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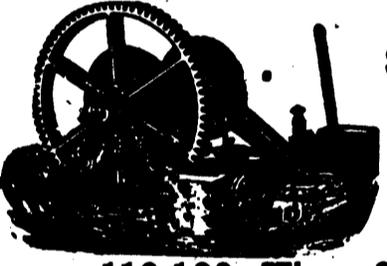
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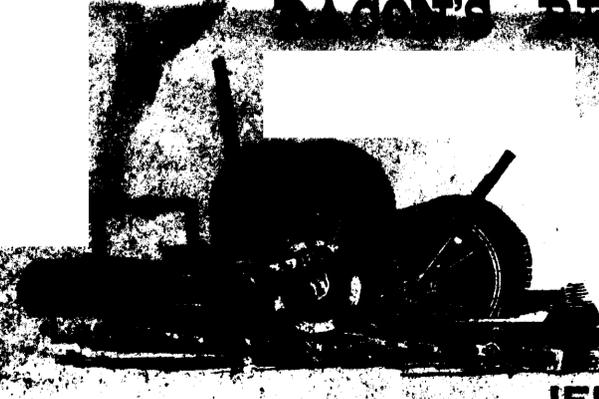
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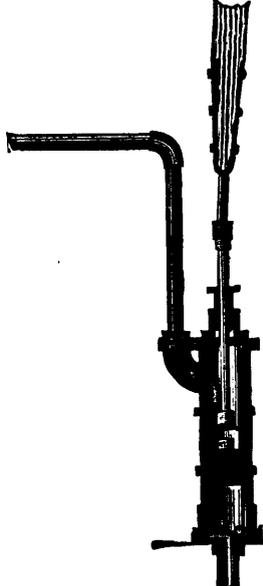
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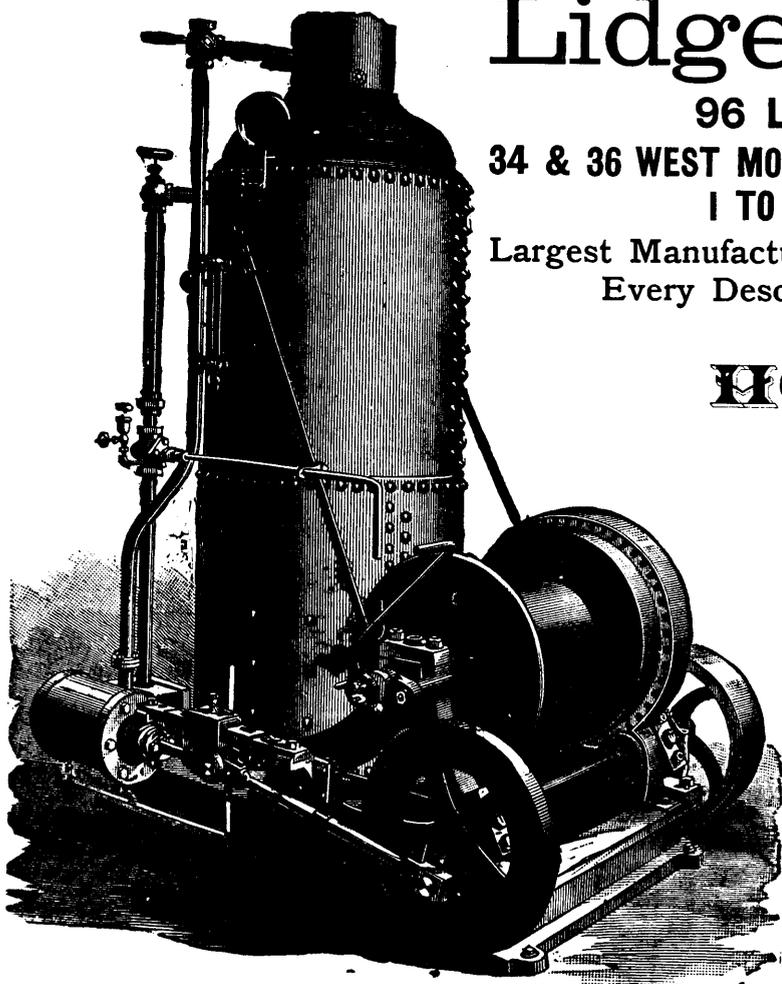
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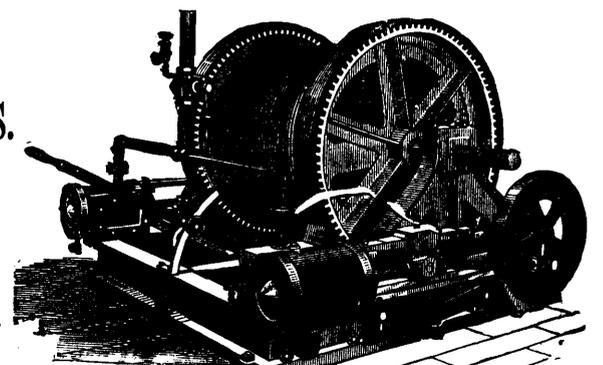
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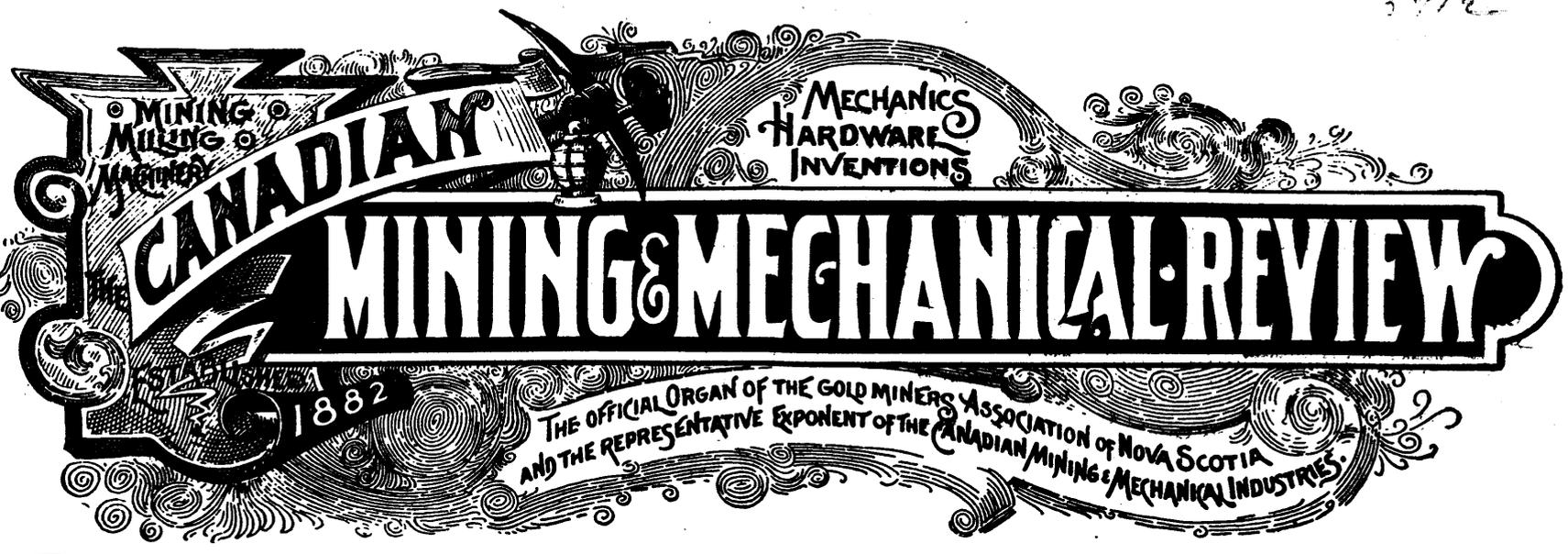
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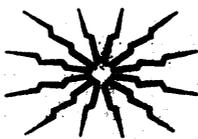
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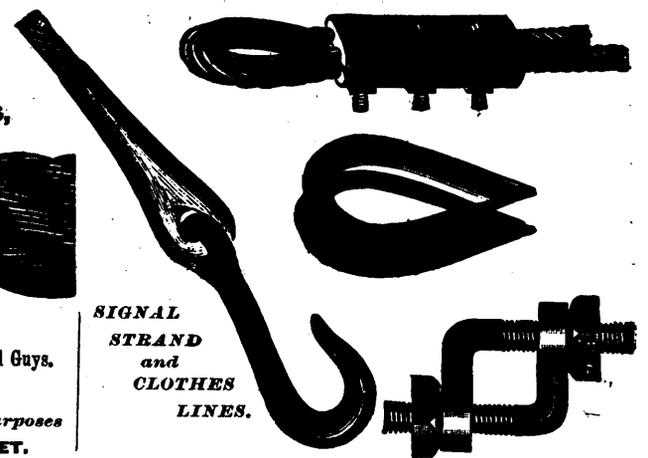


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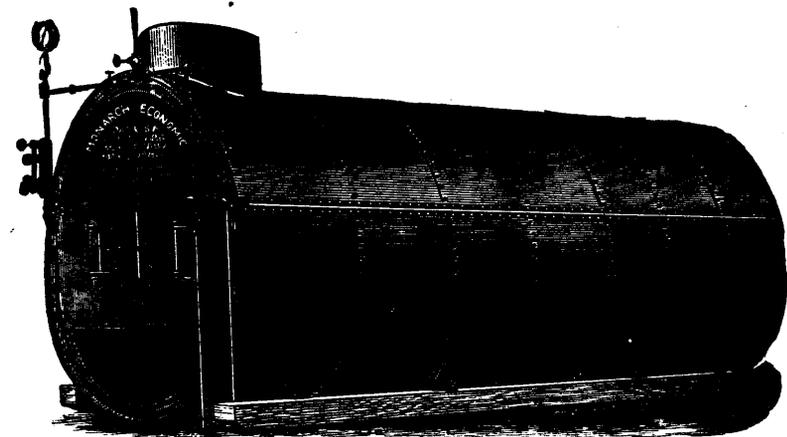
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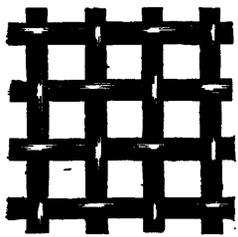
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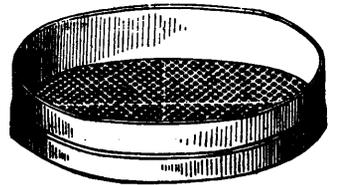


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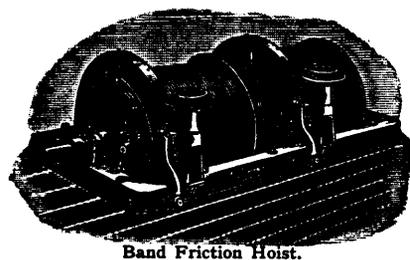
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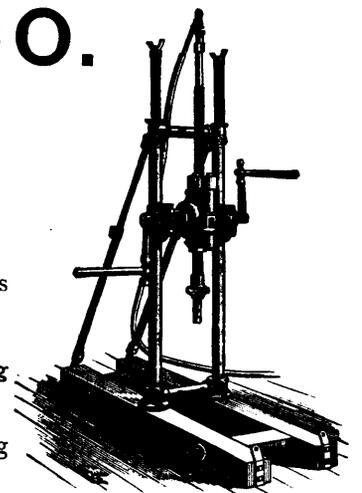
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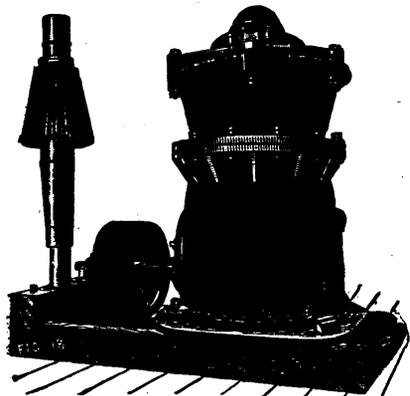
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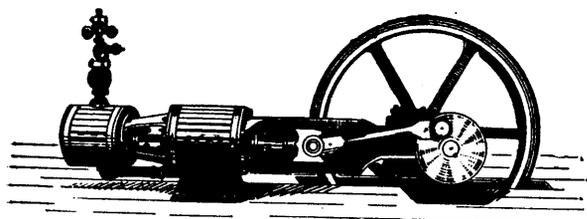
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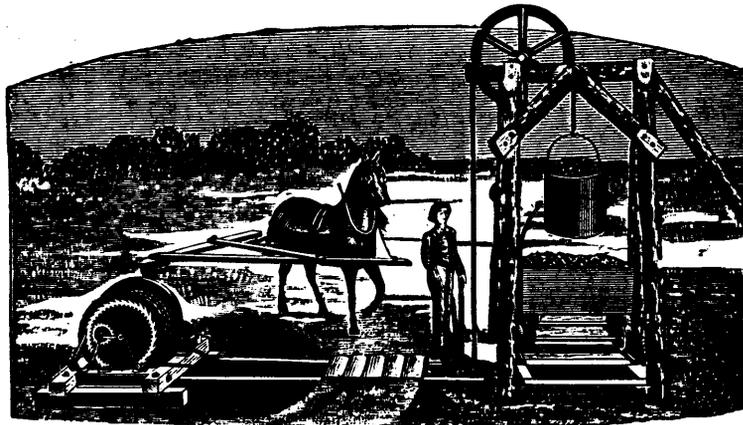
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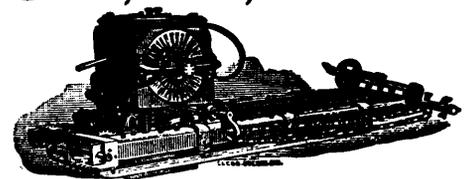
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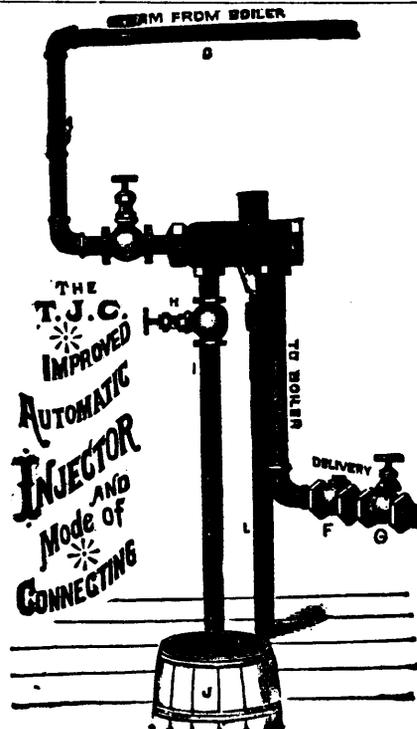
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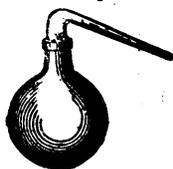
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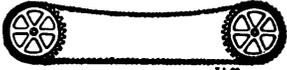
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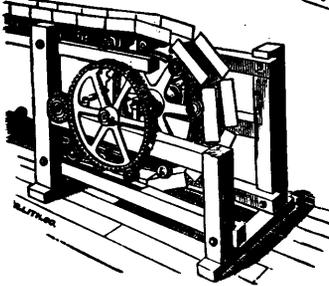
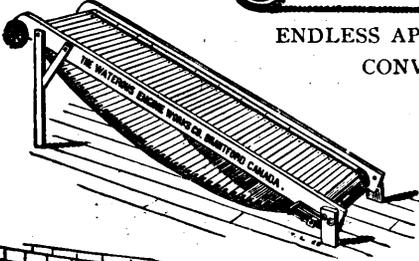
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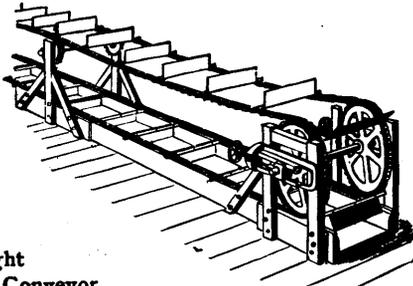


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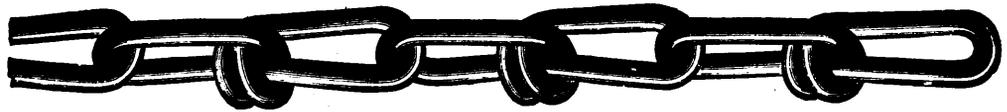
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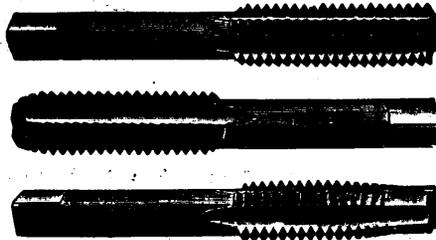
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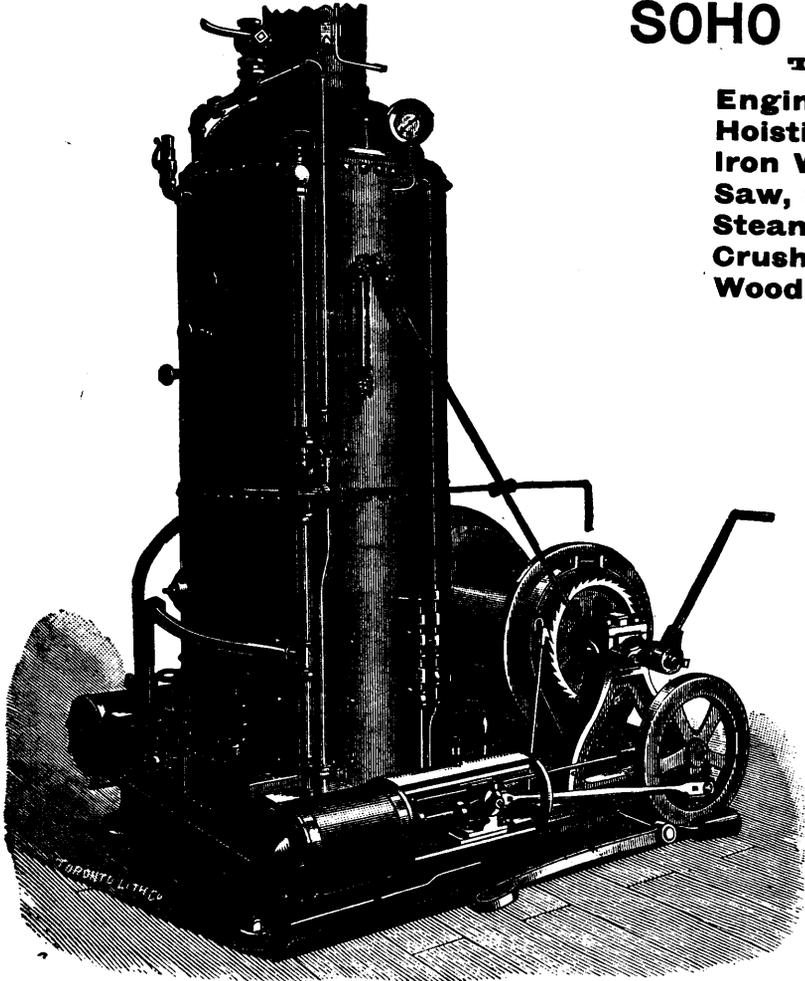
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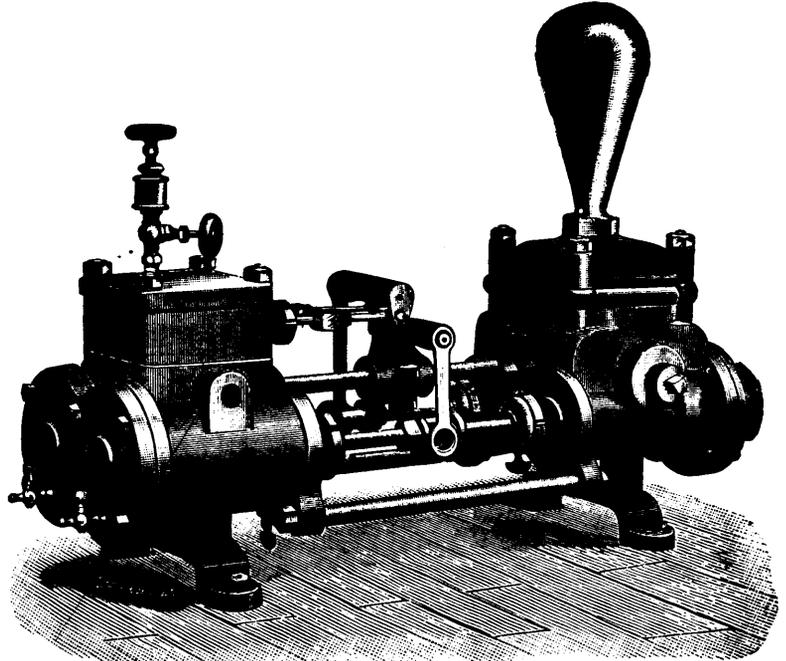
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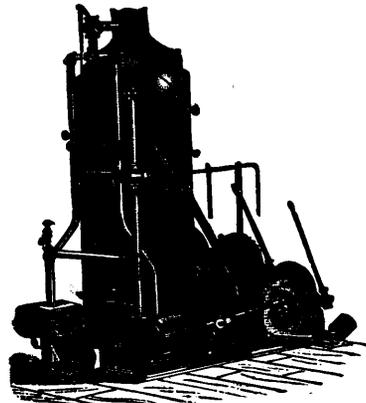
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The Gold Industry of Nova Scotia in 1890.

Full returns from all the gold mines of this Province are not attainable at the hour of going to press owing to the dilatoriness of several companies in making returns, but from the figures accessible it is evident that the total yield will not much (if any) exceed 20,000 ounces for the year. The yield for 1889 was 26,000 ounces, making a decrease for 1890 of over 20 per cent.

This large falling off has not been unexpected by persons acquainted with the industry during the last six months, and has not been confined to one or two districts, although the three Queen's County districts of Brookfield, Malaga Barrens and Whiteburn show a shortage of about 4,000 ounces as compared with 1889. Of this amount Whiteburn alone represents one-half, and the cause is due to the closing down of the McGuire mine in December 1889; the decreased yield of the "Philadelphia" and the "Molega" companies accounts for the other half.

Among the other districts reporting decreased yields are,—*Caribou*, producing little more than one half as much as in 1889; *Renfrew*, which reports a decrease of over 500 ounces; and *Stormont*, showing a decrease of over 1,000 ounces. This decrease in Stormont is due to the enforced idleness of the Palgrave company which obtains because of the litigation in which unscrupulous speculators have involved this valuable property.

The districts which have practically maintained their yield are principally Salmon River, Oldham, Uniacke, Montagu and Rawdon, embracing both East and Central Rawdon. Rawdon has maintained its yield on account of the new property opened by Mr. Northup, and on account of the re-opening of the East Rawdon mines in the second half of the year. The older mine in Central Rawdon has practically ceased producing, for the present at any rate. It appeared like a comet in the summer of 1889, was sold in the United States, and all but disappeared, with almost equal celerity, in 1890.

The large district of Sherbrooke shows a gain of less than 100 ounces, the total being about 300. Waverley, after two years preparation and the lavish expenditure of money, reports about 500 ounces. The Egerton Co., on Fifteen Mile Stream, have the best progress to report, having doubled its production in about one-half the

year owing to energetic management and improved machinery.

The districts producing 2,000 ounces or over are Oldham, Malaga and Rawdon (East and Central united).

The main cause of the large falling off, this past year has been the old familiar one of lack of development. The rich streaks being gouged out as rapidly as found, there came periodical times of poorer quartz, and in some cases total collapse, as in the Neptune mine at Chester Basin.

The outlook for the coming year is not favorable; several schemes which have been inflated during the past year will be pricked the coming season, and with probable disaster to the good name of the gold industry abroad. Several of the older districts, however, will probably show a large increase, as Salmon River and Oxford, which have been equipping their mines with new mills and improved machinery for development and extraction.

In spite of the lessened production the industry is on a better basis than last year, and out of the extinction of the recent "boom" and "boomers" will come more substantial prosperity and progress.

The Quebec Mining Bill.

If Mr. Mercier desires to convert the Quebec mining men into straight anarchists, he could hardly have devised a better means than the enactment of the new Quebec Mining Law; a measure so full of unjust and vexatious provisions as to induce a contempt for the whole system of legislation under which such annoyances are practicable. Better no law at all than such interference with individual enterprise and such violation of agreements. By reference to our summary of the Act, the main features may be readily grasped; and we will here merely allude in brief to some of the points that appear to us to be especially objectionable.

If purchasers of a mine know beforehand that a royalty of three per cent. is to be levied upon the output, they have the option of investing or leaving the industry alone. But when mines are sold outright and subsequently a royalty is imposed, there is a breach of contract committed which constitutes a moral outrage, and we should think a legal offence. If our working mines were now owned by the original purchasers at the low government prices, there would not be so much reason for complaint; but in nearly every case the operating companies have purchased their lands at such high prices that, as a rule, it is difficult for them to earn profits in excess of the interest upon capital. They paid these prices with the supposed guarantee of freedom from royalty or they never would have paid them. If the tax was levied upon profits, instead of upon the output irrespective of its cost, it would be less open to the charge of injustice and less likely to be injurious in its effects upon struggling enterprises.

The appointment of inspectors with unlimited

powers will create an offensive oligarchy, whose unappealable decisions will cause a vast amount of ill feeling and vexation; and if unsuitable persons are appointed, as is certain sometimes to be the case, a great deal of injustice will be perpetrated.

The right of the owner of the soil to have the option of buying the mineral rights, after their value has been discovered by the explorer, will put a check upon research and discovery; and the power of the commissioner to advance the price of lands, or put them up to public auction, will be a discouragement to the prospector and often work a great injustice, allowing the rich idler to appropriate the efforts of the poorer, active explorer.

The power of a single arbitrator to force the sale of a property at the price he dictates will be felt to be very oppressive, though we do not deny that it may tend to promote mining operations while it depreciates the value of vested interests.

The confiscation of mining rights, after two years of idleness, may be a wise measure for future application upon lands yet to be sold, but its enforcement upon lands already ceded without any such proviso is of the nature of such legislation as is advocated by revolutionists. It is probable that an appeal will be made to the Dominion authorities to disallow this measure as a violation of legal rights and an unwarrantable trespass upon vested interests.

The exaction of minutely-detailed quarterly reports from mines, and monthly reports from quartz mills, will prove vexatious. Although some general report is desirable, there seems to be no reason why the Government should have "a description of all shafts, quarries, inclined galleries, working levels, plant, machinery, tramways, railways, openings, open spaces, pushed, made or constructed during the previous quarter." Perhaps the farmer may next be required to report every furrow he ploughs, every crop he sows, and every cow shed he erects. If "that government is the best which governs the least," the present Quebec government, if it is to be judged by this bill, is a very bad one.

On phosphate properties it is customary to make a large number of surface workings. We know of one property on which there are at least 300 pits and trenches over four feet deep, some of which are of great extent. To erect fences four feet high around all these would be a herculean and expensive task. As pits are usually indicated by a rock dump there would seem to be warning enough of their existence.

The list of fines, winding up with \$20 for every day of contravention of all other misdemeanors, approaches the ridiculous; but when an offer of half the fine is made to the informer we are compelled to regard the matter seriously as a most demoralizing and vicious measure. Worthless loafers may then earn a living by prowling through the bush in search of pits minus the four foot fence; and for every discovery they may secure \$25 as the reward of their sneaking business. The only comfort afforded by this section of the bill is that its

lucrative possibilities may entice some of the Quebec legislators into adopting the profession of mining informers, in which case they will perhaps do less harm than by enacting such pernicious laws.

Finally, our objections may be summed up in a query that comes to us from London, "What is the Quebec Government trying to do? Does it want to kill the mining industry?"

Nova Scotia Coal Trade, 1890.

Complete returns of the Nova Scotia Coal trade for the year 1890, have not yet come to hand. Enough, however, is known to allow it to be said that the increase over previous years is satisfactory. The Cape Breton Collieries nearly all increased their output, the Sydney colliery, of the General Mining Association, standing at the head with a total sales of 152,681 tons. Generally speaking there was a want of coal cutters and this was specially felt in the early part of the fall. The mines are preparing for a brisk season's work next year, levels and slopes are being driven in advance, and it is expected that coal will soon be dug and banked out in readiness for the shipping season. The Gardiner Colliery at Bridgeport, which has been closed for about ten years, is being refitted and will be added to the list of producers next season. It is reported that it will be equipped for an average daily output of about 300 tons. The Sydney and Louisburg Coal Company will increase their facilities for cutting and raising coal at their Emery Colliery which was re-opened last year, and by the spring should be able to raise at least 400 tons a day from it. In Pictou County the introduction of the Longwall system at the Vale Colliery will allow an increased output. The work of opening the Albion Main Seam by the Acadia Coal Company is proceeding favourably and will present many new features of interest. Stanley coal heading and coal cutting machinery are being introduced. The coal from this seam yields an admirable coke, and fifty new ovens are being built close to the Foord

pit, and so arranged that the waste gases will heat the pump and winding engine boilers. The Intercolonial Company are enlarging their works on the second seam. At Springhill the usual sinking and preliminary work is going on, and generally speaking the mines are in a position to meet any ordinary increase in business.

