	4207	21	3211	0	15	8154

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