So far as can be learned the results of the year's work have been fairly satisfactory. The prices that have ruled are not in all cases precisely ascertainable. It is understood that the prices for Cape Breton coals have varied at Montreal from \$2.90 to \$3.15 a ton, and that at the same point Pictou coals were sold in the vicinity of \$3.60. Little Springhill coal is sold in Montreal. The price delivered at Springhill Junction is said to have been \$2.50.

It is worthy of note that there is a strong competition at Montreal and Quebec among the coal brokers representing the various mining companies, which tends to lower prices. It is a matter of frequent remark that, if the Cape Breton coal companies were to pool their coal or employ only one seller, they could readily realize 25 cents a ton more on their sales in Quebec and Montreal. This would, beside adding to their profits, allow a slight increase in wages to their employees. In this connection it may be stated that at present enquiries are being made with a view to effecting a combination of the collieries at present operating in Cape Breton. By reducing the expenses of management, offices, haulage, etc., there is no doubt that these companies when amalgamated should yield to both owners and employees far more satisfactory results than have yet been possible.

The operations of the past year have been carried on without any noteworthy accidents. A number of miners have been injured by falls of roof, etc., but in many cases their own negligence has contributed to the accident. The more gaseous mines have been worked with caution, and in many cases the use of powder has been discontinued. The most noteworthy incident connected with the coal trade during the past season was the ten weeks' strike at the

Springhill Collieries. This strike was fought with firmness on both sides, but the men gave little cause for uneasiness to those holding property in the town. The ends obtained by the men as conceded by the company were calculated to remove friction in the future, but it is reported that much of the feeling expended on the strike has been directed against the more systematic and economical management that was being inaugurated. The deplorable waste of time and money should prove a warning to the men. They had an excellent Provincial Arbitration Act to which they could have appealed—an Act which very decidedly invited their invocation as its clauses all favored the workmen. In future it is to be hoped that both masters and men will avail themselves of the advantages of arbitration.

There has been a slight increase in the amount of coal shipped to the United States during the past year, principally for gas purposes, owing to a deficiency in the home supplies for that purpose. The suggestion has been made that the Provincial Government should appoint a commission to look into the question if reciprocity in coal would benefit the Nova Scotia coal mines. Numerous references are made to New England manufacturers, etc., who are in favor of reciprocity. These people have everything to gain by reciprocity, as it means cheaper coal to them. But on the other hand it is not yet clear to our miners that they will be able to meet the American shippers who no doubt will meet them with a fierce competition, and at the same time maintain their St. Lawrence trade against the English coal that would come in free of duty as ballast.

The local outlook however, is reassuring. The demand for domestic purposes is steadily increasing, The increase of the bunker and steamer business forms an important item. The Londonderry furnaces are increasing their demand for coal, and the projected iron works in Pictou County seem now fairly launched, so that next summer they should make heavy demands upon the local collieries.

Imports of Coal by Water at the Ports of Montreal, Sorel, Three Rivers and Quebec for the Years 1889 and 1890.

(Authentic figures compiled for THE REVIEW.)

	MONTREAL.		SOREL.		THREE RIVERS.		QUEBEC.		TOTALS.		REMARKS.
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	
CAPE BRETON COLLIERIES.											
"International".....	52,879	89,138	.....	1,400	.....	.....	3,841	2,871	86,720	93,409	Increase over 1889 6,689
General Mining Association.....	45,297	42,365	8,404	9,000	1,300	10,046	21,828	24,636	76,829	86,047	do 1889 9,219
Sydney & Louisburg Coal & Ry. Co.....	48,915	62,798	3,900	14,800	.....	.....	5,759	8,094	58,574	85,692	do 1889 27,118
"Caledonia".....	33,454	70,187	9,910	10,800	3,000	1,690	10,077	3,259	56,441	85,936	do 1889 29,495
"Glace Bay".....	33,380	51,000	4,819	3,680	2,240	.....	.....	1,634	40,439	56,314	do 1889 15,875
"Gowrie".....	32,106	45,339	7,372	3,540	.....	.....	550	4,000	40,028	52,879	do 1889 12,551
"Bridgeport".....	.....	.....	.....	.....	.....	.....	.....	9,941	.....	9,941	do 1889 9,941
	276,031	360,827	34,405	43,220	6,540	11,736	42,055	54,435	359,031	470,218	do 1889 111,187
PICTOU COUNTY COLLIERIES.											
"Intercolonial".....	35,452	45,857	9,200	7,100	.....	.....	.....	.....	44,652	52,957	do 1889 8,305
"Vale" and "Acadia".....	1,213	6,316	.....	.....	.....	.....	.....	.....	1,213	6,316	do 1889 5,103
Total Lower Port Coal by Steamers.....	312,696	413,000	43,605	50,320	6,540	11,736	42,055	54,435	404,896	529,491	do 1889 124,595
Total importations from Great Britain.....	.....	.....	.....	.....	.....	.....	.....	.....	62,629	16,974	Decrease over 1889 45,655
Grand totals.....	.....	.....	.....	.....	.....	.....	.....	.....	467,525	546,465	Increase over 1889 78,940

The following statistics of the coal sales have been kindly furnished us by the officers of the companies, and while not wholly complete, will be of interest as showing the output and distribution of the product of the leading producers:—

Pictou County.

Acadia Coal Company:

	Round.	Slack.
To New Brunswick	14,260	2,615
" Newfoundland		49
" Nova Scotia	94,550	64,836
" Prince Edward Island	3,863	20,951
" Quebec	22,640	463
" Other countries		289
" Bunker steamers	18,945	136
" Colliery employees	4,514	1,646
Total sales 1890, (tons)	158,772	90,085

Intercolonial Coal Mining Company, (Ltd.):

	Tons.
To Nova Scotia	68,449
" Prince Edward Island	9,036
" New Brunswick	9,634
" Quebec	65,470
" Newfoundland	118
" West Indies	358
" Colliery employees	2,582
" Consumed by engines	7,232
" Consumed by coke ovens	1,491
Total disposals 1890	164,370

East River Coal Co., (Muir & Sons,):

Total sales 1890	1,360
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Black Diamond Coal Company, (Ltd.):

	Round.	Slack.
To New Brunswick	1,982	30
" Nova Scotia	18,318	10,083
" Quebec	1,888	
" Colliery employees	276	
Total disposals 1890	22,464	10,113

Cumberland County.

Cumberland Coal and Railway Company:

	Round.	Slack.
To New Brunswick	89,715	17,332
" Newfoundland	nil	nil
" Nova Scotia	57,341	32,184
" Cape Breton	nil	nil
" Prince Edward Island	nil	nil
" Quebec	157,975	15,302
" West Indies	nil	nil
" United States	7,734	
" Bunker steamers		
" Colliery employees	6,368	
Total (tons)	311,399	72,552

Phoenix Coal Co., (Ltd.):

	Tons.
(Joggins Colliery.)	
Total disposals 1890	53,492

Londonderry Iron Co.:

	Tons.
(Chignecto Colliery.)	
Total disposal: 1890	7,485

Cape Breton.

General Mining Association, (Ltd.), London, Eng.:

	Round.	Slack.
To New Brunswick	5,613	
" Newfoundland	27,603	22
" Nova Scotia	32,975	33
" Cape Breton	1,328½	3,743
" Prince Edward Island	897	
" Quebec	68,923	4,732
" West Indies		
" United States	161	786
" Bunker steamers	5,865	
" Colliery employees		
Total disposals 1890	143,365½	9,316

Glance Bay Mining Co.:

	Round.	Slack.
To New Brunswick	3,253	476
" Newfoundland	8,608	7
" Nova Scotia	14,160	4,047
" Prince Edward Island	806	819
" Quebec	53,969	2,179
" West Indies	3,571	
" Other countries	12,119	742
" Bunker steamers	3,815	
" Colliery employees	50	600
Total disposals 1890	100,351	8,870

Low Point Barasois and Lingan Mining Co.:

	Tons.	Tons.
To New Brunswick	10,764	104.
" Newfoundland	16,028	92
" Nova Scotia and Cape Breton	21,735	2,715
" Prince Edward Island	1,649	2,150
" Quebec	7,470	1,564
" West Indies		
" United States		627
" St. Pierre Miquelon	277	
" France	180	
" Bunker steamers	12,014	
Total sales 1890	70,118	7,252

Sydney & Louisburg Coal and Railway Co., (Ltd.):

	Round.	Slack.
To New Brunswick	4,466	100
" Newfoundland	4,893	7
" Nova Scotia and Cape Breton	16,300	3,146
" Prince Edward Island	4	172
" Quebec	73,483	14,113
" West Indies		
" Other countries	3,942	
" Bunker steamers	19,151	
" Colliery employees	6	3,271
Total sales 1890	122,299	20,809

Gowrie Coal Mining Company:

	Round.	Slack.
To New Brunswick	2,531	75
" Newfoundland	11,065	206
" Nova Scotia and Cape Breton	30,303	46,579
" Prince Edward Island	7,790	2,015
" Quebec	48,700	8,969
" West Indies	404	
" United States		2,869
" Bunker steamers		
" Colliery employees	3,210	2,170
Total sales for 1890	104,003	22,883

Caledonia Coal and Railway Company:

	Round.	Slack.
To New Brunswick	10,634	1,211
" Newfoundland	13,291	1,406
" Nova Scotia	7,419	2,359
" Prince Edward Island	644	4,749
" Quebec	63,710	26,056
" West Indies	384	
" Other countries	7,698	5,822
" Bunker steamers	(Included above.)	
" Colliery employees	629	972
Total sales 1890	104,409	42,575

The International Coal Co., (Ltd.)

	Round.	Slack.
Sold in Nova Scotia	3,019	1,878
" New Brunswick	6,753	380
" Newfoundland	1,135	287
" Prince Edward Island	273	113
" Quebec	56,523	33,062
" St. Pierre Miquelon	132	14
" United States	6,898	766
" Bunker steamers	20,411	1,432
Total	95,144	37,932

The White's Asbestos Company.

The White's Asbestos Company, to which reference has already been made in these columns, has again been before the public, and, as might be expected from its character, in an unfavorable light. It will be remembered that its prospectus set forth in glowing colors the amount of the mineral already in sight—"the face of the rock displays a network of asbestos veins"—while the annual production was to be at the very least 1400 tons. Subsequent results have by no means justified this promise; the veins are few and scattered, the quality of the worst, and since operations were commenced a poor eight tons alone have been produced, which brought about £20, or not sufficient to pay the expenses of mining and transportation. In view of these facts, the shareholders found the repeated calls upon their stock exceedingly irksome, and one, a Mr. Hoare, refused to pay

any more upon what was so evidently worthless. Suit was accordingly brought against him for the amount claimed, and came up for trial a short time ago. The judge found, upon consideration, that the directors had disregarded several "serious and important warnings" that had appeared in several journals, whereas it was their bounden duty to investigate the allegations made against the company's property, and furthermore that material statements in the prospectus were untrue or misrepresented, and judgment was therefore given in favor of defendant, with costs. With this as a precedent, the other shareholders who have not yet responded to their calls will not hesitate to follow suit, and a speedy liquidation appears to be inevitable.

The Geological Map of Nova Scotia.

Being cognizant of the immense importance attached to the geological map of Nova Scotia, by those engaged in mining operations in that Province, a call was made at the offices of the Geological Survey to ascertain what progress was being made in its preparation, and also whether it will be upon the scale generally desired. The whole mining community of Nova Scotia, without exception, have expressed their wish that it shall be upon the scale of one mile to the inch, and representations to this effect have been made both by the Gold Miners' Association and the members of the House from that Province, while the fallacy of the course of the Survey has repeatedly been exposed in these columns. No notice has been taken of these statements, however, as the Director of the Geological Survey, from economical motives, considers that four miles to the inch is ample. During several years, but one report has been published in this region, and that being unaccompanied by maps, was of no practical value to miners though exhaustive surveys have been made in this time, and now that a more extensive treatment of the subject has been entered upon, it will be a serious mistake to thus curtail its usefulness by the reduction of the map to one-sixteenth of the wished-for size, destroying its uniformity with the map of Cape Breton already issued upon the scale of one mile to the inch. Regarding the cost of the work—the great stumbling block—the expenses of the surveys amounted, in round figures, to about \$30,000. To produce the maps upon the scale on which they were originally designed, and which is desired, would require a little less than \$4,000, but, in order to economise, nearly \$1,000 was expended in their reduction to the size proposed by the Department—a sum that would have gone far to make up the difference between the cost of the two maps—so that taking this into consideration, the saving is of no account when compared with the utility of the other. Not only this, but the already culpable neglect shown to this, the most important mining province, has been augmented by the delay entailed in the change. We believe that Dr. Selwyn now desires that the local government of Nova

Scotia should bear part of the expense of the larger map, but this is not within the province of that Legislature, while it is the plain duty of the Survey to publish a map of some economic value, that may be useful to those whom it more immediately concerns, rather than one which, while showing the general configuration of the country, has no utility beyond that point. We understand that strenuous efforts will be made to have this error rectified in the coming session, and the probable ending of the matter will be that the Department will be put to double the expense that would have been incurred had not false notions of economy interfered with the duty owed to the public in general, and an important mining region in particular.

Exports of Canadian Asbestos, 1890.

The following official returns of the shipments of Canadian asbestos have been very kindly furnished by Mr. Frank Grundy, general manager of the Quebec Central Railway. As will be seen, there has been a very substantial increase over the exports of the previous year:—

	Tons.
Coleraine station	158½
Black Lake station.....	2,518¼
Thetford mines.....	5,148¼

Or a little over..... 7,825

The shipments of previous years have been:—

Year.	Quantity	Value.	Year.	Quantity	Value.
1879...	300	\$19,500	1885..	2,440	\$142,441
1880...	380	24,700	1886..	3,458	206,251
1881...	540	35,100	1887..	4,619	226,976
1882...	810	52,650	1888..	3,936	277,742
1883...	955	68,750	1889..	5,588	360,144
1884...	1,141	75,097	1890..	7,825	.....

Silver Exports.

From official returns received we are enabled to give the following statement of the exports of silver ore and bullion from the Port Arthur silver district:—

MONTH.	ORE.	BULLION.
January.....	\$18,050	
February.....	1,525	
March.....	100	
April.....	2,500	
May.....	10,450	500
June.....	770	
July.....	800	
August.....	56,000	
September.....	45,190	
October.....	30,000	
November.....	35,400	
December.....	20	500
	\$200,805	\$1,000

The cost of the recent Australian strikes has been estimated at over one million and a quarter sterling. The loss to labor in the three Colonies of Victoria, New South Wales and South Australia, is reckoned at £909,000, to trade, at £305,000, and to the Governments, in maintenance of military and police, and loss of wharfage and customs dues, at £80,000.

Petroleum in Canada

The production of petroleum in Canada is at present entirely confined to one district, Lambton County, Ontario. Indications of oil have been discovered elsewhere throughout almost the whole of the Dominion, but with one exception, they have not proved of a paying nature, and all operations hitherto commenced have resulted in failure. In Nova Scotia, oil is known to occur, it being frequently seen to rise through the waters of Lake Ainslie, and swamps in the district are often found to be covered, and many springs impregnated with petroleum. Several companies have been formed to test this district, but beyond "indications," nothing has been found. Desultory boring has been done in New Brunswick also, on similar indications and with identical results. At several points in the Province of Quebec, notably in the Gaspé Peninsula, oil is known to exist, and a small amount of exploratory work has been done, and here the prospects are somewhat better than in the two former provinces, but so far no results of any importance have followed. But one attempt has been made to strike oil in Manitoba, by the Manitoba Oil Company on the banks of the Vermilion River, but although boring was carried on to a depth of 743 feet, nothing was obtained, and the effort was finally abandoned as useless. But in the region lying to the north of the territories of Alberta and Saskatchewan, and drained by the Peace and Athabasca rivers, lies an immense oil region, the exploration of which, slight as it has been, has been sufficient to show that it is of great value in this respect, and may be expected at a future time to contribute largely to the output of Canadian petroleum.

As has been observed, however, the production is at present confined to Lambton County, Ontario, where the oil occurs in two distinct "pools" known as the Oil Springs and the Petrolia fields, the former comprising an area of about 2 square miles, and the latter of about 26 square miles. Data are unfortunately wanting to show the production of these pools since their first development, though the output for the past few years has been in the neighborhood of 600,000 barrels per annum. In the earlier years, before the economic operation of the wells was understood, the waste was very great; oil was at one time quoted at ten cents per barrel, and during the spring and summer of 1862, it is estimated that 5,000,000 barrels of petroleum floated off upon the waters of Black Creek.

It is estimated that some 3,500 wells are now being pumped, 2,500 of which are in the Petrolia field, and the remainder on the Oil Springs field. About 400 new wells are annually drilled, to take the place of about the same number that are annually abandoned. The oil from these is run off by pipe lines into the tanks of the various tanking companies, the total capacity of which is about 1,000,000 barrels, certificates being issued to the owners therefor.

Thirteen refineries are in operation, nine of

which are located in Petrolia, two in London, one in Sarnia, and one in Hamilton. These employ about 260 men in and about the works, and throughout the oil producing territory there are about 2,000 men employed directly or indirectly, in the production of crude and refined oil.

The exact output of the wells in 1890 cannot at this date be ascertained, but it is estimated at 675,000 barrels of 35 imperial gallons each, as against 639,991 barrels in 1889. The average price per barrel in the latter year was 95½ cents, considerably less than in 1890, as will be seen by the subjoined table, for which we are indebted to Mr. James Kerr, secretary of the Petrolia Oil Exchange:—

MONTH.	HIGHEST PRICE.	LOWEST PRICE.	AVERAGE PRICE.
January.....	\$1.03	\$1.01¼	\$1.02¼
February.....	1.11	1.02	1.05¾
March.....	1.09½	1.05½	1.07¾
April.....	1.10	1.06¼	1.07.7
May.....	1.08	1.07	1.07.51
June.....	1.16	1.07¾	1.10.18
July.....	1.37	1.16	1.23.04
August.....	1.35½	1.31	1.32.77
September.....	1.31¾	1.27¾	1.30.45
October.....	1.32	1.28	1.29.3
November.....	1.36¼	1.28½	1.32¾
December.....	1.35	1.27	1.30.2
Whole year....	1.37	1.01¼	1.17¾

An interesting lecture on "Asbestos," was delivered by Dr. R. W. Ells, before the Ottawa Field Naturalists' Club, on the 17th inst. The lecturer began by tracing the history of asbestos as known to man, from the earliest times, and then proceeded to describe the different varieties, their modes of occurrence and distribution throughout the world, with special reference to the importance of the Canadian field. The remarkable growth of the industry was then commented on, and the uses and manufactures to which it is applied, while the other non-conducting substances which might compete with the mineral were touched upon. With reference to the characteristics of the different qualities of serpentine from which asbestos might be extracted in paying quantities, Dr. Ells, who, it may be remarked, is an unquestionable authority upon the subject, stated that the brown, weather-beaten, siliceous serpentine does not carry asbestos at all; it is rarely found in the soft, slaty, greasy formation of the south, which is very different from the massive serpentine of Thetford and Black Lake. Regarding the age of the formation, he held that the older the richer, and that more asbestos may be looked for in the Cambrian than in later serpentines, an hypothesis borne out by the experience of quartz gold mining. There is a very large asbestos field in the Laurentians of the Ottawa valley and elsewhere, which is only beginning to be known, and in some localities, there is certainly every prospect of finding it in considerable quantities, although, perhaps, not to as great an extent as in the Eastern Townships. We hope to give the full text of this valuable paper in our next month's issue.

En Passant

We notice that at the general meeting of the Canada Company, held in London on the 2nd inst., considerable stress was laid on the discovery of natural gas on their lands. As our readers are doubtless aware, the company owns some quarter of a million acres in Ontario, on which prospecting and mining has been done, particularly in the Township of Loughboro'. The company has not met with as great success in the last few years as formerly, owing to agricultural depression, and any discoveries that will enhance the value of their lands will be appreciated.

An excellent Report on the mineral resources of the Province of Quebec has been compiled under the supervision of the Geological Survey by Dr. R. W. Ellis, well and favorably known for his connection with the asbestos industry of that Province. As its title implies, it is a compendium of valuable information regarding phosphates, asbestos, copper, iron, gold, etc., and contains besides the history of all the more important mining enterprises undertaken within the Province, together with a variety of other information obtained from early works upon the subject, not now easily accessible. Its economic geological value is great, and it will be found an exceedingly useful book of reference to all engaged in mining operations.

A deputation from the coal section of the Montreal Board of Trade, consisting of Lieut.-Colonel Henshaw, Messrs. H. A. Budden, R. P. McLea, D. Napier, F. P. Brown and R. T. Routh, accompanied by Mr. J. J. Curran, M.P., recently had an interview with the Minister of Marine and Fisheries, in reference to the recognition of the English Board of Trade certificates of inspection, requesting the exemption of such vessels holding unexpired English certificates when chartered for coal carrying purposes in Canadian waters, as the imposition of inspection dues on this side in addition to the very heavy dues in England, seriously embarrassed the coal and shipping trade, and to no purpose. Hon. Mr. Tupper, replied that the double imposition has only recently been decided in view of a decision of the Department of Justice, but as there was no apparent necessity for it, he would confer with his colleagues with a view to devising a remedy.

Elsewhere will be found, reproduced in full for the first time in Canada, the report to the United States Government of Commander Folger and Lieut. Buckingham, on the nickel and copper deposits of the Sudbury district. Taking it as a whole, it will be a valuable addition to the literature on this subject and will be read with attention by those interested in mineral properties in that region, but it would appear that the writers, throughout the report, have been somewhat biased in their consideration of the Canadian Copper Company, and have instituted a number of comparisons disparaging

to the other companies treated of. We are much mistaken if there be not ranges of nickel and copper in the Sudbury country as rich and extensive as those possessed by the Canadian Copper Company. These points we leave to the consideration of our readers, who will draw their own conclusions on perusal of the report. Otherwise it is of interest as affording a comprehensive idea of the workings in the Sudbury region, and as such will be appreciated at its proper value by holders of lands in that vicinity.

The record of shipbuilding done in the United Kingdom within the past year, shows that the total output was 1,271,110 tons, as compared with 1,300,933 in 1889, and 903,687 tons in 1888. The Clyde, as usual, heads the list with 349,995 tons, an increase of 14,974; the Tyne is next with 235,567 tons, a falling off as compared with 1889, of 46,143; the output on the Wear was 197,482 tons, a decrease of 19,854; on the Tees, 127,741 tons, an increase of 17,305; the Hartlepoons 99,847, an increase of 13,792 tons; at Belfast 66,783 tons, a decrease of 16,220; on the Mersey 36,577 tons, a decrease of 5,196; at Barrow, 24,665 tons, a decrease of 2,182; and at Dundee 24,494 tons, an increase of 6,183. In connection with this, it may be interesting to point out that the output for the whole of Scotland during 1890 was 416,617 tons, as compared 395,841 in the previous year, or an increase of 20,776 tons, and that the tonnage of the north-east ports of England, which reached 695,357 in 1889, had fallen last year to 660,637, a decrease of 35,720 tons. Messrs. Russell of Greenock and Port Glasgow are the largest contributors to the grand total, having launched during the year no less than 70,370 tons of shipping. They are followed in the order given by Sir Wm. Gray & Co. (Ltd.), Hartlepool; Messrs. Harland & Wolff, Belfast; and Palmer's Company on the Tyne.

The number of mining companies formed within the past year, sixty-one in all, shows the interest that is awakening in Canada's mineral wealth. From the Atlantic to the Pacific fresh capital has been introduced into the industry, infusing new life into districts previously languishing, and stimulating other sections into increased activity. The greatest number of corporations were instituted in or for the purpose of working mines in Ontario—twenty in all; Nova Scotia comes next with seventeen, while British Columbia, with fourteen, and Quebec, with seven, have received large additions to the amount of capital invested within their borders. Manitoba and the North-West Territories and New Brunswick, show two and one new companies respectively. The sum represented by these concerns is very large but owing to the fact that some are private ventures, that is, not incorporated, the exact aggregate cannot be ascertained; and the capital of one English Company, H. H. Vivian & Co., of Swansea, amounting to over \$1,500,000, can not be included, both from the fact that only a comparatively small portion of its funds are invested in Canada, and also on the ground that, although

incorporated last year, operations had been carried on for some time previously. Even without these, however, the total capital stock of all corporations amounted to \$19,637,750—a sum that, whether taken on its own merits or as indicative of what is to come, is extraordinarily large. Of this, British Columbia received the largest share, \$6,255,000, Quebec, if the General Phosphate Corporation be included, coming next with \$5,334,000 invested. Nova Scotian mines also received a considerable accession of capital, the stock of new companies in that Province aggregating \$4,255,000; \$3,578,750 was put into Ontario enterprises; \$125,000 in Manitoba and the Territories, besides a private concern; and \$100,000 in New Brunswick. From these figures it is evident that the mining industry is rapidly advancing throughout the Dominion, and to a greater degree than is generally known, and as a large influx of outside capital may be looked for, before very long, the present year may be expected to show a still larger sum. A complete list of all companies will be found on another page.

The Excelsior Copper Company, which for two years has been working the well known Harvey Hill mine in Megantic County, Quebec, appears, from the account of the meeting published elsewhere, to have met with no better success than its predecessor. Its chances from the first were very small. To begin with, the capitalization, £450,000, was altogether out of proportion to the value of the mine to be worked, and the real—not prospectus—profits to accrue therefrom; nor have the subsequent operations borne out the expectations entertained. But it is with the statements and promises of the directorate and management that we have at the moment to do. The chairman apparently entertains the most sanguine belief as to the value of the property, and such expressions as "proved beyond the realm of doubt" are liberally interspersed throughout his remarks. The shareholders hardly seem imbued with the same confidence, however, and the response to the call for £20,000 last April was so small that all subscriptions were returned. It is now proposed to wind up the present concern and reconstruct the company upon the basis of imposing on the shareholders a payment in proportion to their several holdings. Captain Davey, the mine manager, made a most eulogistic speech on the future prospects of the mine—prospects that in the light of past experience are unwarranted, and, it seems to us, that would require something akin to a miracle to fulfil. It is an easy matter to say that at a certain rate of production such and such a profit may be realized, but the prime necessity is to obtain the ore for treatment; and past workings do not justify the assumption that such can be mined in anything like paying quantities. The former owners of the property operated it upon a careful and economical basis, and yet found it exceedingly unprofitable; and nothing in Captain Davey's remarks leads one to suppose that any new and rich developments have been made. Of course it is within the bounds of possibility that such a

strike may be made; but the fact remains that such has not yet been come upon, nor from the formation of the country is it likely to occur. It would, we think, be exceedingly rash—not to use a stronger term—of the shareholders, in view of their past experience, to sink further money in what has already proved to be more of a chimera than a speculation. 'Two years' work has hitherto resulted in the mining of only eighty-seven tons, and yet they are asked to further subscribe on the statement and promises of an interested party, who can show no grounds on which to support his far from unbiassed opinion. Such companies are not only disastrous to their own investors, but do incalculable harm to really genuine enterprises, which receive the cold shoulder from English capitalists, who are unable to discriminate between a loudly-trumpeted concern, whose only profits are on paper, and a really honest and remunerative investment.

In a recent issue of one of our American contemporaries reference is made to the fact that notwithstanding that the demand for mica had so increased of late, no corresponding activity was observable in its production within the limits of the Republic. In the construction of dynamos, motors, and other electric appliances, mica plays an important part on account of its flexibility and insulating properties, and with the constantly enlarging sphere of electrical mechanics, a very large quantity is annually used. For these purposes the American article is unsuited, it being found to be inferior in cleavage and flexibility, the two great requisites, and the Canadian "amber mica" is in almost universal use. This is chiefly obtained from the mines of the British Canadian Mica and Mining Co., in the Township of Villeneuve, Ottawa County, Quebec, and of the Sydenham Mica and Mining Co., in the Township of Loughboro', Ontario, although considerable quantities are also taken out by small operators in the Ottawa Valley and Kingston districts. The United States Government, in its recent enactment of the McKinley tariff, has done all in its power to foster the industry by imposing a duty of 35 per cent. upon the foreign product; but even with this assistance very little improvement is noticeable in the output of the American mines, for the reason that, protected or not protected, it is not of sufficient quality and is not therefore wanted; and the only alternatives left to manufacturers of electrical apparatus are either increasing the cost of the machines or using inferior materials; and in this latter connection it is said that some have gone the length of using paper as a substitute for mica. Reference to a recent report of the U. S. Geological Survey discloses some statistics bearing upon the subject. The production of mica in the United States in 1884 was 147,410 pounds; in 1885, 92,000 pounds; in 1886, 40,200 pounds; in 1887, 70,500 pounds; and in 1888, 48,000 pounds. The value of the amount in 1887 was \$142,250, and of that in 1888, \$70,000. These figures show conclusively that the output is on the whole falling off. Compared with these are

the imports of foreign (*i.e.*, Canadian) unmanufactured mica, which for 1884 were \$28,284; in 1885, \$28,685; in 1886, \$56,354; in 1887, \$49,085; and in 1888, \$57,541. It must, however, be noted that in the imports of the last three years, ground mica waste is included, an article which concerns about 90 per cent. of the product of the mines, and for which there is a steadily increasing demand in the manufacture of lubricants. It is evident, therefore, that left to itself and unhampered by tariff restrictions, the trend of the American demand would be almost entirely towards the Canadian "Muscovite" and amber qualities; and even under the detrimental influence of a 35 per cent. duty, there will no doubt be a large consumption of it within the Republic, while the American mines will derive little or no benefit from a stimulant that may galvanize them into a short artificial life but which can effect no permanent results upon an industry which lacks the essential element of filling a demand. Some one must pay the increased cost of the electrical apparatus or use inferior machines, and that some one is of course the purchaser, while many articles produced by electric power will be dearer, so that it appears as if no one would be benefited, but many injured directly or indirectly, by the mistaken zeal of the Ohio statesman.

The statement of the receipts of coal by water at the four principal ports on the St. Lawrence during the year just closed, given elsewhere in our columns, affords an interesting study at a moment when the question of reciprocity in this particular is being agitated. The arguments used by those who favor this movement are several. It is said that the United States is the true geographical market for Lower Port coal, and that the tariff restrictions which confine the output of Canadian collieries to their own country are vexatious and hamper the industry, whereas, if done away with, the loss of the St. Lawrence market would be more than counterbalanced by the large demand that would arise from the Atlantic ports, etc. Regarding the first, its soundness is only apparent, for it will be readily seen that the American coast market is equally contiguous to the home producing centres from which it is at present supplied, and the competition would be such that the business would not, at all events for a long time to come, amount to very much—a fact that nullifies their second proposition also. This is proved, moreover, by the light of actual experience. In the days of reciprocity there was no great prosperity, but on the contrary the industry languished and made little or no progress, and it was not until 1879, when a duty of 50 cents per ton was imposed by the Dominion Government, that affairs began to look up. Subsequently the tariff was raised to 60 cents, owing to an increase in the imposts in mining plant, etc., and since that time the annual output of Nova Scotia has steadily enlarged until it has reached the present figures. The records of the two periods of reciprocity and protection contrast strongly when placed side by side:

In 1869, the total coal sales of Nova Scotia were 511,795 tons, and in 1879, in which a duty was imposed, 688,626 tons; an increase of only 176,831 tons; while in the next ten years we find the sales have increased to 1,555,107 tons, or a gain of 866,481 tons—sufficient and incontrovertible evidence in support of our statement. It is true that the price is still low and profits are comparatively small, but the present condition of affairs is far more satisfactory to owners and employees than the old condition of things. And it is to Quebec that this is due almost entirely. Ontario is too far west for the Nova Scotian collieries to compete with American coal, even under the present duty, but the sister province has since 1879 turned altogether to the Lower Provinces for fuel, and has absorbed vast and ever-increasing quantities. In 1879, the shipments to Quebec amounted in all to only 83,710 tons; in 1889 the imports by water at the four principal St. Lawrence ports of Nova Scotian coal were 404,896 tons; and last year, owing to somewhat lower freights and a better demand, the aggregate had increased to 529,491 tons—124,595 tons more than in the preceding year. From this it may be judged that the industry is in a healthy state, and that the future shows a promise, for the loss of which no American demand that Nova Scotia could secure could compensate. Two further features in the statement of favorable character also attract attention. It will be observed that not only was the aggregate exportation greater but that every colliery participated in the gain, the relative business of each for 1889 and 1890 showing a satisfactory balance, in some instances amounting to many thousands of tons, in favor of the latter year. And also the imports of coal from Great Britain had largely decreased and formed but an inconsiderable item in the gross total, for while in 1889 62,629 tons were brought to the Province of Quebec, only 16,974 were imported last year, showing that the Nova Scotia article is growing in favor as well as in demand. From these considerations, it is plain that the collieries in the Lower Provinces have much to lose and nothing to gain by any change from the present state, and on the subject of reciprocity a "masterly inactivity" will be found the most profitable attitude in the end.

The case of *Dansereau et al v. the Dominion Phosphate and Mining Company, limited*, was resumed on the 15th instant, in the Supreme Court at Aylmer, Mr. Justice Malhiot presiding. Mr. J. M. McDougall appeared for the plaintiffs, and Mr. J. R. Fleming, Q.C., for the defendants. It was commenced in May, 1892, but owing to the difficulty in collecting witnesses, and the absence at one time and another of the principals, it was adjourned until the above date. The history of the suit is as follows: In 1883 the phosphate mine owned by plaintiffs on what is known as the Chapleau lot, situate in the Township of Portland East, Ottawa County, Province of Quebec, was closed down, the mining plant being left on the property. Adjoining this property is the North Star mine, operated by the Dominion Phosphate

and Mining Company, the defendants in the present action, and it is claimed that the latter appropriated the plant belonging to plaintiffs for the purpose of developing their own mine. Dausereau *et al.* are now taking action to recover the value of the following effects, alleged to have been taken from their property: one steam boiler, one Ingersoll steam drill, with pipes, steels, fitting, etc., one pipe cutter, vise and tongs, three one inch globe check valves, two ¾ inch ditto, two dumping cars, a lot of crowbars, hammers, hand drills, etc., one complete set of blacksmith's tools, comprising sledges, bellows, files, anvils, pincers, etc., six iron pulleys, three shears, wire rope, derrick irons, three mining buckets, one hand force pump, between 600 and 1,000 feet of rope, and sundry minor articles, the whole of the value of \$2,176. The defendants while admitting the taking of the above articles, answer that a number were returned. To this the plaintiffs respond that, if such be the case all articles returned were in a condition unfit for further use, and that their claim for the whole amount should lie. The case is likely to continue for some days. A number of witnesses have been examined on the plaintiffs' side, among others, Messrs. G. R. Smith, E. G. Horan and F. S. Higginson, giving corroborative testimony as to the value of the plant.

The Annotated List of Canadian Minerals, by Prof. G. C. Hoffman, which has appeared in recent issues of the REVIEW, has attracted much attention as a concise and handy reference for the mineral community. In it will be found the chief localities of occurrence of each mineral, though it should be noted that Prof. Hoffman disclaims the enumeration of all the territories in which these minerals are found. The value of the work has been recognized by the Government who have had it issued in pamphlet form under the direction of the Geological Survey.

During 1890, 6,221,518 tons of coke were marketed from Connellsville, Pa., as compared with 5,325,826 tons in the preceding year. The prices obtained in 1890 were also considerably better than in 1889, coke selling for the first two months at \$1.75 per ton, and for the remainder of the year at \$2.15, the total value of the sales being \$12,903,940. In 1889, the price varied from \$1 to \$1.75 per ton, the average being about \$2.40, and the aggregate value \$8,156,156. Oven building has been active during the year, over 1,600 new ovens having been erected and a large number re-built. In 1889 the number was 14,458, while including those approaching completion, the total ovenage for 1890 was 16,113. The shipments for 1890 show a grand total of 355,070 cars, an average of 1,147 cars for every working day in the year, nearly 100 cars better than in 1889.

The price of coke, which had been firmly maintained at \$2.15 during the last ten months of the year, has been reduced 25 cents per ton for the present, owing to the importunities of the furnace men and the depressed condition of the iron trade, but the understanding is that it will shortly be advanced again to at least \$2.

Regarding reciprocity in coal, which is elsewhere referred to, several strong arguments against it are brought forward by Mr. J. R. Lithgow, secretary of the Glace Bay Mining Company, Halifax, in a letter from which we take a few extracts. He says:

"I have received a letter from one of the best informed coal brokers in New York, and during the reciprocity treaty which ended in 1866, the largest importers in the United States of Nova Scotian coals, whom they say: 'We do not think the market for Nova Scotian coals in the United States, would be materially increased by the removal of the present duty of 75 cents per ton. The sharp competition which exists between the different producers of the domestic coal, and the rapid growth of the facilities for supplying them, will, we think, keep the price of our domestic coals as low, if not lower, than Nova Scotian coals could be delivered in the States free of duty.'

"Not only would American coal, if free of duty, supplant Nova Scotian to a considerable extent in the province of Quebec, it would also create such a competition that the delivery prices in that province would be so lowered as to leave little if any profit to the shippers. Even with 60 cents per ton duty, delivery prices have been too low; remove the duty and of necessity still lower prices would follow and some of our collieries would have to shut down.

"In the United States their own coals are so much preferred to Cape Breton, being free of sulphur and soot, that they are preferred at 25 to 50 cents per ton more; hence this must be borne in mind in estimating the probable net value of Cape Breton coal in the United States. Now, last year \$2.15 to \$2.25 was the f.o.b. price at Baltimore of the best steam coal, and the freight to Boston was 90 cents to \$1.15 exclusive of the cost of discharging on to the wharf of purchaser. And this, be it remembered, when foreign competition was shut out by the 75 cents duty. American consumers are said to be crying out for the removal of the duty and cheaper coal; suppose the duty were removed and the way prepared for the admission of Cape Breton coal, would not the price of American coal be lowered at least 25 cents per ton? If so, then \$3 would be about the cost of a ton of American steam coal delivered at Boston; deduct from that 50 cents and you have about the value of a ton of Cape Breton coal delivered alongside of wharf in Boston. Well, when it comes to that, I hardly know whom to pity most, those who ship the coal or those who freight it."

We recommend these paragraphs to the consideration of those who are agitating for reciprocity.

Some light is thrown on the impressions created in the minds of European investors by the proposed mining tax of three per cent. to be imposed by the Quebec Government, in the following extracts from a letter from Dr. C. Killing of Amsterdam:

"I have been sent out by a large financial syndicate from Europe to Canada for the purpose of examining whether conditions are favorable to the investment of capital in Canadian phosphate mines or not. I have made a careful study of the question and my impressions on the whole are not unfavorable. But I may say the story of the proposed Government tax of three per cent. upon the output is a great disappointment.

"Suppose for instance that the European capitalists I represent should invest \$50,000 in the purchase of a mine or phosphate lands, and the yearly output of the property was 5,000 tons; the governmental tax would in that case amount to between \$2,500 and \$3,000, or between 5 and 6 per cent. of the invested capital. Do you believe that foreign capital will be attracted to a country where, besides other taxes, 6 per cent. must be paid to the Government? I believe that not one dollar of such capital will come into the country if this tax is imposed.

"I am now going back to Europe to report on the conditions of the investment of capital in Canadian phosphate mines, but I am sure that my friends will not think further of putting money into an enterprise under these circumstances.

"Everybody in the country knows that phosphate mines with a small output lose money, and that only those which produce large quantities make any. It would be an unjustifiable wrong to impose a tax upon phosphate mined at a loss. This experiment is very dangerous as well for the future of the phosphate mines as for mines in general, because I believe the industry cannot progress without foreign capital, but must remain in its present crude state.

"The principle of the tax is not wrong; it is its application. If the Government were to place an impost of three per cent. upon all outputs in excess of 4,000 or 4,500 tons, the small miners, who are barely paying expenses, would be protected, while the Government would derive more revenue from the paying properties."

We hope to have our old cover ready from the paper maker in time for the next issue, that in the present number being purely temporary.

The change of title in this issue from the Canadian Mining Review to THE CANADIAN MINING AND MECHANICAL REVIEW will not bring about any material alteration in the matter contained therein, being merely in order to assimilate more closely some interests connected with the mining and quarrying industries.

Representations were made a few days ago to the Montreal Board of Harbor Commissioners by a deputation from the Coal Agents' Association, that the existing charge of seven and a half cents per ton of 2,000 pounds for coal wharfage was too high, in view of the large and increasing trade between the Maritime Provinces and Quebec. The Board undertook to fully consider the arguments advanced and the deputation then withdrew.

The annual report on the work done by the Geological Survey of Canada in 1890, is daily expected, though it has not yet left the printers' hands. Sufficient time has elapsed to allow of its publication, and we hope, therefore, to be able to refer to it at greater length next month. The full report on the Sudbury district by Dr. Robert Bell is expected to appear some time in March. An interesting feature will be a number of photographic views of that region.

Mr. James Cooper, president of the Ingersoll Rock Drill Company, has gone to England to further negotiations for the transfer of some mining properties in which he has an interest. Mr. Geo. R. Smith, for many years superintendent of one of our phosphate mines, and more recently extensively engaged in the mining machinery and supplies business, has also gone to England in company with Mr. Cooper. Both gentlemen are widely known and highly respected, and we are sure that good wishes will follow them from their numerous friends.

A Novel Application of Electricity to Mining.—A recent addition to the application of electricity to mining, and one which seems destined to find considerable use, is a portable device for detecting the presence and nature of a mineral where the latter is exposed in the rock or earth. This apparatus, which is intended for the use of prospectors more particularly, consists of a battery and spark coil, which are enclosed in a box, and the conductors end in two platinum points. It is evident that if these points be connected to a conducting body and the circuit ruptured, a spark will be formed, the flame and color of which will give some indication of the nature of the body which the electrodes have touched. Thus, by placing the two points against a rock containing metal in a free state, its presence may be detected by merely applying one electrode and passing the other rapidly over the surface. The machine, which was invented by Mr. F. H. Brown of Chicago, will, it is said, enable a novice or "tenderfoot" to pick up float rocks on the hills and tell instantly whether they contain mineral or not, and even the comparative quantity in a rough way. By means of this instrument, also, it is possible to find a lost "lead" in a shaft or cut by applying it to the walls. Another use to which it may be put is to the sorting of ores, the color of the flame enabling the sorter to separate the different kinds. The apparatus, which weighs about ten pounds, is arranged to be carried on the back, and can be used to explode blasts in connection with electric primers.—*Electric Engineer.*

Brown's Patent Steel Wire Chain.—The Greening Wire Co. of Hamilton have just made a very important addition to their already extensive lines of manufacture, having purchased the sole right for the manufacture in the Dominion of Brown's Patent Steel Wire Chain. They claim for this chain, that being made of hard drawn steel wire, and the links being formed without welding, a uniformity of strength is obtained that is not possible in the ordinary chain. Actual tests show a wonderful difference between the Brown chain and the welded, a test made of No. 3 wire, broke at 1,950 lbs., breaking at the end of the link, while the same size of welded chain broke at 490 lbs.

Sudbury Nickel Deposits.

Report by Experts to the United States Government.

BUREAU OF ORDNANCE,
NAVY DEPARTMENT,

OCTOBER 14th, 1890.

Hon. B. F. Tracy,

Secretary of the Navy, Washington, D. C.

SIR,—In obedience to the Department's order of the 28th ultimo, we proceeded to Cleveland, Ohio, and on the afternoon of the 1st inst. were received by the Board of Directors of the Canadian Copper Company. These gentlemen informed us that every facility would be afforded us to see their property in Canada, and the plant, progress and processes at their mines.

Mr. S. J. Ritchie, one of the directors, was selected by the Board to accompany us, and he subsequently instructed the manager of the works to freely answer all our questions concerning the mines, and the operations of the company, at the various points under his management, and during our visit we found every indication of the desire on the part of the management and its employés to show us the exact state of affairs.

Wednesday night we left Cleveland; arrived at Sudbury Friday afternoon in time to examine the mining operations at the Copper Cliff Mine. Saturday we visited the roasting beds, and the smelting works at Copper Cliff, and were shown the indications of the line of ore deposits extending from the Evans to the McConnell mines.

The same evening we went to White Fish station, on the Algoma branch of the Canadian Pacific Railway, and the next day visited the deposits of the Crean Hill range and the Vermillion mine, returning to Copper Cliff to spend the night.

Monday we went to the Naughton station on the same line, and from there rode to and saw the Company's property in Creighton Township. Tuesday we visited the Stobie mine, and the works of the Dominion Co., at the quarter section marked Du Charme on the map (enclosure No. 1), Sir Hussey Vivian's works at the Murray mine, and the Worthington mine, belonging to the Dominion Company, at the point called Crean mine on the map above referred to.

The next morning we started on our return, via Sault Ste. Marie, visiting on the 10th inst. the shops of the Gates Iron Works and Fraser & Chalmers, manufacturers of mining machinery at Chicago, thence to Cleveland, Ohio, where we were again present at a meeting of the Board of Directors of the Canadian Copper Company, and on the 12th inst. returned to our regular stations.

Having thus briefly summarized our itinerary, we have the honor to submit the following general observations upon the mining district of Sudbury, and a more detailed description of the special points we visited:

THE SUDBURY MINING DISTRICT.

The presence of extensive and promising tracts of mineral deposits in what is now called the Province of Ontario has long been known, and as early as 1846 a report was made to the Canadian Government stating this fact, but saying that owing to the difficulties of access and the cost of transportation, working these deposits must be delayed until railways were constructed, and freightage to markets thereby reduced.

Enclosure No. 2.—A map published by the Canadian Pacific Railway Company shows the situation of this district and the lines of railways now finished; and it was not until the construction of this railroad that the great value of these deposits were even moderately estimated. Mr. S. J. Ritchie took out applications covering a territory of about 100,000 acres, extending in a north-easterly direction from Crean mine to Stobie, and embracing a belt of territory about 25 miles long and from three to seven miles broad, within which the mineral deposits were reported to lie. Upon a more careful examination of this district he selected the territory shaded red from the Evans to the Stobie mine, suffering the remainder which he had pre-empted to revert to the State. The Canadian Copper Company, which had been chartered January 6th, 1886 (capital \$2,000,000, afterwards, August 8th, 1889, increased to \$2,500,000) under the laws of the State of Ohio, and granted by special act of the Canadian Government, all the rights that it would have acquired under a Canadian charter, subsequently purchased the tract of land colored red in Creighton. All of the beds of ore seem to lie between strata of granite on one side, and diorite on the other, and as those formations generally plainly appear on the surface, they have guided the company in its selection of territory. We were fully convinced from the surface indications and the borings and shafts already sunk, that the company have an amount of mineral which cannot be exhausted by this generation. The surface indications are found in the belt previously mentioned, and although they seem in each case bounded by the walls of granite and diorite, more careful examination of the country when it is opened out may discover other valuable deposits, connecting those owned by this company.

The general character of this country and the neighborhood for hundreds of miles is broken by rocky ranges, from 100 to 600 feet high, the bare rocks cropping out in many places and the rest covered by a thin soil, upon which were pine forests. Between the hills are marshy valleys, and numerous lakes and streams, capable of

furnishing abundant water power. As yet there are no roads, excepting in the immediate vicinity of the railways, and the country is accessible only on foot, except where trails have been cut to several points.

About eighteen years ago forest fires swept the whole neighborhood, and the standing trunks of immense pines are surrounded by a second growth, which in the valleys is so dense as to be scarcely passable, and, with the fallen trees, slippery rocks and marshy lands, renders even a prospector's task difficult.

The Canadian Copper Company claim to have spent thousands of dollars in surveying and prospecting, and as they had the right of selection, it is reasonable to suppose that, with the great capital at their disposal, they did not leave much to others. The properties of the other companies mentioned are at the extremities of the belt, and may be only the fringe of the main body of deposits. From our examination they appeared to be in extent and capability hardly one per cent. of that owned by the Canadian Copper Company.

The Crean mine, at the south-west extremity, has been worked out and abandoned, and the Worthington mine, near the same, seems to be only a pocket.

The Dominion Company's mine, at the other extremity, seems to be nearly worked out, and the Murray mine but comparatively small; should other deposits be not found outside the belt mentioned, the Canadian Copper Company have practically everything. The others claim, however, to own large tracts of land in the north and north-west, but the existence of ores therein is disputed, and seems to be doubtful. Neither company claims to be doing any work beyond prospecting, at any points we did not visit.

The character of the ores in this district is technically described in a paper written by Dr. E. D. Peters, who was for a time manager of the Canadian Copper Company.

It is important to notice from an economic point of view, that these ores can be smelted in their natural state, that is, they do not require the admixture of fluxing substances. The dead pine timber found in great abundance in the neighborhood, and which can be delivered at the furnaces at \$1.80 per cord, is a good fuel for roasting, though hard wood would be better, but owing to the fusible qualities of the ores, and intermixed rock, it answers the purpose. Coke is hence the only material that has to be brought from abroad. This is procured from Pittsburgh, and can be delivered at the works at \$7 per ton.

The general processes are:

- 1st, Mining.
- 2nd, Roasting.
- 3rd, Smelting.

The points selected for mining are determined from surface indications, and by examination of the substrata by a diamond drill. This drill cuts a core from the rock through which it passes, thus furnishing material for analyses of the substrata. The convenience of working and transportation are of course considered. Should the deposits of ore be in large quantities on a hillside, it is simply blasted off, but as they more frequently dip under the surface, mining by a series of levels is less expensive. A shaft is run at an angle determined by boring a convenient depth, and then the ore blasted out of a large chamber, the miners working around the walls and ceilings, standing on the mass already thrown down, until work on this level is exhausted. The shaft in the meantime is continued to another level, and another chamber worked as before. Shaft mining is also much better adapted to the severe winter climate than surface work, and is alone sufficient reason for its adoption here.

The mass of rock and ore thrown down in the chambers is broken into handling sizes by the miners, the good ore separated from the rock and low grades, loaded into trucks and hoisted to the crusher at the top of the shaft. Passing through this, it is divided by sieves into three sizes, and falls into bins respectively. Before and after crushing, the "gangue" (non-ore bearing rock) is picked out as much as possible.

The rock from the chambers and low grade ore are dumped into a heap at one side.

2nd, Roasting.—Roast beds are prepared by levelling a surface on the ground, which should be well drained and hard. Upon this a thin layer of the "fines" is laid, then a layer of pine wood from one and one-half to two feet in thickness, according to the fusibility of the ores; then "coarse" and "ragging" is laid on to a depth of about seven feet, and the whole covered over with "fines" to confine the heat. Fires are started, and the mass burns from 40 to 70 days. It is then broken up and transported into bins near the smelting furnaces.

3rd, Smelting.—The furnaces are, speaking generally, vertical receptacles, into which combustion, started at the bottom, is continued through successive layers of coke and ore, the minerals fusing and running off as matte at the bottom, and the feeding continuing at the top as the mass smelts down.

Various qualities of ores are in bins at the level of the charge door of the furnace, and the successive charges of ores and coke are weighed and shovelled into the same. A cold blast at the bottom stimulates the combustion, and as the mass is fused it runs into a forehearth, from which the slag is drawn off at short intervals through a taphole near the top, and the matte at longer intervals from the bottom.

Upon the disposition of the means of handling the material through its various stages, avoiding handling to the greatest possible extent, depends to a considerable degree economic production.

Having thus generally noticed the characteristics of the district, and the processes employed, we beg leave to give a detailed description of the mines and ore deposits, as follows:

THE CANADIAN COPPER COMPANY.

The Copper Cliff mine and vicinity.
The Evans mine and vicinity.
The Stobie mine and vicinity.
The deposits in Creighton Township.

THE DOMINION MINERAL COMPANY.

The Bleazard mine.
The Worthington mine.
The Crean mine.
The Murray mine.

The Copper Cliff mine is situated on a branch road, about a mile from Copper Cliff Station, about four miles from Sudbury, on the Algoma branch of the Canadian Pacific Railroad, and was opened in the summer of 1886. The face of the hill, about 60 feet high, was blasted off, and a shaft sunk at 45° into the earth. The mining is now on the fifth level, and the sixth about to be opened, the length of the shaft being about 600 feet. 56,534 tons of ore have been taken to the roast yard from this mine from the opening up to the 1st of October, 1890. At present about 180 tons of ore are crushed daily. There are no indications of decrease in the extent or richness of the ore. It does not appear in veins, but the entire mass seems ore of varying grades, with small quantities of rock intermixed. There is irregularity in the ore as to the proportions of the above named minerals, one or the other predominating in spots in a way not to be predicted or accounted for.

The average amount of copper and nickel combined is about eight per cent., five of copper and three of nickel. Specimens, however, have been picked with copper running as high as 30, and nickel 15 per cent., but the presence of small deposits of abnormal richness cannot be considered as indicative of the richness of the mine, as regularity promises greater extent of the deposit.

The plant consists of a hoisting engine, with two drums and cables, one No. 5 Blake crusher, 15" x 9" aperture, with sieves for sorting ore, capable of crushing about 400 tons of the kind of ore taken from this mine in 24 hours, a steam pump and reservoir for compressing air for the rock drills, a small machine shop for making repairs, two boilers, furnishing about 80 H.P., which suffices to run all of the machinery, one steam pump used at the lower level of the mine, which condenses into the tank it pumps from, one small pump run by compressed air for filling this tank, and four rock drills, also run by air. In addition are the ore trucks and utensils for blasting, breaking and handling the ore.

Near this mine are the offices of the company, and about 40 log houses for the employés and their families.

The ore from the bins under the crusher drops into dumping cars upon the railroad track, which connects with the roast yard. This track runs up grade on to a trestlework about a mile long, leading towards the smelting furnaces. On one side of this trestle, the level of which is about 15 feet higher, the ground is levelled off for the roast beds, about 2,000 feet along the track, and from 150 to 75 feet wide. The ore from the cars falls through a chute in hand barrows, by which it is distributed over the beds. After roasting, the ore is carried in hand barrows to a track running parallel to the other, on the opposite side of the trestle, and on the level of the roast beds. This track leads to the smelting furnaces, and the roasted ore is dumped into the bins thereat. The present capacity of the roast yards is about 60,000 tons. This can be easily increased to 90,000 by preparing the ground near it at small expense, and indefinitely by lengthening the trestle, and cutting into the hillsides at no great expense.

At the time of our visit about 35,000 tons of raw ore were in the roast yards. The work in the yards is done by contract, and at present about 75 men are employed. The company provides fuel, plant and tools, and the contract price is 20c. per ton from bins and off cars on to the beds; and 30c. per ton off beds into cars, and into bins at smelting furnace. Total from bins at the mine to bins at the furnace, 50c. per ton.

Working full power, the beds can be used about four times a year; that is, counting the time occupied in bedding, roasting, and clearing the beds, it can hardly average less than three months; the full yearly capacity of the present yards is 240,000 tons. By additions that could be made in one month, the yearly capacity could be increased to 360,000 tons.

All the roasting of the Canadian Copper Company will be done at this point.

In connection with the line of tracks from the main line and roast yards are the smelting furnaces. The plant here consists of two Herreshoff water jacketed furnaces, with two complete sets of blowers, either of which has sufficient power to supply the blast for both furnaces.

The two levels of track are conveniently disposed for economical handling, the upper level dumping into the bins, on the level of the feeding platform, the roasted ores, raw, "fines," and coke, and the lower taking away the "matte," loaded from where it lies level with the platform of the cars.

The Herreshoff furnaces are an American patent, and said to be the best used. One has reduced 187 tons of the ore from these mines in one day, and the manager and furnace man said that, running without forcing, 135 tons could easily be reduced. English furnaces of the same size do not reduce more than 50 tons per diem.

The manager and chemist at the works said the average of the last month production was that about six tons of ore produced one ton of matte. The directors say that the records of the office show that, since the smelting works were started, about five tons of ore produced one of matte.

The ores from the three bins are smelted here, the company having no other furnaces, and they are combined so as to smelt readily. About one ton of coke is used for every ton of matte run off.

At the time of our visit only one furnace was running; the other was repairing. The average daily production of matte for the last month was 25 tons.

The full capacity of the two furnaces per diem would be about 60 tons of matte. The matte averages 17 per cent. nickel and 23 copper.

The daily output of nickel would be, at this rate, 10.2 tons.

There is at present about 6,500 tons of matte ready for delivery, and the ore on the roast beds will produce about 6,000 tons more, containing 1,105 and 1,020 tons of nickel respectively.

To run one furnace the following men are required:

- One weigher.
- Two engineers.
- Two furnacemen.
- Two slag-wheelers.
- Two charges.
- One yardman.

Total, ten men, at an average pay of \$1.80 per diem.

Attached to the furnaces is a well fitted laboratory with F. L. Sperry, chemist, in charge, and two assistants. Here each run of matte is analysed, and assays made of ores as needed.

The whole disposition of the plant is well planned for working with economy, and it will be observed that the ores are handled but four times: 1st, into the cars in the mines; 2nd, into the crusher; 3rd, off the roast beds; 4th, into the furnace. At other operations it falls by gravity into or from the bins or cars.

To increase the plant the company has purchased a "Gates Crusher" from the Gates Iron Works of Chicago, and it, with its accessories, is now on the grounds ready to be set up. It is the largest size they make, with three apertures, 18" x 42" each, and its capacity is listed in the catalogue of the makers 100 to 150 tons per hour. Gates, whom we saw in Chicago, stated that it would crush 200 tons of the friable ores of Sudbury per hour. This will give a per diem crushing capacity at the Canadian Copper Company's of 6,000 tons.

THE VICINITY OF THE COPPER CLIFF MINE.

Starting from the hill into which the shaft of this mine is sunk, we rode over a range of hills to the point named on the map "McConnell mine," a distance along the range of about 2½ miles. On the hill just back of the shaft of the Copper Cliff mine borings have been made, all finding good ore. One was sunk to a depth of 291 feet at 15° from perpendicular, and the core extracted showed good ore for 226 feet along this length. Following along the ridge, which we estimated was from 100 to 250 feet above the level of the valley at Copper Cliff, and from 300 to 1,000 feet broad at base, the surface indications are continuous. At the Lady Macdonald mine and the McConnell mine the hills of ore were most conspicuous, and at places of each the surface had been blasted away to a depth of several feet, where rich ore, unaffected by exposure, was found. The surface indications are so evident that no expert knowledge is needed to pick out the ore-bearing rock, which is reddish brown, and quite friable, very different from the granite and diorite range which bound it. The assays of both the above mines show rich ore, better than at Copper Cliff, and in the case of the Lady Macdonald, blasting at the top of the hill and about 150 feet lower, at the small lake, finds good ore, leading the prospectors to assert that the hill was a rich mass throughout.

From this range to Stobie mine, the land is lower, and the country hardly passable. We were told that surface indications at various points connected these with the range of Stobie deposits three miles to the north east. We did not attempt to ride through this country.

Specimens from the various points blasted out were procured on the spots, and can be analysed if the department so directs.

The Evans mine is situated about 1½ miles south west of Copper Cliff station, near the Algoma branch of the C.P.R., and is connected therewith by a half mile of track. It was opened in the summer of 1886, but work was not pressed, and in 1887 only a depth of 20 feet was reached. Now the shaft runs down to the second level

of 186 feet from the collar of the shaft. The first level has been blasted to the surface, and a large pit about 90 feet deep and 200 feet in diameter is exposed. The sides appear to be for the greater part, ore, and no limit has yet been reached.

The mining plant here is practically the same as at the Copper Cliff. The hoisting machinery, however, is somewhat heavier, and the steam power is provided by a battery of four boilers, capacity, 220 H.P., of which two are sufficient to run the plant. The crusher capacity is the same as at Copper Cliff, about 400 tons maximum per day. 32,817 tons of ore have been taken from this mine to roast previous to October 1st, 1890. At present about 180 tons are crushed daily.

The grade of the ore is not quite as high as at Copper Cliff, and averages about seven per cent. Some roasting has been done here, but in future all the ores will be taken to the main roast yards. A short line, about half a mile, connects with the main line, and facilities for handling ore are the same as at Copper Cliff.

THE VICINITY OF THE EVANS MINE.

A granite range between the hill now worked at Kelley Lake seems to bound the deposits in a south-easterly direction. The company owns the lots which are shaded by etching in addition to those colored red on the map. Surface indications are found to the north connecting with the Copper Cliff Range, and the hill halfway between has promising deposits; thence across the valley to Copper Cliff are no surface indications, nor have any borings been made, but it is thought that the bed of ore connecting the two may be found at a moderate depth.

The Stobie mine is situated about 3½ miles north of Sudbury, near a branch of the C.P.R., built to serve this and the Blezard mine, and connected therewith by a

the base of the mounds forming the ridge.

THE DEPOSITS IN CREIGHTON TOWNSHIP.

These we reached from the railway above Naughton station by a ride of five miles through an almost inaccessible country. The size of the deposit is far more striking than any we visited. It is a mound of the general dimensions shown in this sketch, the dimensions of which are estimated. The height of the mound is taken from the level of a body of water as indicated on the map. The hill, over the greater part of which we rode, seems to be entirely ore-bearing rock. No assays have been made of the ore of this deposit, and we can only say that the indications of an immense deposit were more striking here than at any other point. This property was acquired by the company in 1886 and 1887.

THE DOMINION MINERAL COMPANY.

The Blezard mine.—This, the principal mine of the company, is situated on a branch built by the C.P.R., and owned by it, in the quarter section marked "Du Charme" on the map, and colored yellow. It is about 4½ miles north of Sudbury, and it is the northern extreme of the deposits now worked or known to us to exist. Three shafts are sunk into the hill vertically, about a hundred feet apart. The main one is sunk about 90 feet, and chambers worked from this level. They extend for about 200 feet in each direction, and the manager said that since July 15th, 1889, 45,000 tons of the ore had been taken out. The rumours in the neighborhood are that the mine had been worked out, but they were from competitive sources. The chambers seem well cleaned from ore, and though lighted by electricity, we could see but few evidences of active mining. The manager claimed a daily product of 180 tons of ore; that it took from nine

to twelve to make one ton of matte, and that this averaged from 20 to 30 per cent. nickel, and from 12 to 15 per cent. copper.

The hill which was being worked was about 100 feet high, and about 500 feet in diameter. We saw no evidences of other deposits near, and the manager claimed none. The plant is excellent, and copied after that of the Copper Cliff mine in the selection of machinery. One Blake No. 5 crusher, and rock drilling and pumping machinery, of the same pattern as before mentioned—the whole rather better installed than at the Copper Cliff mine. The roast beds, however, were placed all about the grounds, and could not be so economically handled. We counted 26 heaps in all, and estimated there was about 13,000 tons of ore upon them.

In the smelting works is one furnace similar to those at the Canadian Copper

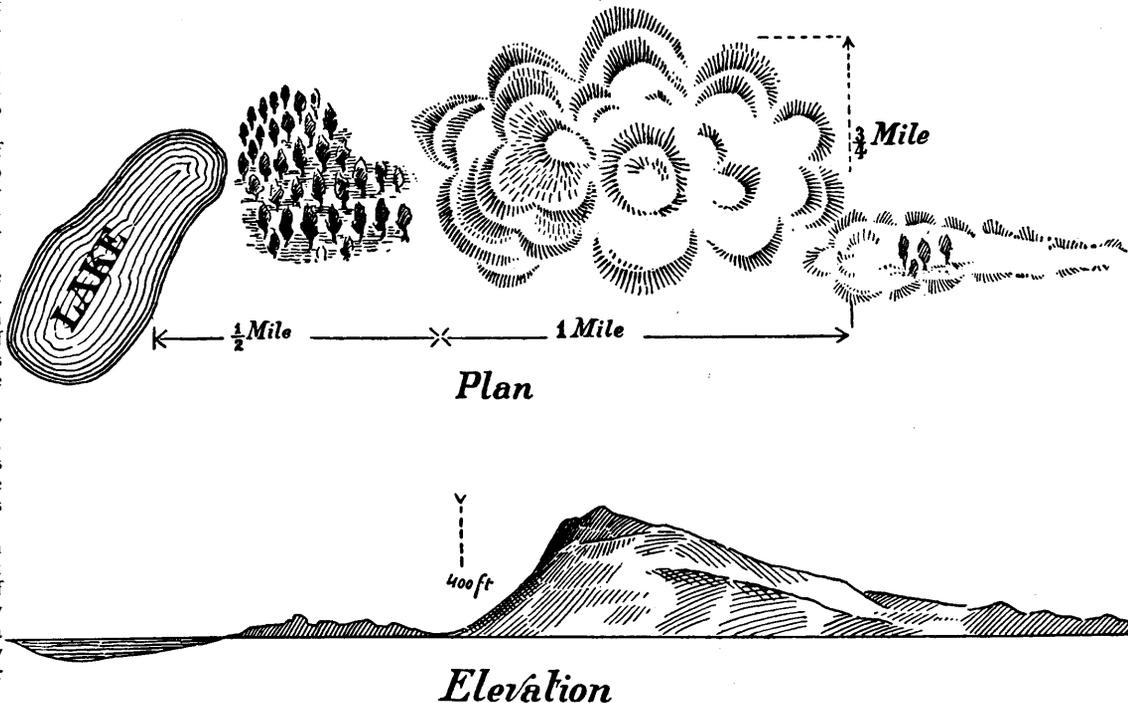
Company's works, with similar accessories. They had not more than ten tons of matte on hand, in two heaps, which they claimed to assay 30 and 33 per cent. of nickel. We procured samples from each pile, which can be assayed if the department directs. The manager claimed that the company owns 5,000 acres of land, upon which were nine places they contemplated working, six for copper and three for nickel. He spoke of the Worthington mine as being the richest, and gave us a sample of ore which he claimed would assay 40 per cent. nickel. He said that one shaft had been sunk 72 feet (Crean mine), one 25 feet (Worthington mine), and at four other places cross-cuts had been blasted. Although the deposits at Crean mine as shown on the map had been represented to us as worthless, owing to his representations we visited them.

The Worthington mine is situated on the Algoma branch of the C.P.R., about seven miles west of White Fish Station. We found a mound about 30 feet high and 50 in diameter, with a small shaft sunk in the middle about 25 feet deep. From it had been taken a few tons of ore, which appeared quite rich in nickel. The man in charge, however, said it appeared to be only a pocket, and that the end had been probably reached. He mentioned one very fine specimen of ore, half of which he had sent to the principal office, and showed us the other half of the piece we had in our possession. As the property is alongside a railroad now seven years in active operation, it seems reasonable to suppose that it does not pay to work.

The Crean mine is within a few hundred feet of the Worthington. The shaft was sunk by previous owners to a depth of about 70 feet, and was abandoned as unprofitable. No work has been done on it since.

H. H. VIVIAN & COMPANY.

The Murray mine is situated on the main line of the C.P.R., 2½ miles north-west of Sudbury. The railway cuts through the deposits. On the left side is a hill about 75 feet above the track, and extending about 300 feet perpendicular to and 150 along the same. This embraces



quarter of a mile of track. It was opened during the summer of 1887, by running two tunnels horizontally 100 feet into the hillside, about 150 feet apart, both of which developed excellent ore. Since then mining has been carried on by simply blasting off the face of the hill to about 50 feet depth, and 300 feet across the face. No limit to the deposit has yet been reached. 15,690 tons of ore have been carried from this mine to the roast yard up to October 1st, 1890, and the daily average at present is about 110 tons.

The mining plant is about the same as at the Evans mine; one Blake No. 5 crusher, drilling and hoisting machinery.

The blasted rock is broken up in the pit, loaded by hand into buckets, which are dumped into trucks, hoisted up an incline to the crusher, and thence passing to the bins.

The percentage of nickel and copper at this mine is smaller than at either of the others, hardly averaging above five per cent., but several pockets very rich in nickel have been worked.

The ore is remarkable for its fluxing qualities, and forms a valuable mixture to smelt the less fusible ore of the other mines, and entirely obviates the necessity of the addition of any foreign fluxing substances.

The crushed ore is carried on cars to the roast yard as Copper Cliff.

THE VICINITY OF THE STOBIE MINE.

Stobie is, in the opinion of the Canadian Copper Company, the north-west limit of the valuable belt of ore deposits. Passing over the hill now worked, which is about 90 feet high, and about 600 feet at the base, and seems almost entirely a mass of ore, and over a valley, a ridge is found extending to the south-west in the direction of the Lady Macdonald mine. The range is almost bare of timber, and the deposits could be easily seen. We were told the length of the ridge was two miles, but we did not take time to go over the whole of it. The height is estimated from 50 to 150 feet above the level of the railroad at Stobie, and from 300 to 1,000 feet across

all the deposits claimed on this side of the railroad. On the other is a mound about 15 feet high, and extending 100 feet perpendicular to and 70 along the track. Both of these are evidently of ore-bearing rock. Beyond the mound on the north side of the track, across a marsh about 100 feet wide, another small deposit was visible, which the manager claimed extended to the north-east for miles, he knew not how many. They were making no preparations to work these latter deposits, and their existence is disputed. The manager says another company owns the section north of them, but beyond that they owned a large territory.

There is one shaft sunk in the hill on the south side of the track to a depth of 60 feet, and from this they are taking small quantities of ore, which is handled in hand barrows. They have a small crusher of not over 75 tons capacity per diem. The furnace is of the English pattern, the same as used in the company's works at Swansea, England. It can reduce about 40 tons of ore per diem, and has been in operation about three weeks. Another similar but larger furnace is building. The works are not economically planned for working on an extensive scale.

Eight thousand tons of ore have been mined in the last year and a half, since the mine was opened. The ore runs about two per cent. of copper and nickel combined.

The matte is 8 per cent. nickel and 4 per cent. copper. The manager said he had orders to mine 40,000 tons next year.

The place cannot be in any way considered as a competitor of the Canadian Copper Company.

GENERAL SUMMARY.

	Canadian Copper Co.	Dominion.	Vivian's.
Aeres owned known to us	13,000	480	320
Additional claimed		5,000	4,000
Amount of ore taken from mine to Oct. 1	105,000	45,000	8,000
Daily crushing capacity, ore	1,200	400	150
Daily furnace capacity, matte	72	14	5
Estimate of tons of ore above surface of ground in de- posits seen by us.	650,000,000	2,500,000	240,000

We visited the Fraser & Chalmers Company, and the Gates Iron Works, in Chicago, where the various statements concerning the capacity of the plant and embodied in this report were verified.

Very respectfully,

WM. M. FOLGER,
Commander U. S. Navy.
B. H. BUCKINGHAM,
Lieutenant U. S. Navy.

Examination of Mineral Properties.*

By PROF. H. S. MUNROE.

The mining engineer, when called upon to examine a mineral property, should be prepared to answer the following questions, or their equivalent:

1. Will it pay to work the deposit?
2. How much capital will be required to develop and work the property?
3. What is the property worth? Do you advise its purchase at the price asked?

These questions involve more than is apparent at first sight. It may sometimes happen that the deposit is so large and rich, or so small and poor, that the first and most important of these questions can be answered at once. In such cases, however, the services of the mining engineer will hardly be required.

If it is at all doubtful whether the property is workable or not, we must ascertain the extent of the deposit, its average thickness and the probability of its continuance. We must determine the richness and purity of the mineral, and other things having influence on its market value. Finally it will be necessary to estimate the cost of mining and of preparing the mineral for market, the cost of transportation and the probable selling price. Each of these new questions will suggest further lines of investigation. For example, the cost of mining will depend largely on the scale of operations, and this, in turn, on the extent of the deposit, the market for the product, and many other things.

The value of the property depends on its capacity for earning profits or dividends, to determine which demands most careful and accurate estimates of capital, working costs and probable production, as well as the time required for the different operations, as affecting the question of interest.

Many, if not most of these things, are usually guessed at. The value of the estimates and conclusions in such case depend on the guesser's ability and previous experience in the particular kind of mining in question, and on his familiarity with the local conditions affecting the result. Such guesses are often far from the truth, and the consequences disastrous both to the reputation of the guessing expert and to those who invest their money on his recommendations.

The object of the present series of papers is to outline a method of procedure by which data can be obtained for

* School of Mines Quarterly.

careful estimates, and much of the uncertainty now attending the inception of mining enterprises removed.

It rarely happens that questions involving the scale of operations, the amount of capital required and the value of the property can be answered definitely, or even guessed at, until the nature and extent of the deposit have been determined by exploratory workings, costeaning ditches, drifts, bore-holes, prospecting shafts, etc.

Often large amounts of money have to be expended in such preliminary work before the true character and value of the deposit is known. Sometimes, indeed, it is even necessary to develop and work the deposit on a small scale before these questions can be definitely answered.

The examinations made by the mining engineer will then be of two kinds.

1. A preliminary examination of the undeveloped or partly developed property to determine whether further exploratory work is warranted by the "prospects," and if this prove to be the case, to decide upon a systematic plan of exploration which will give the desired information as to the nature and extent of the deposit.

2. A final and exhaustive examination of the property to obtain data to determine the best method of working, the scale of operations, the amount of capital required and the probable earnings and consequent money value of the property.

PRELIMINARY STUDIES.

Before undertaking the preliminary examination the engineer should make himself familiar, as far as time and opportunity permit, with similar deposits in the same region and elsewhere. The study of developed properties, their history and the conditions under which mining has proved profitable, will be of great service. In some regions an ore yielding one or two dollars to the ton can be worked with profit. In other regions, under different conditions, an ore yielding twenty dollars will not pay expenses. In this study of similar deposits the engineer should also note carefully the associated rocks and characteristic minerals, the mode of occurrence of the useful minerals, and, in general, such features of the deposit as influence the value of the property and determine the mode of working.

In default of opportunity to examine similar deposits, much information can be obtained from geological reports, state and governmental; from the reports made by geologists and engineers on adjoining or similar properties; from the transactions of scientific and engineering societies, and from articles and correspondence in the technical journals. Finally it is assumed that the engineer is familiar with the literature of ore-deposits, and has had practical experience in mining operations and in field geology. Nothing, of course, can make up for the lack of this knowledge and experience.

PRELIMINARY EXAMINATION OF THE PROPERTY.

In the preliminary examination of the property the following objects should be kept in view:

1. Endeavor to determine the geological character of the deposit, as for example, whether it be a regular bed or vein, or an isolated mass or impregnation.
2. Determine carefully the thickness and other dimensions of the deposit where exposed; its dip and strike, the occurrence of folds, squeezes, faults and other irregularities, and the nature of the surrounding or overlying rocks and soils.
3. Note the relations of the deposit to the surface topography, and to the natural lines of drainage and of transportation.
4. Determine the relations existing between different exposures of mineral on the property, and whether they are on the same or represent different deposits; also the relations between the deposit and exposed rock-formations.

TOPOGRAPHICAL SURVEY.

As a basis for this work a topographical map of the property is indispensable. It is only necessary to enumerate some of the possible uses of such a map to make this evident:

1. The relations of the mineral deposits to the property lines can be seen; and steps taken, if necessary, to secure or control adjoining properties before the work of exploration and development is begun.
2. The relation of the different outcrops and developments, and whether they represent one deposit or several, can be determined; sometimes at a glance.
3. The area of the portion of the property underlain by the deposit can be measured, and the available areas of mineral at certain depths and within certain boundaries determined.
4. If the geological structure be complicated, all the known data can be brought together on the map and sections, and advantageously studied.
5. The probable outcrop line can be determined and traced on the map as a guide to works of exploration and development.
6. If necessary, the underground contours of the deposit can be determined approximately; and the probable depth of a shaft, or the length of a tunnel, to reach the deposit can then be measured on the map.
7. Roads, buildings, and all surface works, and in general all the works of exploration and development can be much better located and planned with the aid of an accurate map than is possible without such assistance.

SURVEYING FIELD-WORK.

When the property is small, or the problems simple, a sketch map will serve every purpose. This may be based on an outline plot from the description in the title papers.

When time and the importance of the work permit, a careful topographical survey should be made. All outcrops of the deposit, and of overlying and underlying rocks, should be plotted on this map in their true positions. From the measurements of dip and strike and level it will be possible to construct geological cross-sections and to determine the probable lines of outcrop as a guide to further exploration. Finally, the costeaning ditches, prospecting shafts, and other exploratory workings should be plotted from time to time on this map and on the sections, that the full import of the new developments may be studied as the work goes on.

When the property is covered with timber and underbrush the topographical survey may be made by the rectangular system. When the country is open, however, other more rapid and economical plans of work should be adopted. The expert topographer will not confine himself to any one system of work, but will in every case adapt his method to the conditions by which he finds himself surrounded.

If the rectangular method be adopted the base should be run along the line of the principal developments. From this base laterals will be run, 200, 300, or 500 feet apart, and prolonged as far on either side of the base as may be necessary. These laterals should be joined at their extremities by tie-lines parallel to the base line to check the accuracy of the work. The lines will be run with range-poles, by the compass, or by the transit, and the distances measured by pacing, chaining, telemeter, or steel tape, according to the importance of the work and the degree of accuracy required. To facilitate plotting the stations on these lines should be located at uniform distances, 200, 300, or 500 feet apart, and sub-stations interpolated when necessary for details. Finally, the levels of all stations will be determined by barometer, hand-level, water-level, or wye-level, according to the degree of accuracy desired. If the barometer be used, continuous readings should be taken at some reference point to determine the fluctuations of the barometric column during the day. A self-registering aneroid may be used for this purpose.

The contours should be sketched in the field, and not constructed in the office from the levels of the stations, as is too often done. This is especially important in the survey of mineral properties, as the configuration of the surface often throws much light on the underground structure.

When the country is free from underbrush the survey may be made with the transit and telemeter-rod. A series of closed polygons will be run along roads, ridge lines, and lines of natural drainage. From the main stations on these traverse lines sub-stations will be determined by radiating sights and telemeter readings. More distant points may be located by intersecting cuts. Vertical angles will be freely used for determining differences of level.

If the country be open much time will be saved, and the accuracy of the work increased by triangulation and by the use of plane-table methods. In many cases the plane-table itself may be used to advantage.

For open country, also, surveying by photography,* the camera being used as an angle-measuring instrument, will doubtless find increasing application. Not the least of the advantage of a photographic survey is the short time required for the field work. The photographs also supplant the map, and reveal details of topography which would otherwise be obscure.

GEOLOGICAL FIELD-WORK.

A careful and systematic geological examination of the property will be made in connection with the topographical survey. All outcrops of mineral and of associated rocks should be examined and located on the map in their true position, elevation, and extent. The dip, strike, and thickness of rock exposed should be noted in each case, that the data may be accurately plotted on the sections.

Search for outcrop should be made on steep hillsides, on the crests of hills and ridges, in the beds of streams, in the roots of overturned trees, and in wells, cellars, quarries, road-cuttings, and other artificial excavations.

Even when the solid rock is not exposed the decomposed rocks and soils may furnish an indication of the character of the underlying rock. This, of course, is not the case in alluvial valleys, nor in regions covered by glacial drift. Elsewhere the decomposed rock, often 20, 50, or even 100 feet thick, remains nearly *in situ*. Sometimes the vegetation, shrubs, trees, etc., as characteristic of certain soils, may furnish important clues to the nature of the underlying rocks and minerals.†

Search should be made in the beds of streams and on hillsides for "float mineral" or "shoal stones," and for fragments of rocks and minerals known to be associated with, and characteristic of, the deposit. By tracing such float up the stream, or up the hillside, the outcrop may sometimes be found, or at least approximately located.

The outcrop of a metalliferous vein frequently manifests itself as a line of rocks stained with oxide of iron, often honeycombed and porous, the "gossan" or *eisen-hut*, the iron oxide of which results from the decomposition of the pyrites, usually present as a constituent of such veins.

The bed of fire-clay under a coal-seam, being impervious to water, frequently determines the horizon of numerous springs issuing from the hillsides. As the coal and

* *Photography Applied to Surveying*. Lieut. H. A. Reed. Wiley & Son, 1888. Also, *Modern Methods and Apparatus for Surveying*. H. S. Munroe. *Trans. Am. Inst. of Mining Engineers*, vol. xxiii. (in press).

† See "Indicative Plants," R. W. Raymond. *Trans. Am. Inst. Mining Engineers*, vol. xv., p. 644.

the associated rocks usually contain pyrites these springs are often chalybeate.

RELATIONS OF TOPOGRAPHY TO GEOLOGICAL STRUCTURE.

Finally, the topography of the surface, if carefully studied, will often throw much light on the underground structure.* The ravines and valleys are formed by the gradual erosion of the surface. The shape of the resulting hills and ridges is necessarily influenced by the inclination of the strata, by the relative hardness of different rock-beds, and by the presence of folds and fissures and other lines of weakness. A quartz-vein or bed of hard rock may show itself as a sharp ridge or as a well defined bench; and a stratum of soft rock, or the line of a great fissure, or the weakening of the strata by an anticlinal fold may produce a ravine or a deep valley. A break in the line of a ridge of hard rock may prove to be due to faulting, and in such case is often accompanied by the lateral displacement of the ridge beyond the fault. In regions where the strata are horizontal the small streams often will be found in deep ravines with precipitous banks. When the rock-beds are inclined the ridges will usually follow the strike of the rocks, and one hill-slope will be gentle and the other precipitous.

The importance of care and accuracy in the topographical work is evident. If the contours be carelessly drawn important truths may be concealed or false inferences deduced.

MAP AND SECTIONS.

The field work completed, the data will next be plotted, and the lines of probable outcrop of the deposit traced upon the map as a guide to prospecting operations. If the deposit be a bed or fissure-vein, and the plane of the deposit can be approximately determined, the tracing of the outcrop line is comparatively simple, involving merely the application of the principles of descriptive geometry. If the plane of the deposit be a warped surface, or combination of such surfaces, as in the anthracite coal-basins of Pennsylvania, the tracing of the outcrop is more difficult. The best method of procedure in such case is to construct from the data obtained in the field, and platted on the map, a series of cross-sections. In projecting the measurements of dip into these sections, due allowance must be made for the inclination of the strata from or toward the section where the lines of strike are not normal to the section. Allowance must also be made for the curvature of the lines of strike in some portions of the basin. From the cross-sections so constructed the approximate shape of the basin can be determined and the underground contours of the deposit sketched. Each intersection of an underground contour line, with a surface contour line of equal elevation, marks a point of outcrop. Joining these points by a continuous line we have the required outcrop.

PROSPECTING.

In order to answer definitely the questions asked at the beginning of this paper it is evident that we must know at least approximately the amount of available mineral, as well as its richness, purity, and other circumstances affecting its value. To form a reliable estimate of quantity it is necessary to know the extent of the deposit and its thickness. The area within the definite boundaries and above any assumed level can be determined from the map and sections. Thickness must be measured. It is not enough to know its thickness at one or two places only, but we must know the average thickness. The greater the number of measurements that can be made the more accurate will be the average result. In like manner a large number of samples from different parts of the deposit will be necessary to determine the average quality and richness of the mineral.

The work of prospecting, then, should be conducted so as to expose as much of the deposit as possible, to enable the measurements to be made and the necessary samples secured.

The exploratory workings are of two kinds, surface and underground; the first directed toward uncovering the outcrop of the deposit, and the latter to prove the deposit in depth. Both are necessary. Too much importance, however, should not be attached to workings in depth, and the surface exploration should in no case be neglected. The outcrop of a mineral vein or bed may be altered by weathering, and may be richer or poorer, better or worse, than the unaltered deposit below. Apart from this the outcrop represents an average section of the deposit, and measurements made on the outcrop will probably represent the true average thickness of the vein. The outcrop represents a section produced by erosion, possibly thousands of feet below the original outcrop. It is not probable that an artificial section, obtained by underground workings a hundred feet or so lower, will be any more reliable in this respect. In most cases there is no reason why a vertical section made by a shaft should have any greater weight in the determination of average thickness than a horizontal one.

Surface explorations are far cheaper, are more rapidly executed, and permit a more satisfactory examination of the deposit than underground excavations.

Underground workings are, however, necessary to determine how far the deposit has been altered, and the richness or quality of the mineral changed by weathering. The results will enable the proper correction to be applied to the data obtained in the examination of the outcrop.

* See *Coal and its Topography*. J. P. Lesley. Philadelphia, 1856. Also *Topography with Especial Reference to the Lake Superior Copper District*. J. G. Blandy. *Trans. Am. Inst. of Mining Engineers*, vol. 1., p. 75. Also, *On the Importance of Surveying in Geology*. Benj. S. Lyman. *Trans. Am. Inst. of Mining Engineers*, vol. 1., p. 183.

Meeting of the Excelsior Copper Company, (Limited).

An extraordinary general meeting of the shareholders of this Company was held on Friday, 24th ult., at the Cannon Street Hotel, London, for the purpose of considering and passing certain resolutions for winding up and reconstructing the Company. Col. Malleon presided.

The SECRETARY (MR. G. R. FENWICK) read the notice convening the meeting, after which

The CHAIRMAN said: In the month of April last we held an ordinary meeting of the shareholders of this Company. On that occasion Captain Davey (the mining captain of the Company), who had just then returned from Canada, gave his report as to the value of the mine. He then pointed out that it required a certain sum of money—about £20,000, I think it was—to bring the mine into a dividend-paying condition. It was after that ordinary meeting that the meeting resolved itself into an extraordinary meeting for the purpose of considering the ways and means of the company, and how best to raise the £20,000 required for the development of the mine. It was finally decided by, I think, an absolutely unanimous vote, that the money should be raised by the issue of debenture bonds. We sent out circulars in conformity with that resolution, asking the shareholders to subscribe to the debenture bonds, the directors pledging themselves to subscribe in equal proportion if anything like the sum required should be subscribed by the shareholders. I regret very much to tell you that the reply of the shareholders was not satisfactory. The amount subscribed was so small that it was returned to those who had subscribed, and the directors set themselves to work to try and find out whether there were any other means by which, by subscriptions, among themselves and their friends, they could carry on the development of the property. The value of the property has been proved right up to the hilt, and if any of the shareholders would like to hear anything on that subject, I am happy to tell them that Captain Davey is in the room, and if they wish it he will address them on that subject. Under these circumstances, and having failed to obtain the money required for the development of the mine by debentures, your directors came to the conclusion that the only way in which it might be obtained was by reconstruction, on the basis of imposing on the shareholders a payment in proportion to their several holdings. This will be carried out by the issue to the present shareholders of shares 18s. 6d. paid. That is to say, that each shareholder in the new Company will be liable for a subscription of 1s. 6d. on every share he may hold in the old Company. But, although he becomes liable for 1s. 6d. per share, it does not at all follow that he will be required to pay up that sum. I myself am of opinion that 1s. per share will be the total amount that may be necessary to call up, and I see gentlemen before me who are sanguine enough to think that even 6d. will be sufficient. At all events, whether it be 6d., whether it be 1s., or whether it be 1s. 6d., the amount is small in proportion to the great value of the mine which is your property. The value of the mine, as I said before, is placed absolutely beyond the realm of doubt. I shall content myself now by moving the first resolution: "That it is desirable to reconstruct the Company, and that with a view thereto, the Company be wound up voluntarily."

MR. J. R. ARMITAGE seconded the resolution, which was then put and adopted, with two dissentients.

The CHAIRMAN moved that the liquidator be authorized to transfer to a new Company, to be incorporated with limited liability under the Companies Acts, 1862 to 1890, all and singular the lands, hereditaments, mines, mining water, and other rights, leases, buildings, plant, machinery, stores, and all other the property and effects of this Company, of every description whatsoever, upon the terms and conditions named.

MR. BATTINSON seconded the resolutions, which were then put and carried unanimously.

CAPTAIN DAVEY then said: Since I last met you at this place I have been out to Canada, where I went with the intention of working a diamond drill in connection with the property; but, as the Chairman just now stated, the money which was proposed to be raised by the Canadian Board was not forthcoming, so we had to work with the limited means at our disposal from this side. We commenced on the dump ores with the most primitive method possible to adopt—three wash tables, one hand jigger, and one buddle. All the stuff was put through a screen, the rough being picked by boys, and the fine treated in the jig and buddles. As a result of that we sent to Swansea eighty-seven tons at a cost of about £340. When we can work our concentrating plant we shall have some good ore to commence with. I calculate to have on the dumps about 10,000 tons ready for treatment. We have sent over, as I have told you, 87 tons of ore averaging from 11 to 24 per cent. This, I am sure the shareholders will say, is a good average for dump ore. But, taking the ore at an average of only four per cent., this will give you a grand total of 400 tons of copper or metal, equal in value to £20,000 sterling at the present price of copper. The whole quantity can be brought to market at half that amount, or £10,000, which will include the cost of plant for treating it. Thus you will be left with a profit of £10,000. What is already broken at the surface is one of the best assets on the Company's property. To treat the dumps you require, in my opinion, a mill and concentrating plant to treat 100 tons of stuff per day. This will cost you £3,000 when erected. In treating four per cent. ore as above you will get (counting one per cent. for

loss) three tons of metal per day, or equal to £180 per day, taking the value at £60 per ton. From this deduct £8 per ton for smelting, and you have to the good £156 per day, or £4,368 per month of twenty-eight days. This estimate is taking the stuff at 3 per cent., but it ought to run to 6 per cent., and, if so, be all the more valuable. If £2,000 be taken for mining, milling, and smelting, there will still be left to you a monthly profit of £2,368, or £28,416 for the year. This I consider a good profit on an outlay of £3,000. During the past two years your mine has been worked with an idea to get out all the available ore, without the least thought of where the ore is coming from after the then reserves were worked out. They have worked up to this point, but there is not an and in advance of a stope, and the stopes are shallow and poor generally. The work has been on both vein and bed-rock, and stoped wherever there has been a sign of ore. I am satisfied that you have a valuable property if only it is fully developed. I don't hesitate for one moment to say that if the money is raised, before this time next year you will have a dividend. I may be told that that is a rash promise on my part, but it shows the confidence I have in the mine. There is also asbestos on the property, and I think, with a little looking after and a little prospecting, we shall not only have copper ore, but also asbestos, and that, as you know, is a very valuable commodity.

In answer to questions, the CHAIRMAN said that in future the Company would only have directors in England. The directors had given fullest consideration to various schemes for the raising of capital, but it was felt that in the present state of the money market it was absolutely inadvisable to appeal to the public for assistance.

The proceedings shortly afterwards closed.

A Summary of the Quebec Mining Bill.

This Bill, which has been passed at the late session of the Legislature of the Province of Quebec, may be summarized as to its principal features as follows:—

In all future sales of lands for agricultural purposes, the Crown reserves the mining rights.

Any person discovering a mine may purchase it; but upon private lands the occupant of the surface has the first right to purchase.

From May 1, 1891, a royalty shall be levied of 3 per cent. of the merchantable value of the products of all mines and minerals (unless the amount is already determined otherwise). The royalty on gold is to be 2½ per cent. of the gross weight estimated at \$18 an ounce, and on silver at 2½ per cent. of the gross weight.

For a fee of twenty cents one may see the registers and plans in the mines office.

Inspectors may be appointed by the Lieutenant-Governor, under the control of the Commissioner of Crown Lands.

The inspector has the powers of a justice of the peace, and decides in a summary manner, without appeal, all contestations and suits relating to mining, except in suits relating to rights or titles to immovable property. He may summon persons, convict upon view and settle any difficulty arising from the provisions of the Act.

Any one may explore and prospect on public lands.

An exploration permit, valid for three months, giving the right to make all necessary works, may be obtained by paying, if upon private lands, \$5 for every 50 acres, or if upon Crown lands, \$10 for every 50 acres.

The mine may afterwards be purchased at a minimum price of \$2 per acre for iron and ochre, or \$5 per acre for all other minerals.

The Commissioner may offer mining concessions at public auction, the upset price, or first bid, to be as above.

A mining concession is to be not less than 50 nor more than 100 acres.

The deed of sale may be annulled if work ceases for two years, unless work is resumed within twelve months after notice.

Arbitrators shall decide, if necessary, the compensation to be given to private owners by the intending purchaser of mining rights.

If the purchaser of a mine from private persons does not go to work within two months, or if he discontinues work for eight months his title is forfeited.

Reports must be sent to the Commissioner on the tenth day of January, April, July, and October, containing statements of ores worked, number of men employed, and description of all mining work and erection of plant during the quarter.

Quartz mills may be licensed for \$5.

Mill owners must make monthly returns.

Numerous provisions relate to the duties of inspectors and land surveyors, the duty of owners to erect posts and and mark boundaries, keep passage walls clear, etc., etc., and the powers of the Lieutenant-Governor to aid and regulate mining or control riots.

Maximum penalties are to be imposed as follows:

For mining without permit—\$10 for every day or imprisonment for one month.

For mining without furnishing name, etc. to inspector—\$20 or one month.

For obstructing passage—\$5 or one month.

For damaging another's mine by earth or water—\$5 or one month.

For not complying with inspector's decisions about use of water courses, drains, etc.—\$50 or one month.

For removing a stake—\$10 or one month.

For using a quartz mill (other than hand-worked) without license—\$100 or two months.

For omitting to send returns of mill work, for every day's delay—\$20 or one month.

For not putting a fence four feet high around every pit of four feet or over in depth, not having been worked for eight days—\$50 or one month.

For taking a share in a mine by an inspector—\$400 or one year.

For refusing entrance or assistance to inspectors—\$5 or one month.

For refusing to appear as a witness—\$5 or imprisonment until consent.

For all other misdemeanors, for every day of contravention—\$20 or one month.

For neglect to set up or replace posts—\$100 for each post.

For removing or damaging posts—\$100 for each offence.

For preventing arrest of offenders—\$40 or two months.

Fines wholly recovered in the name of a complainant, are to be paid half to the complainant.

Liquor cannot be sold without a license within seven miles of a working mine.

Anthracite Mine Surveying.*

BY R. VAN A. NORRIS, E.M.

As the mining laws of Pennsylvania require accurate mine maps to be filed with the inspector of mines in each district, very extensive underground surveys are continually being made in the anthracite districts, all the larger corporations having their own corps of salaried engineers, and the smaller operators depending upon independent engineers who do the work either by contract or for fees.

The methods of surveying are almost as varied as the number of engineers. The following is the method used by the Susquehanna Coal Company, Mineral Railroad and Mining Company, Lykens Valley Coal Company and Summit Branch Railroad Company, corporations under the control of the Pennsylvania railroad, and it is believed to be as good as any other system in use.

The corps, as it goes into the mines, consists of a transit man, station man, backsight, foresight and chain-man, with a fire-boss to attend to the safety of the party. The three-tripod method of surveying is used, but instead of tripod lamps, the wicks of which were found too large for accurate sighting, similar lamps are used with the wick replaced by a steel wire $\frac{1}{2}$ of an inch in diameter and $\frac{3}{8}$ of an inch high. The sights are always taken to the bottom of this wire, and measurements are taken on the line of sight with a steel tape 300 feet long, graduated every 5 feet.

When in the mine, the station-marker keeps ahead of the party, and puts in and numbers the instrument stations. There are three ways of making permanent (?) stations in the roof in vogue in the region. A small conical hole is sometimes drilled, and the bob suspended from an iron rod with a notched end fitting the cone of the hole. With these stations, which are used principally with high roofs, the point is transferred to the floor by holding a bob with the iron rod, and placing some mark under it, usually a small bit of coal in the centre of a dab of white paint, the instrument being set up over this. This method has a greater liability to error than either of the others. A second method is to put a horseshoe nail, with a hole punched in the end, into a plug of wood driven into a drilled hole in the roof, and then to suspend the plumb from the ring, and set up the transit under the bob. A third and more convenient way of effecting the same thing is to drill a $\frac{1}{2}$ inch diameter hole in the roof with a twist drill, and put a shoe-peg, holding a small loop of fine (No. 26) copper wire, in the hole. We have used this style of station largely, and find it a most satisfactory one, the wire being flexible enough to allow the bob to hang true; and the station, with its ring of white paint and painted number, being readily found and never confused with any spuds put in by the mine bosses.

The station marker is supposed to be familiar with the mines and with the engineer's methods of mining, and usually places his stations advantageously, being guided in some measure by the light of the fire-boss ahead of him and by the foresight's light behind.

The foresight man carries the forward tripod with him, and sets up under the station, plumbing to the wire on the "lamp," then holds his light to give foresight to the transit-man. He then waits for the chain-man to come up, and assists with the chaining. The transit man, after taking a sight and making the proper notes, follows the chain forward, making the sketch and taking the side-notes. Reaching the next station, he takes the exact distance on the tape with his pocket tape, measuring to a clip which has been put on by the foresight man when the 300 feet tape was stretched. At the new station he finds his instrument, which has been removed from its tripod and brought forward to him by the backsight-man. As soon as the transit man gets a satisfactory backsight on his old station, he calls "move up," and, while he is taking his angle, the backsight brings up the rear tripod and hands it to the chain-man. He then holds the end of the tape while the chain-man goes forward with the reel and tripod. By the time the angle is taken, the chain should be ready to stretch, the transit-man being responsible for the zero end, and the foresight for the other. As soon as the chain is stretched and the distance clip put on, the foresight man takes the tripod brought to him by the chain man and the lamp from the tripod to which he has just measured, goes forward, and sets up under the next station, the chain-man and backsight-man

meanwhile holding the chain for the transit-man to take his side notes from.

The accompanying notes, sketch and map are from regular work, being taken at random. In the notes, the instrument station and foresight station are entered thus: 1592-1593, the backsight being understood to be the previous station unless otherwise entered at the beginning of a survey, thus: Bs. 1287-1562-1563.

Continuous azimuth angles are run, plunging the instrument at each station, and the entries in the note-book consist of the vernier reading on a continuous graduation, 0 to 360, and also the quadrant reading or course. The compass reading is taken roughly, and has been found of great service in finding errors caused by reading in the wrong quadrant, or mistakes of even degrees. In starting, the vernier is set to the course of the starting stations taken from the note-book. The method has the disadvantages of danger of the plates slipping while the transit

Elevation of instruments at 1594...	225.76
Calculated vertical distance.....	5.23
Elevation of lamp at 1595.....	220.53
Height instrument over lamp.....	50
Height instrument at 1595.....	221.03
Rod at 1595.....	2.05
Elevation of station, 1595.....	223.08

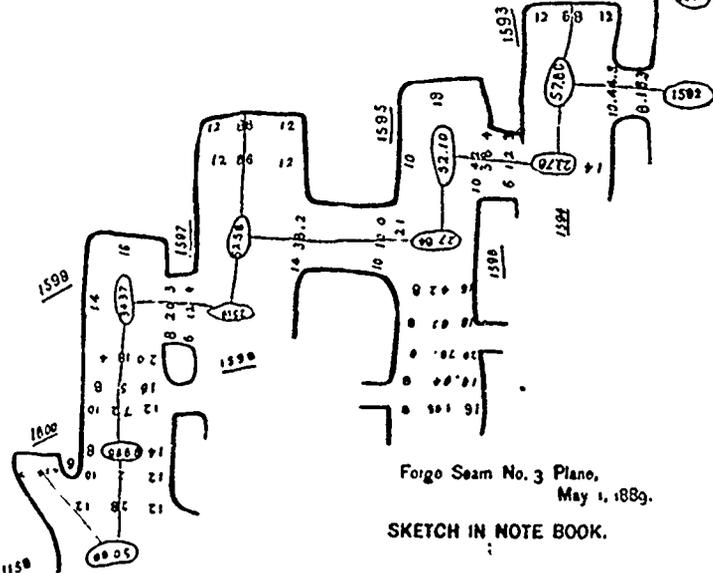
In this way level is carried through the workings, being checked by lines run in the gangways with a level. The method is found to give results sometimes surprisingly accurate, to within $\frac{1}{2}$ foot for lines containing 50 or more stations, and a difference of over one foot in the transit and level elevations is rare.

Working in this way it is possible to attain great speed, from 40 to 50 stations being considered merely a fair night's work.

As many of the seams are only reached by vertical shafts, it is necessary to "plumb" these before starting the underground surveys; two methods of accomplishing this have been used by the Susquehanna Coal Company at Nanticoke.

1st. Two 15-lb. iron plumb-bobs are lowered, attached to No. 20 steel wires, one on each side of the shaft, and the instrument is put in line with the two wires on the surface and again underground, continuing the surface line; the objections to this are the very short base line, as the sight has to be taken in one compartment of the shaft, the base is seldom more than 8 or 9 feet, and the difficulty has to be encountered of keeping the bobs in a 1000-foot shaft from swinging; they can be steadied considerably by immersing each in a bucket of heavy oil, but at the best they will swing somewhat.

This method, however, gives very accurate results if great



is being carried between stations, and that any error in adjustment of the instrument vitiates the survey; but, on the other hand, the courses are obtained directly, and, as all surveys are closed, any error is seen in the mine and the line re-run. In practice we find that a close more than 3' out for a chain of fifteen or more stations is very rare.

MAY 1, 1889.—CONTINUATION OF SURVEY ON NO. 3 PLAN.

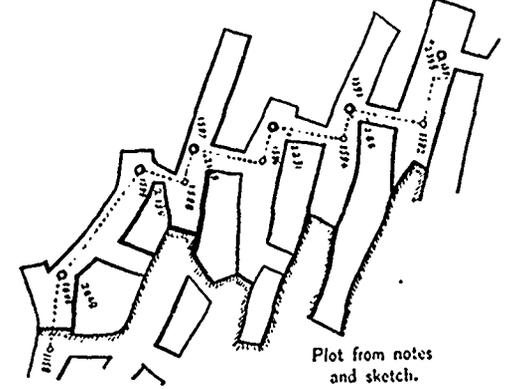
Stations.	COURSES.		DISTANCES.		ELEVATIONS.		REMARKS.			
	Neelle.	Angle.	Course.	Vert. Ang.	Tape.	Hor. Dist.		Ht. Inst.	Rod.	Eleva-tion.	Vert. Dist.
1591-1592	N. 4° E.	173.46	N. 85° 24' E.	6° 00'	57.60	57.28	-1.45	+1.90	+233.89	-6.02
1592-1593	N. 4° E.	173.46	S. 6° 14' W.	6° 00'	57.60	57.28	-1.45	+1.90	+228.32	Face.
1593-x	N. 82° W.	82	S. 5° 50' W.	2° 56'	22.76	22.73	-0.03	+2.25	+228.01	-1.16
1593-1594	N. 85½ E.	84.21	N. 84° 21' E.	5° 46'	52.10	51.83	-0.27	+2.05	+223.08	-5.23
1594-1595	S. 8° 15' E.	170.45	S. 9° 15' E.	3° 07'	27.61	27.60	-0.01	+1.85	+221.88	-1.50
1595-1596	S. 88° E.	91.24	S. 88° 36' E.	15	106	105.92	-0.08	+1.85	+216.95	-5.43
1596-x	S. 87° E.	87	S. 40° E.	5° 52'	52.58	52.30	-0.28	+2.10	+216.08	-1.02
1596-1597	S. 40° E.	174.20	S. 30° W.	3° 42'	35.19	35.13	-0.06	+0.90	+212.99	-2.39
1597-x	S. 80° W.	80	N. 86° 50' W.	4° 42'	34.37	34.28	-0.09	+1.90	+204.94	-9.55
1597-1598	N. 80° E.	84.59	N. 84° 59' E.	4° 03'	34.37	34.28	-0.09	+1.10	+201.14	-3.50
1598-1599	S. 1° E.	177.33	S. 2° 27' E.	5° 29'	99.96	99.50	-0.46	+1.10	+201.14	-3.50
1599-1600	S. 73° E.	107.50	S. 72° 10' E.	5° 01'	50.00	49.87	-0.13			
1600-1158	N. 81° E.	80.12	N. 80° 12' E.							
1158-1157	N. 78° 55' E.		N. 78° 55' E.							

Close. 1' out. Calculated in Office.

The vertical angles are read very carefully, as level is carried with the instrument. On this account the "lamps" were made of such a height that the bottom of the sight wire is just $\frac{1}{2}$ foot below the centre of the instrument.

The column headed "rod" gives the distance from the centre of the instrument to the station in the roof, so that the calculation for the level is thus:

Elevation 1594.....	228.01
Rod at 1594.....	2.25



The hatching shows the face of workings from previous survey

care is used in aligning the transit at the bottom of the shaft, and is, perhaps, the preferable one.

The other method is to hang the two wires at opposite sides of the outer compartments, and fix two stations underground, and measure the angles and the sides of the resulting quadrilateral, and from these calculate the course between the stations, the course between the wires being obtained on the surface by putting them in line with the transit or by a method similar to that just outlined. The greatest objection to this method is that even a very small error in measurement, and it is not a very easy matter to measure accurately to a wire swinging in a wet shaft, will introduce serious error in the results.

Recently the two systems of plumbing were compared with a line run from the surface down two slopes and a plane, and with about a mile of underground traverse, and the three courses agreed to within a half minute, the first system of plumbing and the traverse line (which was run very carefully with an instrument reading to ten seconds) agreeing exactly.

All gangway stations are plotted from calculated latitudes and departures, and the stations in the workings filled in by plotting with a protractor; the outline of the workings is then filled in from the sketch taken in the mines. In making this sketch the transit-man walks along by the tape, and, taking his distance from that, measures at intervals to the rib at either side and to all openings passed; this measurement is usually, by experienced men, done by the eye; at the station the distance is put on the sketch, the number of the station being afterwards supplied from the notes. In surveying the breasts, either a line is run through the headings, as was the case in the accompanying notes and sketch, or, where this is impracticable, either on account of pitch of seam or gas, a line is run up every third breast noting all headings and the two intermediate breasts sketched in by measurements through the headings.

On many corps where the three tripod method is not in use, an extra man is employed, whose sole duty it is to take the side notes and make the sketch.

* School of Mines, Quarterly.

Annotated List of Canadian Minerals.*

G. C. HOFFMAN, F. INST. CHEM., ETC.

(Continued from page 185.)

183. **NICCOLITE**—Has been found, in admixture with domeykite, in a vein cutting a bed of amygdaloid on Michipicoten Island, Lake Superior, Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 506.

184. **NITRE**—Has been found in cavities in calcareous tufa, on the Nazco River, and has also been met with at Big Bar, Fraser River, Province of British Columbia.

185. **OBSIDIAN**—Is found in large and small masses on the higher eastern slopes of the Il-ga-chuz Mountain, but the most notable locality for this mineral is the mountain named Beece or Anahim's Peak, an isolated summit between the Il-ga-chuz and Tsi-tsutl Mountains, in the upper Blackwater country (G. M. Dawson, Rep. Geol. Can., 1876-77, pp. 78, 79): it also occurs at Tsooskatli, the upper part of Masset Inlet (on a small islet north-east of Tas-kai-guns), Queen Charlotte Islands (id.—ib., 1878-79, p. 88 B), and other localities in British Columbia.

186. **OCTAHEDRITE**—Is reported, by Prof. How, as occurring in small but fine crystals, in quartz, at Sherbrooke, Guysborough County, Province of Nova Scotia.

187. **OLIGOCLEASE**—Occurs in more or less perfect crystals, in groups, of a white or faintly greyish-white color, in the Township of Hull (Ottawa Co.), and a white, rarely greenish or greyish, felspar, having the composition of oligoclase forms, with black hornblende, the intrusive diorite of Mount Johnson (Iberville Co.), Province of Quebec. A white to pale grey felspar, also referable to this species, is the constituent of a coarse crystalline diorite occurring at the Fournier mine, in the township of South Sherbrooke, Lanark County, in the Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, p. 477; B. J. Harrington, Rep. Geol. Can., 1873-74, p. 198.

188. **ONTARIOOLITE**—A scapolite from the Township of Galway, Peterborough County, Province of Ontario, has been called Ontarioolite by C. U. Shepard (Am. Journ. Sci., 3 ser., vol. xx, p. 54, 1880). [The value of an approximate analysis given, is destroyed by the impurity of the material analyzed; thus far it has no claim to be considered an independent species—Dana, Min., App. iii, p. 106, 1882.]

189. **OPAL**—Common opal or semi-opal is mentioned, by Dr. How, as occurring at a few localities in the Province of Nova Scotia. See also notes to "Cacholong" "Hyalite" (under Addenda), "Tripolite."

190. **ORTHOCLASE**—This felspar is very abundant among the rocks of the Laurentian system, and well-defined cleavable masses of a reddish, greyish-white or white color, may be obtained in many localities, some of the most important (Laurentian) of which are—the Townships of North Burgess and Elmsley (Lanark Co.), Ross, in large crystals, and Sebastopol, also in very large crystals (Renfrew Co.), in the Province of Ontario—Grenville and Chatham (Argenteuil Co.), and most of the Townships of Ottawa County. Also occurs in veins cutting altered slates in the Townships of Leeds and Inverness (Mégantic Co.), and Sutton (Brome Co.), and in the trachytes of Chambly, Brome and Shefford Mountains, and Mount Royal, Province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, pp. 475, 476; G. C. Hoffmann, Rep. Geol. Can., 1876-77, pp. 511, 512.

191. **PARGASITE**—Finely terminated crystals of dark green pargasite, sometimes an inch in diameter, are found implanted upon, or imbedded in, a greenish-white pyroxene, at the High Falls and at the Ragged Chute, on the Madawaska in the Township of Blythfield, Renfrew County, Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 466.

192. **PEARL-SPAR**—Is abundant, generally associated with calcite and gypsum, in cavities and geodes in the dolomites of the Niagara formation; also, in association with calcite, gypsum, barite and quartz, in geodes in the dolomites of the Calciferous formation, and is found in many of the metalliferous veins of Lake Superior and Lake Huron, Province of Ontario—and occasionally in those of the Eastern Townships of the Province of Quebec.

193. **PECTOLITE**—Occurs in radiated fibrous aggregations, the fibres being an inch and a quarter and less in length, at Cathcart (now McKellar's) Point, Thunder Bay, Lake Superior, Province of Ontario.

194. **PERISTERITE**—The felspar described by Dr. Thompson under this name (in allusion to its beautiful blueish opalescence)—a variety of albite, occurs in large cleavable masses, with quartz, in veins in the Township of Bathurst (Lanark Co.), and in a vein made up of a fine-grained mixture of reddish-white albite and quartz, enclosing large cleavable masses of the opalescent albite, on the north shore of Stoney Lake, near the mouth of Eel Creek, in Burleigh (Peterborough Co.), Province of Ontario. Analysis of a specimen from first-named locality, T. S. Hunt, Geol. Can., 1863, p. 477.

195. **PERTHITE**—The Perthite of Dr. Thompson (a flesh-red aventurine felspar, which, as shown by Breithaupt, consists of interlaminated albite and orthoclase) occurs in large cleavable masses, in pegmatite veins cutting Laurentian strata, in the Township of North Burgess, Lanark County, Province of Ontario.

196. **PETALITE**—Is here mentioned among the minerals of Canada, upon the authority of Dr. Bigsby, according to whom this mineral was found, with tremolite, in a large boulder on the lake shore, at Toronto, York county, Province of Ontario.

197. **PETROLEUM**—The most important oil springs are

in the township of Enniskillen, in the western peninsula of Ontario, but it also occurs in other townships of this section of the country, as for instance those of Mosa, Oxford and Dereham. It is found, in small quantity, on Great Manitoulin Island in Lake Huron, Province of Ontario—also on the St. John River, and on a branch of Silver Brook, and other localities in the County of Gaspé, Province of Quebec.

198. **PHLOGOPITE**—This mineral is of very common occurrence among the crystalline limestones of the Laurentian system, through which it is sometimes more or less abundantly disseminated in the form of small scales or crystals. The largest specimens are generally found in beds near to bands of quartzite or pyroxenic gneiss, which often limit the crystalline limestones, or are interstratified with them. It is also met with imbedded in massive pyroxene rock. Large plates are obtainable in the Townships of Grenville (Argenteuil Co.), Buckingham, Templeton, etc. (Ottawa Co.), in the Province of Quebec—and in the Townships of North and South Burgess, in the Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 495.

199. **PICKERINGITE**—Occurs as an efflorescence on the shale of a sheltered cliff on the banks of the Meander, Newport, Hants County, Province of Nova Scotia. Anal., H. How, Journ. Chem. Soc., new series, vol. 1, p. 200, 1863.

200. **PICROLITE**—This variety of serpentine is met with in the Townships of Bolton (Brome Co.), Shipton (Richmond Co.), etc., in the Province of Quebec. Anal., T. S. Hunt, Geol. Can., 1863, p. 472.

201. **PITCHSTONE**—A pitchstone-porphry, and pitchstone with veins of agate, occurs on the eastern extremity of Michipicoten Island, Lake Superior, Province of Ontario.

202. **PLATINUM, NATIVE**—The earliest reference to the finding of native platinum in Canada, is that by Dr. T. Sterry Hunt (Rep. Geol. Can., 1851-52, p. 120), who mentions having observed it, in association with iridosmine, in the gold washings of the Rivière du Loup and Rivière des Plantes, Beauce County, in the Province of Quebec. It has since been met with, according to Dr. G. M. Dawson (Ann. Rep. Geol. Can., vol. iii, 1887, Part R), in association with placer gold in several localities in the Province of British Columbia—occurring in notable quantity in the region of the Upper Similkameen and Tulameen Rivers, in minute scales where the gold is "fine" but increasing in coarseness to small pellets and nuggets in places where "coarse" gold is found. Coarse grains and pellets have, so far, been found only on Granite, Cedar and Slate Creeks, all entering the Tulameen on the south side. He also mentions its occurrence, in fine scales with gold, on Tranquille River, Kamloops Lake; at a place ten miles below Lillooet on the Fraser River, and in nearly all the tributaries of the Yukon River which have been worked. Analyses, G. C. Hoffmann, Trans. Roy. Soc. Can., vol. v, sec. iii, p. 17 1887—and an abridged statement of results, Ann. Rep. Geol. Can., vol. ii, p. 5 T, 1886.

203. **POLYDYMITE**—What is regarded as evidently a ferriferous variety of this mineral is found in association with pyrrhotite, chalcopyrite, some pyrite etc., at the mines of the Canadian Copper Company, Sudbury, District of Nipissing, Province of Ontario. Anal., F. W. Clarke and C. Catlet, Am. Journ. Sci., 3 ser., xxxvii, p. 372, 1889.

204. **PRASE**—A breccia, consisting of angular fragments of prase cemented together with white chalcidony, was found by Dr. G. M. Dawson filling cavities in Tertiary basaltic rocks in mountains at head of Nicoamen River, British Columbia.

205. **PREHNITE**—Occurs chiefly in the trap rocks of Lake Superior, sometimes forming distinct veins, as on Slate River, an affluent of the Kaministiquia and with imbedded nodules of native copper on an island near St. Ignace—Province of Ontario. It has also been found in the Laurentian of the Township of Templeton (Ottawa Co.) in the Province of Quebec. Analyses, E. J. Chapman, Can. Journ., 2 ser., vol. xii, p. 267, 1869; B. J. Harrington, Rep. Geol. Can., 1877-78, p. 34 G.

206. **PSEUDOMORPHOUS QUARTZ**—Fine specimens of quartz pseudomorph after chabazite, have been found at Horse-Shoe Cove, Cape d'Or, and of quartz pseudomorph after stilbite, at Clarke's Head (Cumberland Co.), Province of Nova Scotia. Silicified wood is found in the vicinity of the Elbow of the South Saskatchewan River, and very characteristic specimens of the same at Ross Coulee, Irvine, District of Assiniboia, North-west Territory.

207. **PSILOMELANE**—Occurs in association with pyrolusite, at Douglas, Hants County, Province of Nova Scotia.

208. **PYRALLOLITE**—Occurs in beds in the crystalline limestone of Grenville (Argenteuil Co.), and Clarendon (Pontiac Co.), in the Province of Quebec—also in the Townships of Ramsay (Lanark Co.) and Rawdon (Hastings Co.), in the Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, p. 471—and of a specimen from Portage du Fort, Township of Clarendon, B. J. Harrington, Rep. Geol. Can., 1876-77 p. 484.

209. **PYRITE**—Is very widely distributed throughout the Dominion. The following are a few of the localities where it is met with in a crystalline form:—in fine crystals at La Hve (Lunenburg Co.), and Seven Mile Plain (Hants Co.), in the Province of Nova Scotia—in large cubical crystals in a vein of copper ore in the Township of Melbourne (Richmond Co.), Province of Quebec—in perfect octahedra at Elizabethtown (Leeds Co.), also in a crystalline form in many of the veins and gneissoid rocks of the Townships of Madoc, Elzevir and Tudor (Hastings

Co.), and in the trap dykes of Lakes Superior and Huron; Province of Ontario.

210. **PYROLUSITE**—Is met with near Kentville (King's Co.), at Springville (Pictou Co.), Musquodoboit (Halifax Co.), Onslow (Colchester Co.), near Amherst (Cumberland Co.), and at Walton and other places, especially at Tenny Cape, in Hants County, Province of Nova Scotia. This mineral also occurs at several places in the Counties of Westmoreland, Albert, St. John and King's,—the most important deposit being at Markhamville, in the parish of Upham, King's County,—in the Province of New Brunswick.

211. **PYROXENE**—Is of common occurrence especially among the rocks of the Laurentian system, where it is not unfrequently forms beds, or large segregated veins, which sometimes consist of pure pyroxene, at other times of pyroxene in admixture with other minerals, constituting pyroxenite. It also sometimes occurs disseminated in beds of magnetic and, in the form of grains and imperfect crystals, it is common in the beds of limestone. Among the numerous localities of its occurrence may be mentioned:—Kildare (Joliette Co.), the Townships of Argenteuil and Grenville (Argenteuil Co.), Buckingham, Templeton, Portland, Wakefield, and adjoining Townships (in Ottawa Co.), and Litchfield (Pontiac Co.), in the Province of Quebec. The Townships of North Elmsley and North Burgess (Lanark Co.), and elsewhere in this part of the Province of Ontario. Very large crystals of pyroxene are not unfrequently met with in the above referred to Townships of Templeton, Portland, and Wakefield, as also in the Townships of Sebastopol and Blythfield (Renfrew Co.), in the Province of Ontario—and a very handsome lilac-colored pyroxene occurs in the Augmentation of the aforementioned Township of Grenville. See also notes to "Augite," "Coccolite," "Diallage," "Fassaite," "Malacolite," "Sahlite."

212. **PYRRHOTITE**—Occurs in many localities; among which may be mentioned the Townships of Barford (Stanstead Co.) Sutton and Bolton (Brome Co.) where it is associated with copper ores; St. François (Beauce Co.) associated with pyrite, arsenopyrite, etc., and St. Jérôme (Terrebonne Co.) associated with pyrite—in the Province of Quebec. Abundantly, more or less associated with chalcopyrite, in McKim and adjoining townships (District of Nipissing); accompanying pyrite in Elizabethtown (Leeds Co.), at Balsam Lake (Peterborough Co.), Province of Ontario. A very interesting twin crystal found by Dr. Harrington at the Elizabethtown deposit (Anal., B. J. Harrington, Rep. Geol. Can., 1874-75, p. 304), was examined by Dr. E. S. Dana, Am. Journ. Sci., vol. xi, p. 386, 1876.

213. **RETINALITE**—Is found, imbedded in crystalline limestone, in the Township of Grenville (Argenteuil Co.), and on Calumet Island (Pontiac Co.), in the Province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 471.

214. **RHODOCHROSITE**—Has not, as yet, been found in Canada in distinct examples, but occurs in admixture with many of the manganese ochres, and is also present, in traces, in some of the altered strata of the Eastern Townships of the Province of Quebec.

215. **RIPIDOLITE**—Has, so far, not been identified with certainty as occurring in Canada. A chloritic mineral occurring—in uneven folia, of an olive-green color and pearly lustre—in association with apatite, quartz, pyrite and calcite, in the Township of Templeton (Ottawa Co.), Province of Quebec, has been examined by Dr. Harrington (Rep. Geol. Can., 1877-78, p. 34 G), and found to have, approximately, the composition of ripidolite. A foliaceous mineral found in a serpentine rock in the adjoining Township of Buckingham would, so far as it has yet been examined, also appear to be referable to this species.

216. **ROCK CRYSTAL**—Is found, in large crystals, at South River (Antigonish Co.): in perfect crystals at Spencer's Island (Cumberland Co.): at Sandy and Mink Coves (Digby Co.), etc., in the Province of Nova Scotia. In crystals (known as Quebec diamonds) showing unusual modifications in form, in fissures and cavities in limestone rocks in the vicinity of Quebec, and in large transparent crystals, in quartz veins, at Harvey Hill mine (Leeds Co.), Province of Quebec. Also in good crystals in cavities of the quartz veins of the Bruce mines, Lake Huron, and similar veins at Thunder Bay, Lake Superior, Province of Ontario.

217. **ROSEQUARTZ**—Is found at Westfield (Queen's Co.) and, in the form of pebbles, near the town of Shelburne (Shelburne Co.), in the Province of Nova Scotia.

218. **RUTILE**—Occurs, in the form of needles in quartz, at Scot's Bay (King's Co.), Province of Nova Scotia. In small orange-red grains in the ilmenite of St. Urbain, Bay St. Paul (Charlevoix Co.); in small red flattened crystals in the chloritic schists of the township of Sutton (Brome Co.); in minute grains in the black sand obtained in the washing of the auriferous gravel at Rivière du Loup (Beauce Co.), and in somewhat large crystals, occasionally geniculated, in a gangue of dolomite and barite, in the Township of Templeton (Ottawa Co.), Province of Quebec. It has been found in tolerably distinct crystals in crystalline limestone on Green Island in Moira Lake, in the township of Madoc (Hastings Co.), and in the form of delicate acicular crystals, in quartz cavities at the Wallace mine, Lake Huron, Province of Ontario. See also note to "Sagenite."

219. **SAGENITE**—A transparent quartz penetrated with needles of rutile is stated, by Prof. How, to have been found at Scot's Bay, King's County, Province of Nova Scotia.

220. **SAHLITE**—The most common variety of pyroxene met with in the apatite deposits of Ottawa County,

* Paper read before the Royal Society of Canada.

Province of Quebec, would appear to be a lime-magnesia-iron pyroxene or sahlite. On peculiarities in forms of crystals from this locality, see results of observations by B. J. Harrington, Rep. Geol. Can., 1877-78, p. 18 G.

221. SAL-AMMONIAC—Has been met with, in association with native sulphur, constituting a deposit on the cliffs of shale on Smoky River, North-west Territory. Anal., G. C. Hoffmann, Rep. Geol. Can., 1875-76, p. 420.

222. SAMARSKITE—Has been found on lots one and two of the second range of Maisonneuve, Berthier County, Province of Quebec. [When first met with, this township was not laid out, consequently the locality could not be given more definitely than as it appears in the report, here referred to, viz., just beyond the north-western limits of Brassard (the adjoining township), Berthier Co.] Anal., G. C. Hoffmann, Rep. Geol. Can., 1880-82, p. 1 H.

223. SAPONITE Occurs in cavities in the trap of St. George or Hog Island, Richmond Bay, north coast of Prince Edward Island. Anal., B. J. Harrington, Can. Nat., 2 ser., vol. vii, p. 179, 1875.

224. SELENITE—Is met with in greater or less quantity at several of the gypsum deposits in the Province of Nova Scotia, as at Oxford, River Philip (Cumberland Co.). In the Province of New Brunswick it is especially abundant at Petitcodiac (Westmoreland Co.) where the gypsum deposit, which has a breadth of about forty rods and a total length of about one mile, is traversed through its entire extent by a vein of nearly pure selenite eight feet wide. This mineral is also met with in the Provinces of Quebec, Ontario, Manitoba and elsewhere.

225. SENARMONTITE—Occurs, with native antimony, stibnite, valentinite and kermesite, in veins traversing argillite in the township of Ham, Wolfe County, Province of Quebec.

226. SERPENTINE—Is met with abundantly among the metamorphic rocks of the Eastern Townships and Gaspé peninsula, in the Province of Quebec, where it forms vast masses, which are frequently almost free from other admixture, but at times enclose diaspore, actinolite, garnet and chromite; or are intermixed with carbonate of lime, dolomite and occasionally ferruginous magnesite. Extensive beds, mostly containing intermixed carbonate of lime and dolomite, occur in the townships of Thetford and Coleraine (Megantic Co.), Broughton (Beauce Co.), South Ham and Garthby (Wolfe Co.), Melbourne (Richmond Co.), Orford (Sherbrooke Co.), and Bolton (Brome Co.); around Mount Albert in the Shickshock Mountains, and at Mount Serpentine near Gaspé Bay, in Gaspé County. Among the massive and nearly pure Laurentian serpentines may be mentioned those of the townships of Grenville (Argenteuil Co.), in above named Province—and North Burgess (Lanark Co.), in the Province of Ontario. See also notes to "Chrysotile," "Pierolite" and "Retinalite." Analyses, T. S. Hunt, Geol. Can., 1863, p. 472.

227. SEYBERTITE—Is mentioned by Dr. Hunt, as occurring, with small crystals of blue spinel, in a crystalline limestone in the seigniory of Daillebout, Joliette County, Province of Quebec.

228. SIDERITE—A bed of spathic iron, varying in thickness from six to ten feet, occurs in sandstones of the Millstone-grit formation, near Sutherland's River, Pictou County, Province of Nova Scotia. Occurs in thin veins in Huronian rocks in the Nerepis valley, and is also diffused to a considerable extent through rocks of Devonian age in the northern part of Charlotte County, in the Province of New Brunswick. Is found in quantity, in beds, on Flint, Davieu's, and other islands of the Nastapoka group, eastern coast of Hudson Bay—and is also met with in quantity in the township of McIntyre, Thunder Bay, Lake Superior, Province of Ontario. See also notes to "Clay iron-stone," "Sideroplesite." Analyses, Gordon Broome, Rep. Geol. Can., 1866-69, p. 442; B. J. Harrington, ib., 1877-78, p. 47 G.

229. SIDEROPLESITE—Occurs in the ankerite deposits of Londonderry, Colchester County, Province of Nova Scotia. Anal., H. Louis, Trans. N. S. Inst., vol. v, p. 50, 1879 2.

230. SILICIFIED WOOD—See note to "Pseudomorphous quartz."

231. SILVER. NATIVE.—Nuggets and grains of native silver have been found in washing for gold in a great many parts of British Columbia, the largest being obtained in the Omenica district. It also occurs, in association with argentite, at the various mines enumerated in the note to "Argentite."

232. SMALTITE—Has been met with in the form of minute crystals, in association with chalcopyrite, in the Township of McKim, District of Nipissing, Province of Ontario. Ann. Rep. Geol. Can., vol. ii, p. 11 T., 1886.

233. SMOKY QUARTZ, CAIRNGORM STONE—Is met with in several localities in the Province of Nova Scotia, amongst the most noted being Paradise River and the neighborhood of Bridgetown and Laurencetown in Annapolis County; is also found at Mud Village (Lunenburg Co.), at Margaret's Bay (Halifax Co.), and of very dark color at Little River, about five miles from Halifax.

234. SOAPSTONE—See note to "Talc,"

235. SODALITE—Occurs in the nepheline-syenites of Brome (Brome Co.), Montreal (Hochelaga Co.), and Belœil (Rouville Co.), in the Province of Quebec. A very beautiful blue sodalite, in large specimens, has been found by Dr. G. M. Dawson, in abundance, in the vicinity of Ice River, a tributary of the Beaver-foot, in the Rocky Mountains, Province of British Columbia. Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. iv, sec. iii, p. 81, 1886.

236. SPECULAR-IRON—Amongst other localities, is

met with in tabular crystals at Sandy Cove, Digby Neck (Digby Co.), Province of Nova Scotia: in tabular crystals, or thick plates, in the Township of Leeds (Megantic Co.), also in thick plates in the Township of Shefford (Shefford Co.), in the Province of Quebec.

237. SPERRYLITE—This recently discovered and highly interesting mineral, arsenide of platinum, was found at the Vermilion mine, Township of Denison, District of Algoma, Province of Ontario. Anal., H. L. Wells, Am. Journ. Sci., 3 ser., vol. xxxvii, p. 67, 1889: on the crystalline form of Sperrylite, S. L. Penfield, ibid., p. 71.

238. SPESARTITE—Is found, together with black tourmaline, uraninite, monazite, etc., in a coarse pegmatite vein—composed of microcline, albite, muscovite and white and smoky-brown quartz—in the Township of Villeneuve, Ottawa County, Province of Quebec.

239. SPHAEROSTILITE—Has been met with by Prof. How, at Hall's Harbor, King's County, Province of Nova Scotia.

240. SPHALERITE—Is somewhat widely distributed, being found, but most frequently in small quantities only, in all the Provinces of the Dominion. It is met with, in greater or less abundance, in almost every metalliferous vein which has been opened on the east and north shores of Lake Superior, and an important deposit of the same is situated some eleven miles north-east of Rossport (formerly McKay's Harbor) on the north shore of that lake, Province of Ontario. Also occurs in quantity in the Township of Calumet—where it is associated with more or less galenite and a little pyrite,—Pontiac County, in the Province of Quebec.

241. SPINEL—Small translucent octahedrons of blue spinel are found in a bed of crystalline limestone in the seigniory of Daillebout (Joliette Co.), in the Province of Quebec. Large and not unfrequently very symmetrical black crystals, sometimes an inch or even two inches in diameter, occur in crystallized limestone in Burgess (Lanark Co.), and similar crystals, though less perfect, are found, together with fluorite, apatite and crystals of white orthoclase, in a vein of flesh-red calcite in the Township of Ross, Renfrew County, Province of Ontario.

242. STODUNITE—Is said, by Dr. Hunt, to have been observed in a small rolled mass of granite near Perth, Lanark County, in the Province of Ontario.

243. STAUROLITE—Occurs in mica-schists of Moore's Lake, Charlotte County, Province of New Brunswick.

244. STEATITE—See note to "Talc."

245. STEELEITE—Is found imbedded in red clay in cavities in Triassic trap, at Cape Split, thirteen miles west of Cape Blomidon, King's County, Province of Nova Scotia.

246. STELLARITE—The name given by Prof. How to the so-called "stellar" or "oil-coal," which occurs with bituminous coal (in a seam five feet thick, of which one foot ten inches are stellarite) at the Acadia mines on the Acadia Coal Company's area, Pictou County, Province of Nova Scotia. Analyses, H. How, Min. N. S., p. 24, 1869. Sir William Dawson, referring to this substance (Acadian Geology, 3rd ed., 1878, p. 339) says—"The material known as stellar-coal is, as I have maintained in previous publications, of the nature of an earthy bitumen; and, geologically is to be regarded as an underclay or fossil soil, extremely rich in bituminous matter, derived from decayed and comminuted vegetable substances. It is, in short, a fossil swamp muck or mud which, as I have elsewhere pointed out, is the character of the earthy bitumens and highly bituminous shales of the Coal formation generally."

247. STIBNITE—An important deposit of this mineral exists in the parish of Prince William (York Co.), in the Province of New Brunswick, where it is contained in numerous large and well-defined veins of quartz, filling lines of dislocation in highly tilted argillaceous slates and quartzites: also at Rawdon—where, in association with a little quartz and calcite, it constitutes a vein cutting talcose slates,—and West Gore, Hants County, Province of Nova Scotia. It is found in small radiating prismatic crystallizations, with native antimony, valentinite, senarmontite and kermesite, in veins in argillite, in the Townships of South Ham (Wolfe Co.), Province of Quebec. It has been met with in small quantities, in association with pyrite and mica, in a band of crystalline dolomite in the Township of Sheffield (Addington Co.), and in small masses mixed with tremolite, under similar conditions, in the Township of Marmora (Hastings Co.), Province of Ontario—also occurs near Foster's Bar, about twenty-three miles from Lytton, Fraser River, Province of British Columbia.

248. STILPITE—Is abundant, and exhibits a large number of crystallized varieties, often of great beauty, at Partridge Island (Cumberland Co.), Hall's Harbor and Morden (King's Co.), and Margaretville (Annapolis Co.), in the Province of Nova Scotia. Anal., H. How, Phil. Mag., 5 ser., vol. i, p. 134, 1876.

249. STRONTIAN—Occurs, in the form of white fibrous tufts, in cracks in concretionary limestone masses in the Utica slate of St. Helen's Island, Montreal, Province of Quebec. Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. i, sec. iii, p. 81, 1882-83.

250. SULPHATITE—The water of the so-called Sour Spring of Tuscarora (Brant Co.), as also that of a spring in the south-west corner of Niagara, and of one at St. David's, in the same Township (Lincoln Co.), and of another about a mile and a-half above Chippewa (Welland Co.), in the Province of Ontario, are all remarkable for containing a large proportion of free sulphuric acid. Analyses, T. S. Hunt, Geol. Can., 1863, pp. 540, 545.

(To be continued.)

MINING NOTES.

Nova Scotia.

From our own Correspondent.)

Waverley District.

The management of the Lake View Mining Co. closed down its stamp mill about the middle of this month (January) and have begun the work of tearing out the latter and foundations. The mill has been in commission less than four months. This is the twenty stamp mill that was completed in September last, at a cost reported to exceed \$16,000, and was publicly announced to be the finest ever built in Nova Scotia. Three of the mortars were of Fraser & Chalmer's latest and best pattern, and the fourth was of exact Homestake pattern, but cast in Truro, N.S. Mention was made of this mill and its vibration in the November issue of the REVIEW. The reason given by Supt. Hayward for the changes to be made is that the western pattern mortars "will not save the gold" but it is rumored that there are other reasons. The superintendent also announces that the mine will close down on the 1st of February.

The Chebucto mine, known as the Gue and Wilson, has been transferred to a company organized under the laws of Nova Scotia and named "The West Waverley Gold Co., Ltd." Mr. J. E. Hardman, of Oldham mines, has been appointed manager. Work will begin this month in the mines, and will be pushed as fast as consistent with economy and permanent advantage. Mr. R. L. Sherman is the mining captain.

Renfrew District.

The Free Claim mine has been permanently closed down by its owners; the pumps having been taken out the first week in January. It is understood that the mine has not been paying for some time.

The Empress Co., have rebuilt their engine house and shaft house destroyed by fire in August and are again at work in this shaft.

The cold weather has seriously interfered with the reclaiming of the old Ophir mine, the power being derived from water and transmitted along distance. The attempt will be abandoned until spring.

Montagu District.

Work in this district continues with little new to report. The Rose lode has not come up to anticipations and will not produce much for some time to come. The DeWolf lode is still working with average results.

Oldham District.

The new mill of the Oldham Gold Co., is approaching completion and will be ready to go into commission in February. The mines of this company are still in very low grade ore, and the large developments made have as yet failed to disclose high grade quartz.

The Standard Gold Co., will complete their new plant of pumping machinery and air compressor in February. The new hoist has been in commission now for three months and has given great satisfaction.

South Uniacke District.

The Withrow mine has secured the services of Alexander Cameron as mining captain, and have had better ore for some time past. The mine looks better to-day than for six months. It is intended to extend operations as soon as spring opens.

Killag District.

Manager MacKay of this district reports the first week's clean up at 57 ounces. Winter has somewhat retarded operations here, but work is going ahead as fast as possible.

Malaga District.

The mill of the Boston Gold Mining Company was started the week before Christmas. It is a very complete ten-stamp mill, built and equipped by the Truro Foundry and Machine Co. It is furnished with the Hammond roller ore feeder, which is reported to work perfectly. The mortar and details are modelled upon the "Homestake" pattern, and the mill as a whole is said to be the best one in the district. The quartz is said to mill from \$16 to \$36 per ton.

The mine, mill and plant of the Minneapolis and Malaga Mining Co. were sold at sheriff's sale on the 9th instant for the sum of \$13,000 to Mr. McLean, acting for Douglass et al. of Philadelphia.

Stormont District.

This district has little to report, the protracted litigation over the surface rights in Hurricane Island acting to prevent work by either party.

On the west side the North Star Company have been developing their property. The main incline on the North Star lode has been sunk over 70 feet and drifting on the lode will soon begin.

Work has also been doing on the Burke lode by the same company.

Cape Breton.

The quantity of coke manufactured at the works of the Gowrie Coal Company at Cow Bay during 1890, amounted to 3,550 tons.

Caribou District.

The Caffrey property is closed down.

There is little to report from this district. The year's returns from the once famous lake lode are microscopic. Some little work is yet doing there, but to little purpose.

The Truro Gold Mining Co., have entrusted Mr. E. Whidden, with the management of their property. Mr. Whidden is also managing the Halifax Prospecting Co's work in this district.

The Dixon property is working steadily and is almost the only producing lode in the district.

The excitement over the auriferous conglomerates running from Brookfield to Lansdowne, in Colchester County has somewhat abated. Mill tests and assays have shown yields ranging from 58c. to \$4.30 per ton, but the lack of any regularity in the gold contents of the conglomerate will necessarily act as a deterrent to capitalists asked to buy these properties at extravagantly high prices. It is probable the coming summer will see some private efforts to thoroughly prospect these auriferous belts.

Quebec.

Eastern Townships.

The total output of copper pyrites from the Capelton mines of the Eustis Mining Company amounted to 27,000 tons.

Returns from the Anglo-Canadian Asbestos Company show a product for 1890 of 11,194 tons of all grades, of which 1,167 tons were exported.

In connection with the copper trade, we notice that the well known firm of Messrs. Thos. Robertson & Co. have been appointed agents for the sale of the Orford Company's products and will hereafter keep a stock of this fine Canadian copper.

The following figures have been received from the American Asbestos Company at Black Lake :

	Output.	Exports.
Extra Quality.....	398 $\frac{1}{2}$	352 $\frac{1}{2}$
Run of Mine.....	661 $\frac{3}{4}$	430 $\frac{3}{4}$
Waste.....	35 $\frac{1}{2}$	5
Total.....	1,095$\frac{3}{4}$	787$\frac{1}{4}$

The following are the exports from the Thetford Mining Company :

No. I quality.....	36 tons.
No. II do.....	20 do
No. III do.....	14 do
Waste.....	10 do

All shipped to Hamburg.

The quantity raised from Mr. A. H. Murphy's lot at Black Lake, included :

No. I quality.....	7 $\frac{1}{2}$ tons.
No. II do.....	9 do
No. III do.....	32 $\frac{1}{2}$ do

Ottawa Valley.

Considerable activity is manifest in phosphate operations in the Templeton district. Among other properties now at work are those of the East Templeton District Phosphate Mining Syndicate, the MacLaurin Phosphate Mining Syndicate, the North American Company and other properties being worked under the energetic management of Messrs. Lomer, Rohr & Co. Of these the most promising producer is unquestionably that of the old Blackburn mine, from which Mr. Lomer is confident of making an output this year of close upon 5,000 tons of good quality.

The property of the North American Company, being worked on royalty, yielded last month 1,000 tons from five men, in six weeks—an excellent showing. The old Jackson Rae property has been opened up and is now worked by Mr. Thos. Fee of Ottawa. Satisfactory reports are also received from the McRae lots, which have been equipped with an excellent Ingersoll plant.

Messrs. S. H. Thompson and Mr. J. W. Agret are also doing well on their properties. Altogether the output from the Templeton district should exceed previous records.

In addition to the figures reported in last month's REVIEW, 500 tons were shipped from the Lievres district for use at the Capelton Chemical and Fertilizer Works.

The dumps of the old Emerald mine seemed to have proved a lucrative investment, for it is reported that fully 1,000 tons were extracted therefrom by Lomer, Rohr & Co.

Owing to the greater portion of the year being taken up with the construction of roads, the erection of buildings, installation of plant and other necessary preliminary operations, the output from the Aetna and Squaw Hill mines operated by the Anglo-Continental Guano Works

Company of Hamburg and London, has not been as large as was expected. The shipments for 1890 will figure close upon 1,000 tons.

Ontario.

Kingston District.

The Canada Company have lately given a new license for ten years to James Bell, of Arnprior, of the Rock Lake Phosphate mine—Lot 21, in 15th concession Storrington. Mr. Bell agrees to raise 100 tons per month for the rest of the time. It is understood that Lomer, Rohr & Co., of Montreal, are in with Mr. Bell, and work is to be carried on vigorously with the best machinery. Operations were resumed about the 15th instant, and the probabilities are that the output will be much larger than the minimum quantity called for by the license.

Manitoba and North-West Territories.

The output of coal from the new works of the Canada North-West Coal and Lumber Syndicate, at Canmore, amounted to about 5,000 tons. A great deal of preliminary work has been done and the mines are now well equipped and in a position to yield a good monthly output.

British Columbia.

The yield of gold from the placer mines for the last year does not equal that of 1889, chiefly due to the fact that the mines of the Cariboo district have gone behind by over \$50,000. No new mining grounds have been discovered, although it is believed by old miners that such may yet be discovered by careful search. The present year will see extensive work in the hydraulic mines of the Quesnelle River, where successful mining has been carried on for many years.

Vancouver Island.

There has been a steady demand for British Columbia coal throughout the last twelve months. The chief market was, as usual, San Francisco, but orders from other points were received and filled, amounting to a respectable quantity, and besides this the shipping demand was very large, while a good deal was taken for local uses. The supply was chiefly derived from the mines of the New Vancouver Company, as owing to the unfortunate strike at Wellington, the mines which have been operated there were rendered comparatively unproductive. Although the strike is entirely over, these mines have not yet secured their full complement of men, and only a limited quantity is produced. Meanwhile the New Vancouver company has materially increased its facilities by the sinking of new shafts and the employment of many additional men, so as to enable it to meet the requirements. The Union mines have turned out a fair quantity of coal, but the production was restricted by the seam turning out to be faulty. Recent boring, however, has discovered a valuable eight foot seam, and they are not likely to be further hampered from this cause. The East Wellington pits have produced a good quantity also. There has been a good deal of prospecting at Fort Rupert, Quatsilo and Tumbo Island, resulting in the discovery of immense deposits, the extent of which cannot be definitely conjectured.

Following are the returns of coal entered for foreign shipment at the Nanaimo, B.C., Custom House:—

	Tons.
New Vancouver Coal Company.....	289,359
Wellington Coal Company.....	103,977
East Wellington Coal Company.....	36,445
Union Coal Company.....	58,393

Total foreign shipments, 1890.... 488,174

This, estimated at a value of \$4 per ton, will make the value of coal exported to foreign countries \$1,952,696. The returns of the domestic trade are not yet to hand, but are estimated to amount to, at least, 125,000 tons, which, at the same price, is worth \$500,000, and the total coal sales in round numbers may be set down as 614,000 tons, of the value of \$2,500,000. This does not include coal at the mines on January 1, 1891.

The total outputs of coal for the five years, 1885 to 1889, were:—

	Tons.
1885.....	365,000
1886.....	326,636
1887.....	413,360
1888.....	489,300
1889.....	579,830

The coal sales of 1890, therefore, may be estimated to exceed the total output of 1889 by, in round numbers, 35,000 tons.

A falling off of over \$76,000 is reported in the shipment of gold dust from Victoria in 1890 as compared with 1889, partly due to the fact that other channels are now used to send the gold out of the country and also to the decreased output of the Cariboo mines, which have fallen \$50,000 behind the previous year. Following were the respective shipments: Bank of British Columbia, \$204,291.26; Bank of British North America, \$23,999.12; Wells, Fargo & Co., (Garesche, Green & Co., agents), \$183,587.61; total shipments, 1890, \$411,877.99; total shipments in 1889, \$488,193.62; decrease in 1890, \$76,315.63.

Lillooet.

Mining here is yet in its infancy, and very little has been done, comparatively speaking, to develop the resources of

this district. Prospecting along Cayoosh Creek has discovered several paying lodes, but there is a lack of capital to work them. The placer mines yield well, considering the number of men engaged, for Lillooet and vicinity the product being about \$40,000.

The Deadwood mine, on the Fraser River, below the Cayoosh Creek, has closed down after a successful season's work by the hydraulic process. The company have a high bank of pay gravel, gold being found from top to bottom. Next year they intend to bring in more water, whereby their power will be greatly increased.

The Great North American Company has done well, considering that they have but twenty-five inches of water, and have taken out more gold in proportion than any other company in the district. They cleaned up \$2,000 for the season, or an average of \$5 per day to the hand. Their ledge extends one mile.

The Vancouver Enterprise Company are pushing their tunnel to completion, and expect to have it through next spring. They have expended some \$12,000 so far, but it is believed they will do well when they begin actual operations.

The Lillooet Hydraulic Company, have also had a successful season, their mines having yielded between \$5,000 and \$6,000 during that time. The company intend putting in iron pipes and a monitor and enlarging their flumes and ditch. They have also a valuable property on the South Fork of the Bridge river, where they have succeeded in turning the river from its bed for half a mile. Owing to the lateness of the season no sluicing was done, but a few holes were sunk to bed rock in which good prospects were found.

Yale.

Mining matters have not been booming in this section, but still a fair amount has been done and the prospects for this year are encouraging. Thirty-six locations were recorded in 1890.

The Fraser River Gold Gravel Syndicate were unable to do much last season, owing to the unfortunate loss of their raft with the boiler to run their plant. In the coming season, however, work will be resumed and actively prosecuted. Another boiler is on its way out. This syndicate, which is very wealthy, possesses mines in Africa, Mexico, Norway, Spain and other countries, and should their property here prove a good one, there will be plenty of capital to develop other claims.

The Fraser River Dredging Company will commence operations next spring with a steam dredging apparatus worth \$30,000.

The Anglo-American Mining Company, which was not incorporated until late in the season, has a lease of 4 $\frac{1}{2}$ miles of Siwash Creek, with an average breadth of 10,000 feet. The prospects are good, and there is reason to believe that if work is carried on vigorously next spring, the results will be good.

The Queen mine (silver) has been worked all summer, and operations are being continued throughout the winter, sinking a shaft on the course of the lode. The indications are that when further developments have been made, there will be a good record. When the quantities of ore are sufficient there will be ample means forthcoming for the erection of all necessary appliances for treating it. From its situation, the Queen is considered one of the best mining properties of the Province. It is expected that on account of the good prospects obtained on the Creek, the companies having claims there will expend a good deal of capital there during the coming season.

Cariboo.

While the gold yield of Cariboo this year has been somewhat less than last, yet the discoveries and developments made exceed in importance those of many years past. In the Barkerville division the Forest, Taylor and Black Jack hydraulic companies have paid fairly well. The Waverley Hydraulic Co., on Grouse Creek, have not yet reached bedrock with their cut, but their annual production of gold increases. The Jarvis Co., who struck such a rich lead last year, got off pay during the winter, and are now drifting in search of the best channel in the hill. Considerable prospecting has been done on Lightning Creek, in some instances with success.

The Black Jack Quartz Mining Company have prosecuted the development of their mine throughout the season. Their shaft is down over 100 feet, and they are still sinking. A very good body of ore was struck at the 64 foot level, the whole width of the drive being a solid mass of sulphurets, and this decided the shareholders to continue the work of development themselves, instead of carrying out their previous intention of placing a portion of the capital stock upon the market to be sold for a working capital. As soon as circumstances warrant, a larger stamp-mill will be erected, and it is hoped that next season will see the industry assume a permanent shape. A very satisfactory test of ore from this mine was made in Glasgow recently. From 360 pounds of ore sent, a result of \$86 per ton was obtained by the process of treating the ore pursued, which worked up to 90 per cent. of the assay value.

The Island Mountain Company's mill, which was at work crushing during the season, has closed down, but is expected to start again shortly. The sulphurets from this company and the Black Jack are being roasted and chlorinated at the Government test works, and the results will shortly be made known.

The Mines at Forks of Quesnelle, in this district, are reported to be doing well. Owing to the wet summer there was an unusually good supply of water during the whole season, which enabled the miners to work to good advantage, and although the mining population, chiefly Chinese, has decreased, yet the yield of gold has been quite up to the average. From the present outlook it is likely that some very good hydraulic mines will be opened before long in this section. A number of companies are engaged in making ditches and otherwise preparing to open up an old channel of the South Fork River, which promises valuable mines of this class, while on Keithly and Snowshoe Creeks, several claims are in full working order.

On Spanish Creek a company has been prospecting for the last twelve months. They have not struck anything very much yet, but have a small prospect and have not yet got to the bottom. They are driving in a tunnel. Two other parties are also prospecting in this vicinity.

The estimated amount of gold taken out of this district last season is \$62,800. Of this amount \$45,300 is from the Keithly division and \$17,500 from the Fraser River in the Alexander and Williams Lake polling divisions. The average number of white men employed was about forty, and two hundred Chinamen.

Kootenay District.

The past year has been eventful in this district, the development of old claims having been carried on vigorously while new locations, some of great richness, have been discovered. The commencement of construction work on the Columbia and Kootenay railway and the prospect of an extension of the N. P. R. R. across the boundary into the Kootenay Lake district, together with the establishment of steamboat lines connecting with existing lines of railway, have done much to inspire confidence in the future of this part of the country. The completion of the smelting works at Revelstoke and the reaching out and bidding by that company for the ores of the district has also tended to give a good impression of the possibilities of the district, and in the current year, everything points to a remarkable development and an output of mineral that will far exceed any previously done. The total yield of gold in the West Kootenay district for the year 1890, including quartz with the placer yield, is \$35,000, an increase of \$5,000 over 1889. This is a remarkably good showing when it is remembered that the Big Bend district is this year thousands behind the yield of 1889.

There is a promising group of claims about three miles west of Nelson, assays from the ore taken out showing good paying qualities.

There has been some prospecting in the Larleau Pass and five locations have been recorded. The assays are good.

A nickel deposit has been discovered on the west bank of the Kootenay. Assays return 30 per cent. of nickel, but the average would probably be 12½ to 15 per cent.

In Illicillewaet considerable development work has been done, and some of the claims are turning out well.

At Albert Canon, a few miles away, the Wild Fox is located. On this claim is a tunnel 47 feet. The vein matter is galena, 3 feet wide, with an assay value of 22 oz. of silver and 47 per cent. lead per ton. There are two other locations here on which assessment work has been done, the ore being of the same character as the Wild Fox.

In the Poszman mine at Eagle Creek, owned by Davenport and Harvey, the company are sloping from the 90 foot level. The upper tunnel is already in 100 feet and will be extended until the ledge is struck, another 400 feet, and beyond to the White Ledge, owned by the same company. A ten stamp mill is in operation, and about 1,200 tons of ore were milled last season, working about three months. The returns are private.

The Catamount, some two miles away, exhibits a large deposit of ore. A cut across the vein extended 16 feet without encountering the foot wall. The vein matter is in quartz, impregnated with sulphurets existing in a hornblende formation; the returns average from \$15 to \$30 per ton, gold. A tunnel is being run at a lower level, a distance of 115 feet. There are besides, the Wild Cat and Forrest, of similar kind. Further down there are other locations, the ore from which assays from \$16 to \$40 per ton.

About a mile from these latter is the Royal Canadian, on which claim there are two tunnels, each 90 feet. The ledge is 2½ feet wide, and the ore reported to be worth \$30 per ton by the owners. An offer has been made by Australian capitalists to put up a mill and pay \$15,000 for a half interest, provided the ore assayed \$20 per ton.

Five localities exist on Rover Creek. On one, the White Water, a tunnel is in 90 feet and will, when completed, intersect the vein, 120 feet from the surface. The ledge is six feet wide and contains excellent high grade gold ore. The average of fifteen samples assayed gave a return of \$80.17 in gold. One and a half tons were sampled at the Revelstoke works, and \$110 in gold and 9 oz. of silver were obtained therefrom. It is the intention of one of the owners to remove two mills now on the Cottonwood Creek to a site in the vicinity of these mines.

The camp at Hot Spring has kept some 125 men mining steadily all summer, besides 200 others at outside work and prospecting.

The Skyline has a 130 foot incline on the vein. The shipments the year before last were 15 tons of 325 ounce ore; last year, 95 tons of 280 ounce ore were sent out, and there are now 1,000 tons of 45 ounce ore on the dump. A new double shaft has been started, an engine and pump set up, and a fine shaft house 70x31 completed. Work on 200 feet of contract sinking has also been begun.

The United is down sixty feet, all in ore, and will have 1,000 tons ready for shipment on completion of the railroad. They will sink 200 feet more this winter. The steam works are nearly completed.

Over 1,000 tons taken from the Krao are ready for shipment on the coming of cheap transportation. They are down 70 feet and have a steam hoist pump nearly ready for operation.

At No. 1 the vein has been struck within 15 feet of the bottom of the old shaft. The ore is of high grade and averages nearly 4 feet of solid mineral. This will help the camp greatly, as hitherto No. 1 was the only claim that could be pointed out as likely to be a failure, while now it is among the best. The vein will be tapped near the tunnel and a large extent of ground prepared for sloping. Here also some 2,000 tons of ore are awaiting the coming of the railway, together with 50 tons of high grade assorted ore.

The Crescent and Eden, Tenderfoot, Vancouver, Old Timer and Neosho, have all struck new bodies of high grade ore carrying native silver, recently, and are taking it out and sacking it.

There has been more development of the surrounding region of late, while within the Hot Springs and Hendryx camps it has also amounted to a good total, that may be summed up as follows: The Blue Bell has 1,500 ft. of tunnel and drifts; No. 1, 1,200; Skyline, 490; Gallagher, 220; Krao, 350; Donald, 250; Spokane, 350; Maestro, 260; Dictator, 200; Highland, 150; Pataha, 120; Fourth, 100; and many others have between 25 and 75 feet.

Perhaps the most important camp formed in 1890 was the one at Trail Creek, which, moreover, gives promise of permanency and value. It is situated on the west side of the Columbia River, 18 or 20 miles from Sprate's Landing. The first find was made a year ago last summer, when a gold lead and silver proposition was discovered on the surface, the gold running into silver as depth was reached. At a depth of 25 feet an assay of \$125 of silver has been obtained. The tunnel is in 30 feet with a 3 foot vein of galena ore. Between 50 and 100 claims have been recorded in the past year.

The Le Roi has a vein 25 feet in width with 15 feet of ore, and 7 feet of copper. The highest assay from this claim shows \$5.00 per ton. Recently capital has been induced to take hold of the Le Roi claim, and a company has been formed known as the Le Roi Mining Company, with a capital \$150,000. Enough stock has been paid in to enable the company to work three shifts during the winter, and the manager expects to sink 100 feet and drift another hundred by the time navigation opens in the spring.

Other claims also show very well and give indications of large returns. Several reports have been made, all of them favorable upon the district.

There is not a great deal to report on Toad Mountain beyond that assessment work has been done on the several claims. The tunnel on the Silver King is in over 300 feet and some 150 feet has yet to be run before the bottom of the incline shaft is reached. The Grizzly, a spur of the Silver King, is developed by a 65 foot shaft, and 72 oz. of silver per ton was got from an assay of an average sample of ore taken from this mine. The Froquois is a parallel claim to the Silver King and shows a good body of ore. In addition to the locations above mentioned, there is also the Water Jacket, Toughnut, Jonah, Morning, Evening and Pacific, in all of which more or less development work has been done. The ore from the latter locations is low grade. The Toughnut shows a well-defined vein, varying in width from six to fourteen feet. The ore from this claim is of a refractory nature on account of the zinc carried, but the percentage of copper, silver and lead is high enough to make it very valuable. On the Jonah, cuts have been run on both ends of the claim, each uncovering the ledge and showing a width of five feet. As depth is obtained, the ore presents the same character as that found in the Toughnut.

CANADIAN COMPANIES.

The following is a list of the companies incorporated under the various Joint Stock Companies Acts, and also private concerns, for the pursuit of mining and kindred industries in 1890, together with the capital stock and chief places of business:—

NOVA SCOTIA.

Name of Company.	Capital Stock.	Head Office.
Bettye Freestone Co.	\$ 25,000	Wallace, N.S.
Bras d'Or Marble Co.	200,000	Halifax, N.S.
Central Rawdon Mining Co.	120,000	Windsor, N.S.
Colchester Coal Mining Co.	50,000	Truro, N.S.
Coldstream Mining Co.	1,000,000	Boston, Mass.
Dufferin Gold Mining Co.	500,000	Truro, N.S.
Halifax Mining & Prospecting Co.	250,000	Halifax, N.S.
Mining & Development Co. of North America.	1,000,000	Boston, Mass.
Mooreland Gold Mining Co.	100,000	Halifax, N.S.
Napier Mining Co.	120,000	Oldham, N.S.
Northup Mining Co.	200,000	Philadelphia, Pa.
North Star Mining Co.	40,000	Halifax, N.S.
Nova Scotia Syndicate.	£ 12,000	London, Eng.
Queen's County Mining Co.	\$ 1,000,000	Boston, Mass.
Rawdon Antimony Mining Co.	50,000	Halifax, N.S.
Rossignol Mining Co.	500,000	Boston, Mass.
Stanley Gold Mining Co.	40,000	Westville, N.S.

NEW BRUNSWICK.

Windsor Gold Co. 100,000 St. John, N.B.

QUEBEC.

Beaver Asbestos Co.	\$ 100,000	Sherbrooke, Q.
Brompton Lake Asbestos Co.	60,000	Quebec, Q.
Fleming Phosphate Mining Co.	Private.	Ottawa, Ont.
General Phosphate Corporation.	£ 1,000,000	London, Eng.
Montana Gold Mining Co.	\$ 24,000	Joliette, Q.
Portland Phosphate Co.	Private.	Ottawa, Ont.
Richmond State Quarrying and Manufacturing and Asbestos Co.	150,000	Richmond, Q.

ONTARIO.

Fairbank Consolidated Mining Co. of Ontario.	\$ 500,000	Toronto, Ont.
Frontenac Phosphate Co.	£ 10,000	London, Eng.
Cavel Bay Mining Co. of Ontario.	\$ 100,000	Toronto, Ont.
Haliburton Mining Co.	100,000	Toronto, Ont.
Kaladar Mining Co.	120,000	Napanee, Ont.
Kingston Phosphate Mining Co.	£ 5,000	London, Eng.
Kingsville Natural Gas & Oil Co.	\$ 43,750	Kingsville, Ont.
La Cumbre Mining Co. of Toronto.	70,000	Toronto, Ont.
Milton Pressed Brick & Terra Cotta Co.	50,000	Milton, Ont.
Ottawa Brick Mfg. Co.	45,000	Ottawa, Ont.
Ontario Gold & Iron Co.	100,000	Malone, Ont.
Portland Asbestos Co.	Private.	Ottawa, Ont.
Provincial Natural Gas & Fuel Co. of Ontario.	500,000	Toronto, Ont.
Premier Oil Co.	150,000	Petrolia, Ont.
Sebastopol Phosphate Syndicate.	£ 5,000	London, Eng.
Silver Centre Mining Co. of Ontario.	\$ 300,000	Toronto, Ont.
Silver Gance Co.	£ 60,000	London, Eng.
Standard Asbestos Co.	\$ 100,000	New York, N.Y.
Standard Oil & Gas Co. of Ontario.	1,000,000	Stratford, Ont.
Vivian, H. H. & Co. (branch).	£ 328,000	Swansea, Wales.

MANITOBA AND N.W.T.

Crowfoot Coal Co.	\$ 125,000	Winnipeg, Man.
Crown Point Mining Co.	Private.	Duluth, Minn.

BRITISH COLUMBIA.

Anglo-American Mining Co.	\$ 3,000,000	Yale, B.C.
Black Jack Quartz Mining Co.	120,000	Barkerville, B.C.
British Columbia Pottery & Terra Cotta Co.	60,000	Victoria, B.C.
Columbia Mining Co.	500,000	Spokane Falls, Wash.
Crow's Bar Mining Co.	25,000	Vancouver, B.C.
Empire Consolidated Gold Mining Co.	500,000	Spokane Falls, Wash.
Golden Mining & Smelting Co. of Canada.	400,000	Golden City, B.C.
Kokisilah Quarry Co.	100,000	Victoria, B.C.
New Eureka Silver Mining Co.	150,000	Victoria, B.C.

BRITISH COLUMBIA.—(Continued).

Name of Company.	Capital Stock.	Head Office.
Northwestern Gold & Silver Mining Co.	1,000,000	Victoria, B.C.
Saanich Lime Co.	50,000	Victoria, B.C.
South Fork of Quesnelle Hydraulic & Mining Co.	Private.	Cariboo, B.C.
Vancouver Smelting & Mining Co.	250,000	Vancouver, B.C.
Victoria Hydraulic Mining Co.	100,000	Victoria, B.C.

Company Notices.

Bell's Asbestos Company.—Mr. F. C. Bell has retired from the board and has resigned the office of managing director of this company.

Red Deer Valley Railway and Coal Company.—This company will apply to the Dominion Parliament at its next session, for an act amending the act of incorporation of the company and extending the time for complying with the conditions of the 89th section of the Railway Act, and for other purposes.

Alberta Railway and Coal Company.—Notice is given that the Alberta Railway and Coal Company will apply to Parliament at its next session for authority to construct and operate a railway from the westerly end of the line authorized by 53 Victoria, chapter 89, and in continuance thereof, through the Crow's Nest Pass to some point on the Canadian Pacific Railway in British Columbia and for other purposes.

Cumberland Railway and Coal Company.—Notice is given that the annual general meeting of shareholders of this company will be held at the company's offices, Imperial Buildings, Place d'Arms, in the City of Montreal, on Wednesday, the 11th day of February next, at 3.30 p.m. The transfer books will be closed from the 1st day of February until after the meeting.

Royal Gold Mining Company.—Application will be made for letters patent of incorporation under the "Nova Scotia Joint Stock Companies Act" by the above company, now doing a general mining and milling business at Whiteburne, Queens Co., N.S. The capital stock of the company is to be \$50,000, divided into 500 shares of \$100 each. The applicants are; Charles Brown, Adoniram Curtis, Boston, Mass., James E. Cushing, Caledonia, N.S., Geo. W. Johnson, Yarmouth, N.S., Thomas Parker, Caledonia, N.S.

Jenckes Machine Company.—This company, which had applied to the corporation of Sherbrooke for a loan of \$50,000 and exemption from taxes, have withdrawn their request. The city council offered a cash bonus of \$10,000 and exemption for twenty years to the company, which was refused as too small, but the committee named for that purpose on visiting the works and becoming acquainted with the scale of the contemplated improvements, expressed a determination to recommend to the council the passing of a by-law granting the aid previously asked.

Medicine Hat Railway and Coal Company.—Application will be made to the Dominion Parliament, at its next session, for an act amending the act relating to this company, by extending the time for completing the same, and authorizing the company to continue and construct and operate its line of railway to a point on the international boundary line between sections one and eight, in the fourth range, west of the fourth principal meridian, Assiniboia, with power to connect there with any other line of railway extending from a southerly direction, and for other purposes.

The Kingston Light, Heat and Power Company.—Application will be made to the Ontario Legislature for an act confirming the amalgamation of the City of Kingston Gas Light Company and the Kingston Electric Light Company, or to create a new company under the above title with power to carry on the business of lighting, heating, and supplying power to the city of Kingston and vicinity; to extend the charter, to increase the capital stock to \$250,000, and for other purposes.

The Ontario Nickel Mountain Mining Co., (Ltd.)—This company makes application for incorporation to the Ontario Legislature, for the purpose of carrying on a general mining business in the District of Nipissing. Head office, Toronto; capital, \$500,000, in 5,000 shares of \$100 each. Applicants: G. S. Macdonald, W. B. Poulton, Margaret Poulton, J. K. Leslie, D. Hunter, W. H. Cathro, R. W. de Morest, Toronto; R. Woods, A. Harvey, Whanapitae; G. S. Macdonald, W. B. Poulton, and J. K. Leslie to be the first directors.

The Mutual Natural Gas Company of Port Colborne, (Ltd.)—Application will be made to the Ontario Legislature for incorporation of the above company, to drill wells for natural gas, oil, and other mineral products, to construct pipe lines and for other powers. Head office, Welland, Ont.; capital, \$20,000 in 200 shares of \$100 each. Applicants: H. Cronmiller, De Witt Carter, E. Armstrong, F. King, J. D. Kinnard, L. G. Carter, and J. B. Neff, all of Port Colborne. H. Cronmiller, De Witt Carter and E. Armstrong to be the first directors.

The Lake Tamagomig Pioneer Company, (Ltd.)—Application will be made to the Ontario Legislature to incorporate the above company for the purpose of dealing in timber lands, erecting saw-mills, dealing in mining lands, operating mines, smelting and refining ores, carrying on a general forwarding business by land and water, acquiring or building piers, railroads, wharves, roads, etc., and building hotels, etc. Head office, Toronto; capital, \$500,000, in 5,000 shares of \$100. Applicants: Wm. Hendrie, Hamilton; E. Wragge, A. Nairn, R. Jaffray, W. B. McMurrich, Toronto, all of whom are to be the first directors.

The Essex Moulding Sand Company, (Ltd.)—Notice is given in the Ontario Gazette that Letters Patent have been issued to G. H. Walker, P. J. Conroy, G. E. A. Walker, P. Mulken, of London, Ont., and A. R. Ferris of the Township of Colchester, Essex County, incorporating the above company with power to dig for, sell and otherwise dispose of moulding sands; to quarry for stone and like minerals, and to manufacture, sell and dispose of the same, together with the usual powers as regards real estate. The head office will be at London, Ont. The capital is \$25,000 in 250 shares of \$100 each.

The Ogema Mining and Smelting Company of the District of Thunder Bay, (Ltd.)—The incorporation of this company by the Ontario Legislature will be asked for, to carry on an exploring, mining, smelting and refining business in silver, copper, lead, nickel, etc., with the usual powers. Chief place of business, Port Arthur; capital, \$150,000, in 3,000 shares of \$50 each. Applicants: J. H. Sixsmith, C. Allen, H. W. Cranmer, of Camden, N.J., and C. B. Crosby, J. Mair and J. M. Scott, of Philadelphia, Pa., all of whom are to be first directors.

The Royal Bridge and Iron Company, (Ltd.)—Application will be made to the Dominion Parliament for the incorporation of this company, for the purpose of carrying on the business of constructing and designing and manufacturing iron, steel and other bridges, and of all structural iron and steel, and to deal in all kinds of structural iron, steel and other metals. The chief place of business to be in Montreal. Capital stock \$30,000, in 300 shares of \$100 each. The applicants are: F. F. Miller, R. Fitzgibbon, W. M. Reid, A. W. Smith, and J. R. Gardiner, all of Montreal, the three first named to be the first or provisional directors.

James Pender & Company, (Limited.)—Notice is given of application to the New Brunswick Legislature for the incorporation of this company for the object of manufacturing wire, wire nails, horseshoe nails, nails of all kinds and descriptions, and articles of iron, steel and other metals. The chief place of business is to be at St. John, N.B. The amount of the capital stock is to be \$100,000, divided into 1,000 shares of \$100 each. The following are the applicants: James Pender, Walter O. Purdy, William Wheeler, John J. Gordon, of St. John, N.B., and Frederick E. Mariner of Chicago. The first three are to be the first or provisional directors.

Rocky Mountain Railway and Coal Company.—Notice is given that application will be made to the Dominion Parliament, at its next session, for an act to incorporate the Rocky Mountain Railway and Coal Company, with power to construct and operate a railway from a point on the line of the Canadian Pacific Railway Company, at or near Anthracite, in the District of Alberta, to a point on the Red Deer River, in the said district, with all powers conferred by the Railway Act; and to construct and operate telegraph and telephone lines; and with power to buy, lease, acquire, sell and mortgage coal and other mineral lands and mines; and to mine coal and other minerals; and to manufacture and sell the products of such mines and lands.

White's Asbestos Company.—The shareholders of this company assembled in general meeting last month in London, Eng. The accounts then submitted for adoption cover the period from April 13th, 1889, the date of establishment of the company, to September 30, 1890, that is, seventeen months. Out of £100,000 authorized capital, it appears that 15,000 shares of £1 each have been taken up and 17s. 6d. per share has been called, producing in cash £10,824. On the other side the directors have paid away £6,257 on account of purchase of property and plant, £1,254 expenditure at the mines, other expenditure £3,907, leaving cash at bank £904, and debtors £92. Of the other expenditure £1,476 is for directors' fees which have not been paid although charged. There is a *per contra* item of sundry creditors, £1,591. The report states that the progress made in development of the property has been very disappointing. The mines have been closed for the winter-season. The properties worked on royalty have been abandoned in consequence of the unsatisfactory nature of the agreements under which the work was carried on.

Buffalo Lake and Battleford Railway Coal and Iron Company.—Application will be made at the next session of the Dominion Parliament for an act to incorporate the above company with power to construct, equip and operate a line of railway from a point on the line of the Calgary and Edmonton Railway at or near the crossing of the Blind Man's River in or near Township 39, range 27 west of the 4th initial meridian, in the

District of Alberta, and running easterly to the Red Deer River in or near Township 39, range 23 west of the same meridian, thence north-easterly to the Battle River in or near Township 40, range 15 or 16 west of the same meridian, thence easterly to Battleford. And also to construct, equip and operate a branch line from a point in the main line in or near Township 40, range 15 west of the same meridian, and running south-westerly to or near Township 33, range 22 west of the same meridian. Also with powers to the same company to acquire lands for coal, iron and other mines, and to work such mines. Also with power to construct and operate a telegraph or telephone line in connection with the said railway, and, generally, with all powers, rights and privileges usually granted to railway companies under charters of incorporation.

The British Columbia Iron Works Company, (Ltd.)—Application will be made to the Legislature of British Columbia, to incorporate the above company, for the purpose of manufacturing all kinds of saw mill, mining and marine machinery, agricultural implements, pumps, hoisting machinery, derricks, cranes, dredges, excavators, boilers, machine tools, safes and vaults, and generally to carry on a blacksmithing foundry, boiler-making and machine business in all its branches; to act as agents for the sale of machinery and machine supplies of all kinds; to build and repair ships and steamers, and vessels of all kinds; to purchase, sell or lease any lands or premises, wharves or docks for the carrying out of the above purposes. The capital stock of the company is to be \$50,000 divided into 1,000 shares of \$50 each. The time of the existence of the company shall be fifty. The principal place of business shall be in Vancouver, B. C., and the number of trustees shall be four, consisting of the applicants, viz., John G. W. Macfarlane, J. W. Campion, J. Whetham and Wm. Hickey, who shall manage the affairs of the company for the first three months.

The West Waverley Gold Company (Limited.)—Notice is given of application for the incorporation of a company under the above title, according to the provisions of the statutes of Nova Scotia, for the purpose of purchasing, acquiring and owning of gold areas, timber and other lands, the development, exploitation, working and operating of gold mines, deposits carrying gold and associated metals, winning, raising and milling such metalliferous ores, selling and disposing of the gold and other metals produced therefrom; constructing, maintaining and operating all mining and milling machinery and appliances necessary for the aforesaid purposes; the selling and disposing of gold mines and gold mining areas, and lands belonging to such company. The chief place of business of the company is to be Waverley, in the county of Halifax, Nova Scotia. The intended amount of the capital stock is sixty thousand dollars in six thousand shares of \$10. The names of the applicants are J. C. Ayer, of New York, manufacturer; Charles F. Ayer, of Lowell, Mass., lawyer; Frederick Taylor of the last named place, merchant; John E. Hardman, of Oldham, Halifax Co., Nova Scotia, mining engineer; and Edmund L. Newcombe, of Halifax, N.S., barrister. The first or provisional directors of the company are to be J. C. Ayer, John E. Hardman and Edmund L. Newcombe.

Goldie & McCulloch.—Application will be made to the Dominion Parliament at its next session to incorporate this company for the purpose of carrying on of all or any business of manufacturers of steam engines, boilers, water wheels, heaters, pumps and all necessary parts and appliances for the working of the same; flouring, saw-mill, shingle, stave and barrel machinery, steel and iron shafting by turning, drawing or grinding, woollen and cotton mill machinery, wood working machinery, wood and iron machinery of every sort and description; mill-wrighting in all its departments, patternmaking, fire and burglar proof safes and vault doors of all kinds; steel and iron chests of all kinds, and also any materials, machinery, apparatus, appliances, articles and things required for or in connection with or incidental to or which shall be capable of being used for the purposes of any of the said businesses or dealings; to carry on the business of foundry, mechanical engineers, machinists and electro-platers, and whatever may be incidental or collateral to the same; to have the customary powers as regards real estate and other property; to have power to apply for purchase or otherwise acquire or dispose of any invention, letters patent, etc. The chief place of business of the company is to be at Galt, Ontario. The proposed amount of the capital stock is \$700,000, divided into 1,400 shares of \$500 each. The names of the applicants are as follows: John Goldie, Hugh McCulloch, sr., Hugh McCulloch, jr., Galt; Robert McCulloch, Toronto, Ont., and David Goldie, Ayr, County of Waterloo, Ont. The first or provisional directors of the company are to be John Goldie, Hugh McCulloch, sr., and Hugh McCulloch, jr., all residing in Canada.

Canadian Companies.

ENGLISH QUOTATIONS.

	Price.
Excelsior Copper, Limited, £410,738 fully-paid shares of £1.	—
Nicola, Limited, £35,000 fully-paid shares of £1.	—
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1.	1/4
Silver Wolverine, Limited, £68,465 fully-paid shares of £1.	—

Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2.....	—	—
Ditto, £80,000 5½ per cent. debentures...	—	—
General Mining, Limited, £219,752 fully-paid shares of £8.....	3½	4
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100.....	—	—
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1.....	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	—	—
Ditto, £149,500 full-paid ordinary shares of £10.....	—	—
Ditto, £900 fully-paid deferred shares of £100.....	—	—
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid ..	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10.....	3	5
Ditto, £250,000 fully-paid ordinary shares of £10.....	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £2.....	—	—
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10.....	—	—
Ditto, £25,000 fully-paid deferred shares of £10.....	—	—
Bell's Asbestos, Limited, £140,000 fully-paid shares of £5.....	13¾	14¾
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1.....	—	—
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1.....	—	—
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid.....	—	—
Ditto, £5,000 fully-paid founders' shares of £10.....	—	—
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100.....	—	—
Ditto, £99,850 fully-paid shares of £50.....	—	—
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100.....	—	—
White's Asbestos, Limited, £20,000 fully-paid shares of £1.....	—	—
Ditto, £15,000 shares of £1, with 15s. paid	—	—

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to September 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. Annual meeting to be held about March 1891.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31, submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3½ each year; for 1887, £4 13s. 9d. per cent.; and for 1888 and 1889, 3¼. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent. was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £57,700.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. Debentures, £3,450.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,744. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 2½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576, which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

Another Meeting of Mine-Owners in Montreal—A Mining Association Formed.

An important meeting of owners and operators of mines and mineral lands in the Province of Quebec, was held in the Windsor Hotel on Friday, the 16th instant. There was a good attendance, among others present being: The Hon. George Irvine, President, Johnson's Asbestos Co., Quebec; Mr. W. H. Irwin, Anglo-Canadian Asbestos Co., Montreal; Capt. Robert Adams, Anglo-Canadian Phosphate Company, Montreal; R. T. Hopper, Anglo-Canadian Asbestos Company, Montreal; J. B. Smith, M. E., Anglo-Continental Guano Works Company, Buckingham; S. P. Franchot, Villeneuve Mica Mines, Buckingham; O. M. Harris, Canadian Phosphate Company, Montreal; George R. Foster, representing Excelsior Copper Co., Montreal; Adolphe Lomer, representing the East Templeton District Phosphate Mining Syndicate and other important companies, Montreal; C. B. Falardeau, Canada Industrial Company, Montreal; W. A. Allan, Little Rapids Mining Co., Ottawa; S. H. Fleming, Fleming Phosphate Co., Ottawa; C. M. Gibbs, Dominion Phosphate Company, of London; Dr. C. Killing, Amsterdam, and a number of others. Capt. R. C. Adams, occupied the chair, and Mr. B. T. A. Bell acted as Secretary.

Letters of apology were read from Mr. R. N. Hall, M.P., Sherbrooke; Mr. W. H. Nichols, New York, and others.

The chairman, having explained that the object of the meeting was to consider the operation of the new Bill affecting the mining interests of the Province, an animated discussion took place on the most feasible steps that should be taken to protect the industry. The following resolutions were adopted:—

(1) *Resolved*—That a General Mining Association for the Province of Quebec be now formed;

(2) *Resolved*—That the following gentlemen be nominated a Committee to prepare a Draft Constitution for said General Mining Association:—Hon. George Irvine, Johnson's Asbestos Co., Chairman; B. T. A. Bell, Editor CANADIAN MINING REVIEW, Secretary; S. P. Franchot, Ottawa Mining Co.; O. M. Harris, Canadian Phosphate Co.; W. H. Irwin, Anglo-Canadian Asbestos Co.; J. N. Greenshields, Q.C., Excelsior Copper Co.; J. B. Smith, Anglo-Continental Guano Works Co.; W. A. Allan, Little Rapids Mining Co.; Capt. Robert C. Adams, Anglo-Canadian Phosphate Co.; James King, King Bros., Quebec; George E. Foster, Montreal; C. M. Gibbs, Dominion Phosphate Co., of London.

(3) *Resolved*—That the mining men of the Province, and all interested directly or indirectly in the welfare of its mining industries, be invited to join and co-operate in the work of said Association; and that the Secretary be instructed to invite them to a meeting to be held in the Windsor Hotel on Friday, 30th January next, for the purpose of ratifying the Constitution, the election of office-bearers, and other business.

Strikes and Their Cost.

An official report upon the strikes and lock-outs of 1889, compiled by Mr. J. Burnett, Labor Correspondent of the British Board of Trade, has just been issued as a Parliamentary paper, and contains facts and figures which are well worthy of careful consideration. Some of the conclusions drawn by Mr. Burnett have been disputed already by one of the trade union secretaries, but for the practical purpose of estimating the cost and incidence of strikes the facts and figures of the report hold good. During the year 1889 there were strikes in 3,164 establishments, the number of distinct strikes being 1,145. Of that total 9.7 per cent. were among miners, 9.34 per cent. in the ship-building trades, 8.5 per cent. in the engineering trades, and 7.5 per cent. among dock and wharf laborers. Most of the strikes were due to claims for higher wages. Of the total number 48.3 per cent. were successful, 31.5 per cent. were partially successful, 10.7 per cent. failed, and in the remainder the results are not known. There were forty-five strikes in opposition to proposed reductions of wages, and one-fourth of them were successful, whilst twenty failed wholly. As many as twenty strikes were due to the sympathy of one body of workers not actually involved with those directly engaged in the struggle. Mr. Burnett states that in the 304 strikes which were successful, 93,524 persons were concerned, and in the 272 partially successful strikes 175,476 persons were involved. In the 171 strikes which failed, 40,472 persons were concerned. In arriving at settlements of the disputes 62.3 per cent. were solved by means of conciliation, and in 4.2 per cent. arbitration was resorted to after the conciliation. As regards the total number of persons involved in the whole of the strikes, the statistics are not absolute, but it is known that in 930 strikes there were 344,840 persons directly and indirectly concerned. As to the duration of the strikes, details are furnished of 840, in which the aggregate number of days lost was 15,100. The average duration per strike was 18.6 days, which gives an aggregate loss of 3,730,000 working days, which, at 3s. 6d. per day, would be a loss of wages alone of £662,000. A fuller calculation and an allowance for the much higher rates of wages received by many of the strikers would in all probability more than double the total just given. In regard to the losses inflicted upon the employers, it is shown that in 216 instances only, the value of the fixed capital laid idle was £14,480,962, while in 169 instances the ratable value of the property laid idle was £268,684.

In 233 cases the estimated outlay caused through the stopping and re-starting of the works was £169,212. In ten cases it is stated that £6,517 was paid by organizations of employers in support of firms whose men were on strike. On their part the trade unions in 369 strikes paid £63,636. There are in Mr. Burnett's report many other figures of considerable interest, but those we have quoted serve to give an approximately accurate idea of the heavy bill paid by the country in respect of the wages agitations of last year. That bill, moreover, cannot be deemed to be complete without a large addition for the loss of business—temporary or permanent—resulting from these serious disturbances of our labour market, and by the higher selling prices necessitated by the augmented cost of labor. On several occasions we have pointed out the losses caused in this way, and have expressed the hope that some day strikes will be wholly prohibited. The trade union leaders take credit to themselves, in criticising Mr. Burnett's report, for the general advances in wages which they have secured by means of the strikes, but they do not deprecate such violent methods of negotiation, and appear to be satisfied to resort to what is virtually brute force rather than to assist in the constitution of a proper tribunal for dealing with all labor disputes as they arise.

Minerals, Chemicals and Colors.

(From Geo. G. Blackwell's Report.)

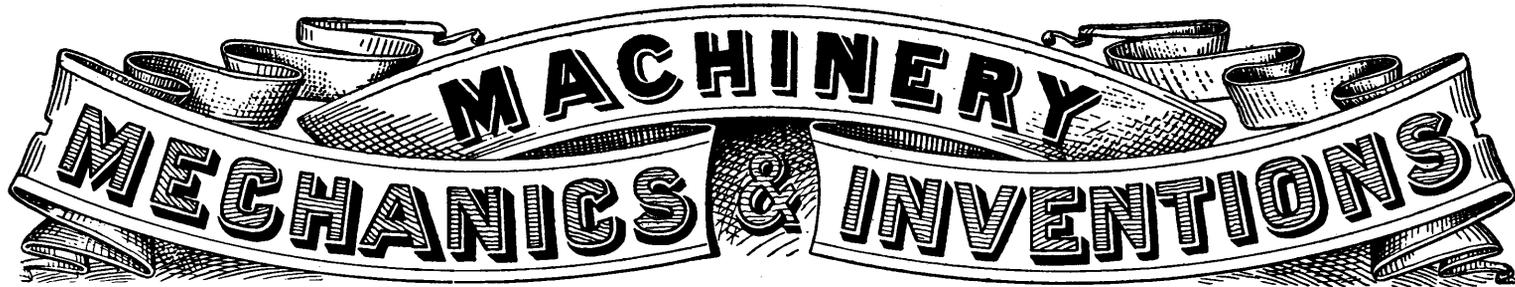
LIVERPOOL, January 16.

MINERALS.—The firmness reported in our market last week has continued. Manganese: Arrivals still small, and prices remain firm. Magnesite: Stocks continue large, and prices low. Raw ground £6 10s, and calcined ground £12 10s. Bauxite (Irish Hill brand): The demand for this article is increasing considerably at advanced figures. French chalk: More arrivals this week; all, however, have gone into consumption; prices remain firm. "Angel White" brand, 97s 6d to 105s od, medium, 110s od to 120s od superfine. Barytes: Carbonate continues easy, whilst sulphate of fine quality is scarce, "Angel White," No. 1 70s od., No. 2 60s od to 65s, No. 3 45s. Pumice-stone: Both lump and ground steady. Iron ore unaltered, also manganiferous and Santander; Irish and Cumberland in good demand at full prices. Emery stone: Fairly brisk for best brands; No. 1 lump £5 10s to £6, smalls £5 to £5 10s. Fullers' earth: Best lump, 55s; fine impalpable ground, £7. "Emerald" ground 80s. Scheelite, wolfram, tungstate of soda, and tungsten metal steady at fair prices. Chrome ore: The demand for high grades continues good at full prices. Antimony ore and metal steady. Asbestos firm, especially Canadian Rock. Fetter's lead ore of best quality in demand; smalls, £13 to £14; selected lump £15 to £16. Calcamine of high grades sought after at full figures. Strontia sulphate (celestine) steady, 15s 6d to 17s. Carbonate (native), £15 to £16; powdered (manufactured), £11 to £12. Limespar: A good business doing; English manufactured old G. G. B. brand in request at 50s (ground). Felspar and fluorspar easier. Plumbago: Best qualities sought for; Spanish, £6; best Ceylon lump at last quotations; Italian and Bohemian, £4 to £12 per ton. "Founders," £5 to £6; Blackwell's "Mineraline," £10. French sand, in cargoes, 20s to 22s 6d. Ground mica, £50. China clay steady; common, 18s 6d; good medium, 22s 6d to 25s; best, 30s to 35s (at Runcorn). Irish moss: More doing at higher figures. Bog ore (oxide of iron) scarce; finest quality 22s.

COLORS without alteration. Ochres: Oxfordshire, common £10; medium £12; best £15. Derbyshire, common 40s; medium, 50s; and best 60s. Welsh best 50s; seconds, 47s 6d; and common 18s; Irish, Devonshire, 40s to 45s; French, J.C., 55s, 45s to 60s; M.C., 65s to 67s 6d. Umber: Turkish, none offering. Devonshire, 50s to 55s. White lead, freed lead, and oxide of zinc still firm. Venetian red, £6 10s. Cobalt: Prepared oxide, 10s. 6; black, 9s 9d; blue, 6s 6d. Zaffres: No. 1, 3s 6d; No. 2, 2s 6d. Oxide of iron: Good inquiry; common, £6; medium, £10; finest, £20.

CHEMICALS.—The tone of our market this week remains unchanged. Soda ash 13½d up. Caustic soda firm; 60 per cent. white, £10; 60 per cent. cream, £9-£12s 6d; and 70 per cent. white, £11 10s; 74 per cent., £12. Bicarbonate, £5 15s. Nitrate of soda, 8s 6d to 9s. Soda crystals, £3 10s. Bleaching powder £7 2s 6d. Salt cake, 42s 6d. Chlorate of potash, 5¼d. Arsenic strong at £14. Sulphate of copper, £18 10s to £19. Manganese: Sulphate, £22; chlorate of manganese, £15 per ton; carbonate, £12 10s; borate, best English make, 6¼d; oxalate, 1s 6d. Chloride of magnesium (antiseptic) strong at 45s to 50s. Montreal ashes; Pot 32s; pearl, 45s to 47s.

The use of the Telephone in Mines.—The telephone is getting to be a great thing in coal mines. The Philadelphia Ledger, referring to its use in this way, says: "Most mines are to a certain extent in difficult positions on precipitous mountains. The telephone enables the manager to be in close communication with his mine at all hours, both day and night. When difficult ground or heavy flows of water are encountered, arrangements can be made to control the situation at once, without the loss of hours in communicating the necessity. The electric bell and annunciator now tell the story of what is wanted and what is going on below in deep shafts and inclines. The touch of the button tells the top men and engineers of ore waste, tools or men are coming up, and what level they are coming from. Another signal tells if timber, wedges, tools, or the foreman are required below."



MACHINERY MECHANICS & INVENTIONS

Mining Machinery with Special Reference to Ore-Dressing Appliances.

The following lecture was recently delivered by Prof. Clarkson at the International Exhibition of Mining and Metallurgy, London;

The previous lectures have taught us much relative to the vast mineral wealth of the various colonies, and have specially pointed out the necessity for improved mechanical appliances to deal with these enormous deposits. Consequently it is to be regretted, that in this series of lectures, there should be only one to deal with the very large and important subject of mining machinery. As evidence of its scope, it will suffice to point out that the title, "Mining Machinery," comprises engines, boilers, pumps, winding gear, waterwheels, and turbines, air compressors, rock drills and their accessories, ore breakers and pulverizers, machinery for amalgamating, classifying, concentrating and chlorinating, diamond and coal washing machinery, railways, elevators, and conveyors, electric transmission of power, lighting machinery, telephage, transport, etc. Now, it is obviously quite impossible, in the short time at our disposal, to deal with more than a small section of this comprehensive subject; I have, therefore, specially selected ore-dressing machinery. In considering the particular requirements of mining machines in general, we may gain much by looking for a moment at the essentials to all successful mechanical appliances. And first in the list stands efficiency. This may be either commercial or merely scientific. The difference will be obvious to all—e.g., Pancellier's combination of links may be the best appliance for drawing a mathematical straight line, but for ordinary use it could never compete with the simple ruler, and so in all. If a machine doing ten per cent. better work than another, costs twenty per cent. more in repairs, it will have to give way in favor of its comparatively less efficient rival. Simplicity will always play a very important part in the question of efficiency, and this is especially true of mining appliances. The stamp-battery furnishes an excellent illustration of an essentially simple contrivance triumphing for years over others of greater efficiency and complication. Scientific investigators may point out fundamental principles, but the work of the mechanical engineer may be defined as the art of simplifying the application of scientific formulae to the attainment of commercial success. The second point we shall consider is the economy of material in the design of machines. This is to some extent implied by the condition of simplicity, and is rendered particularly necessary by the difficulties of transport—e.g., in the present collection of machinery we have pulverizers of different types, ranging in weight from two to ten tons for the same output. What is required is a correct distribution of the most suitable material to fully meet all requirements of stress, strain, wear and tear. Frequently machines have to be made much stouter than is required by their normal work in order to meet extraneous requirements, such as excessively rough handling in transport, etc. Many American machinists seek "lightness of design" to an unreasonable extent, whereas English engineers have often gone to the other extreme. The third and last essential that we shall notice is beauty of form, and this may at first sight appear quite superfluous in mining appliances; nevertheless, its consideration by engineers in other fields has established its importance, and an improvement in this direction is promised for future mining machines. One of the first and chief things noted by investigators of old mining appliances, is the great want of any adequate consideration of the foregoing rules. Indeed, it was stated only the other day by one of the leading exhibitors of machinery, that until very recently the subject has received scarcely any scientific attention, and mining men have been quite satisfied to proceed on the old lines; however, it is to be hoped that the present exhibition will greatly help to overcome the prejudices of a notoriously conservative fraternity. It is not my intention to animadvert any particular machines, but rather to endeavor to supply information to the uninitiated, thereby increasing the educational value of the present fine collection of machines. We will therefore assume that the ore has been "brought to grass." The problem now is to extract the metals as efficiently and as cheaply as possible. We must note the special requirements called for by the physical conditions of the country, the difficulty and expense of transport, the quality and cost of the fuel to be used, the scarcity of water, the class of labor available, and the nature of the ores to be treated. The first operation will be a careful inspection of the ore to determine its nature and value as completely as possible; which metals are present, and how much of each; do they occur in the metallic form, or in chemical combination; the relative hardness of

the constituent minerals, and their ease of pulverization. Next, does the metallic mineral occur in large compact masses, or is it very finely disseminated through the rock (this will indicate to what extent it is necessary or advisable to pulverize) also the specific gravity—as a guide to "concentration." From the above, and probably other considerations, it will be possible to form a very correct idea of the best treatment and best machinery for any particular ore, and it will be now clearly seen why a pulverizer doing excellent work with one kind of ore may not be equally successful with all. The large lumps of ore must be first passed through the rock breaker, which machine has been brought to a high degree of perfection. At the present time there are only two types of mechanism used in stone breakers, viz.: the toggle joint and the eccentric, and by a little mechanical analysis these can be easily resolved into one. The only draw-back to the toggle is, that breaking only takes place during half the stroke. A successful attempt has been made to obviate this in the Gates' eccentric continuous crusher, but the great crushing force is derived in much the same manner. As the vast majority of ores are brittle and fairly hard, they may be readily pulverized in either stamp, roller, or ball mills. The modifications in design of the two latter classes of machines are so multitudinous, that it would be futile to attempt any detailed descriptions. In ball mills, one, two, or three, or a multitude of balls are placed in a suitable vessel, the whole or part of which is made to revolve, and pulverization is effected by the rolling action of the balls. The only representative in this class in the exhibition is Mr. Jordan's fine reducer. Other pulverizers have a breaking, grinding and tearing action, and are more capable of dealing with tough, soft and elastic substances. A good machine of this class is the "Cyclone Pulverizer" which has succeeded in reducing wrought iron or even india-rubber to a fine powder. High speed mills of the "Cyclone" and "Sturtevant" type require a lot of power, frequently 20 h.p., to an output of one ton per hour, and special attention must be continually paid to the bearings where a speed of from 2,000 to 3,000 revolutions per minute is attained. The essential requirements in a good pulverizer appear to be: 1. The production of a uniform sample with a minimum of slimes. What is required is a mill that will crush the bulk to pass a 60-screen and will not produce more than ten per cent to pass 100. Improvements will be effected in this direction by increased facilities for removing the particles of ore, immediately they are sufficiently reduced, thereby preventing undue battering and the consequent loss of power; removal by upward draft in dry machines is bad. Secondly the grade or size should be adjustable. This brings us to the next consideration, viz.: the ratio of output to power expended, which should be obviously as great as possible, and varies in existing machines according to their design from 6 to 20 h.p., for an output of one ton per hour. This is a very great variation, and is governed by the question of speed, the weights to be moved, friction and the above-mentioned facilities for the rapid removal of the pulverized ore. The fourth consideration is that of weight of machine to output. This is especially important, of course, where transport is difficult. It appears to vary from 2½ to 10 tons for an output of one ton per hour. The cost of maintenance is, of course, a very important factor, and no very reliable figures can be given. In place of these, however, we may note some of the most fruitful causes of wear and tear, breakdowns and stoppages. It is clearly inevitable that a machine doing such fearfully rough work as the smashing-up of hard rock, will suffer considerably in some of its parts. These should be made light, of the simplest form, and of the most durable material, such as steel or chilled iron, and when worn out should be readily replaced with the minimum loss of time. Careful protection against grit should be afforded to the bearings, especially when a high speed is employed, and strength considerably in excess of the normal requirements should be provided to meet such emergencies as the accidental presence of a steel wedge or chisel with the ore. Formerly "wet pulverizers" were used almost exclusively, but it is satisfactory to note that "dry mills" are now coming to the front. If the "ore direct from the mine" is sufficiently pure, as is sometimes the case, it may be transferred at once to the smelting house, but in the vast majority of cases the "gangue" predominates to such an extent as to greatly impoverish the ore, thus necessitating a sorting operation before the metals can be profitably extracted. This operation of enrichment is known as "concentration" and may be popularly defined as "retaining in smaller bulk the valuable portion of the ore." Excepting the hand-sorting of some of the larger pieces, "concentration" is performed by mechanical appliances, in which either water or air is used to remove the associated "gangue." In considering the various physical prop-

erties of the associated particles of ore we shall be most struck by the great difference in the specific gravities of the metallic and non-metallic mineral—in fact, but for this variation in the weights no mechanical concentration would be possible, excepting the one or two cases subject to magnetic influence. But clearly the weights of the particles are not fixed merely by their specific gravities, but by their size and form. Everybody knows that a small piece of lead may weigh as much as a large piece of stone, consequently unless a classification according to size is made, no good concentration must be expected whatever appliance may be used. It has been pointed out under the heading of pulverizers, that although an ore may be ground to pass a twenty mesh there is sure to be an infinite variety in the size of its particles, and it is scarcely necessary to mention that it is perfectly hopeless to invent a pulverizer that will produce practical uniformity in this respect. To emphasize the importance of this classification permit me to quote from the opinions of several authorities upon the subject: "Mr. Frecheville, one of I.M.'s Inspectors of Mines, stated before the Mining Institute of Cornwall, in 1884, in reference to the unsatisfactory concentration of tin ore by jigs at the Wheal Jane Mine, that the material was discharged from the stamps into the concentrators without any classification, and under such conditions there could be no perfect dressing with a jigger, nor with any other machine, but he could see no reason why a combination of jiggling and buddling introduced into Cornish mines and preceded by sizing, could fail give satisfactory results." Mr. Philip Argall (manager of a large lead works in Denver, Colorado) stated: "Classifications of the material to be operated upon, is really the secret of good dressing, no matter what method may be adopted for separating." Mr. Renert, engineer of Johannesburg, has written that the "successful working of any concentrator will be greatly affected by proper sizing." To conclude with an extract from the famous book of Kustel! In speaking of Hunter's self-discharging percussion-table he says: "The general fault in treating these tables is overcharging with unsized ore. This may often be the cause of bringing a really good machine into discredit." This expression of opinion you will doubtless consider more than sufficient to establish the importance of "sizing;" let us, therefore, now consider the means available. The old-fashioned and still extensively used appliance is the sieve or screen, which may be arranged in an endless variety of ways. The forms of revolving screens are legion, and in addition to these, there are parallel screens, parallel-compound screens, parallel-stepped screens, screens with cams and lifting wheels, and many others, each description having its separate use, advantage, and partisans. A good dry classifier is still a want. We must pass on now to concentrators, and as time is so short we must confine our attention to typical examples of each class. Concentrating machines are either stationary, percussion, oscillating, and shaking tables, or steady-moving contrivances, and preference is always given to self-discharging continuous mechanisms. The most primitive blanket-table catches some fine Au and amalgam from stamps. Very fine Au is troublesome to save, but cannot be compared to very fine Ag. ores in this respect. Blanket stuff is comparatively poor, sometimes sixty feet long. After some further remarks the lecturer said a few words on the treatment of refractory gold ores. Probably the best treatment was a direct concentration, the following two cases excepted: (1) If the concentrates were designed for smelting on account of Pb. Ag., in which case the ore by a preceding amalgamation was saved from the unavoidable smelting loss of 3 to 4 per cent. (2) If the concentrates were intended for extraction of ore by chlorination, whereby coarse ore particles were not readily dissolved, the loss in wet concentration averaged about 12 per cent., depending, however, much upon the condition of the ore and the "gangue." This loss consisted in the finest and most unfavorably-shaped particles, of which a portion might escape amalgamation.

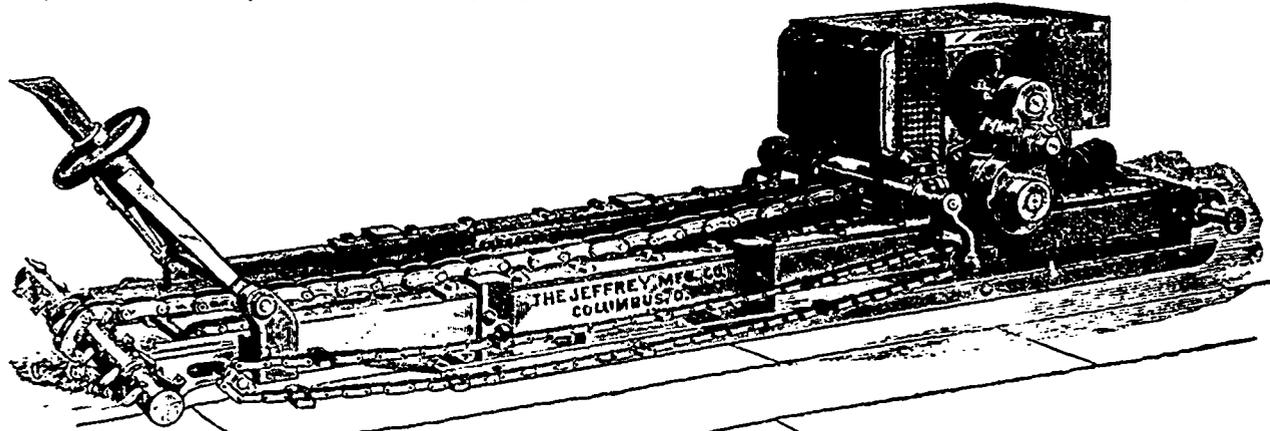
An Electrical Coal Mining Machine.

The transmission of power by electricity is rapidly superseding most other means, but although applied in almost every branch of mechanics above ground, it has, until now been almost unknown in mining operations, and the introduction of an electrical coal mining machine by the Jeffrey's Manufacturing Company of Columbus, Ohio, marks an important step in this connection. This concern is already well known through its "air power machines," the success of which has long been recognized, but their present venture is likely to supercede this and all others when its merits are fully established. Some description may prove of interest. The machine consists of a bed frame occupying a space two feet wide by seven feet six inches long, composed of two steel channel bars firmly

braced, the top plates on each forming racks, with their teeth downward, into which feed wheels of the sliding frame engage. Mounted upon, and engaging with this bed frame, is a sliding frame, similarly braced, consisting mainly of two steel bars, upon which are mounted at the rear ends, one electric motor, from which power is transmitted through straight gear and carried to the rack, by means of which the sliding frame is fed forward. Upon the front end of this sliding frame is mounted the cutter bar, held firmly by two solid steel shoes with suitable brass boxes. The cutter bar contains bits, made of tool steel, held in place by set screws, and when revolved, these cutters or bits cover its entire face. The cutter bar is revolved by an endless curved link steel chain from the driving shaft, and as it is revolved, is advanced by the above mechanism into the coal or other material, to be under cut to the desired depth. The electric motor occupies a space of about 20 inches square, is built in the most workmanlike manner, both mechanically and electrically, and has an efficiency of 90 per cent. The current required is from 30 to 50 amperes at a pressure of 220 volts; each motor is wound to develop fully 15 h.p., though frequently in some veins of coal, the machinery only uses 30 amperes, or 7½ h.p., in making cuts. The machine is started by means of a switch located on a suitable resistance box, in the rear end of the motor, the same being arranged with buttons: the current is gradually turned on by passing a lever over these buttons. The armature of the motor is calculated to run at a speed of 1,000 revolutions per minute, from which the speed is reduced so as to run the cutter-bar 200 revolutions per minute. The momentum of the armature is such that ordinary obstructions met by the cutter-bar in the coal are not perceptible, causing the machinery to run steadily and comparatively quietly. The machines are operated by two men; one man in charge and the other as helper. Trucks

are furnished with the machines which enable them to be handled with ease. The machine is taken into the mine upon this truck and run into the room to be under-cut. It is then placed on two boards in front of the coal at one side of the room, and is fastened firmly by means of the front and rear jacks, which are braced against the face and roof of the coal; this prevents the machine from moving while in operation. The power is then turned on by the machinery operator, and the machine proceeds to its work. The cutter, which is revolved by an endless chain, is fed forward, by means of rack and pinion wheels to a depth of five or six feet, according to the size of the machine. The usual length of the cutter-bar is 39 and 42 inches. When the full depth has been reached the feed is thrown off, and by means of a reverse lever, the cutter-bar is withdrawn to its starting place. This completes the cut, and the machine is moved over the length of the cutter-bar used, and another cut is made in the same manner. This is continued until the entire width of the room has been under-cut, after which the machine is again loaded on the truck and taken into another room. These cuts are made on an average of from four to six minutes each. The amount of coal under-cut, or the lineal feet face for each machine, depends upon the quality of the coal, and the skill of the men handling the machines. In some coal veins the machines have cut at the rate of 130 and 150 lineal feet face in ten hours to a depth of six feet. Twice this amount can be cut if the machines are run on double shift. The construction is very simple, so that any person of ordinary intelligence can understand and handle it with a few days' instructions. Some of the advantages of its use may be thus summed up: The saving in the reduced cost of mining; the saving and better condition of the coal; it cuts away but four inches of the seam; the work is concentrated in the mines, requiring but one-third the number of rooms to

produce a given number of tons of lump coal, as compared with hand labor; reduction of dead work, having the track to lay to the several rooms because of concentration requiring fewer boys and horses for gathering purposes; underlain with fire clay the cut may be made in that, thus saving the coal; it drives all entries and turns the rooms the machine will cut the coal on any level desired, either at the bottom or at any level above, and if thought desirable to cut out any seam of slate occurring from ten to eighteen inches above the bottom, it may be done, as the machine will cut the slate as readily as the coal; the lighting of the mines by incandescent lamps; and hauling the coal by electrical car motorage. With these advantages it will be evident, that an investigation into this machine on the part of coal operators, will be to their interest. As regards the cost, it depends very much upon the distance the power is conveyed, and also upon the local circumstances surrounding the mines, the skill with which it is handled, and the steadiness with which the mines are kept running, but it may be stated in a general way, that the saving on the average is from 25 to 33½ per cent. on account of the small amount taken out in the bearing-in. As yet electricity is but in its infancy as a motive power and further improvements will doubtless, in the course of time, be made, but with the machine under consideration a profitable success can be made, it being the most perfect as yet evolved, and it is as well for mine owners to be awake to the introduction of all labor saving devices that tend to their own profit and interest. Already twelve great American mining concerns have put in these plants, and the results have been in every case satisfactory, while a number of other coal companies are now negotiating with the same end in view. Information, catalogues, etc., will be furnished on application to the Jeffrey's Manufacturing Company, Columbus, Ohio.



Automatic Expansion Gear for Steam Engines.

(Paper read before the Manchester Association of Engineers.)

In undertaking the task of preparing a paper on the above subject, to be read before the Manchester Association of Engineers, I was conscious of the great difficulty I should have in presenting anything that was novel, or that was not well known to most of the members. At the same time I was convinced that it would be interesting to have the most notable types of expansion valve gear collected and compared as to their efficiency and economy as adjuncts to the steam engine.

I will not go into the history of the subject, but confine myself to a description of the most modern forms of gear. Necessarily, I do not mention a great many well-known and efficient gears, because of the limited space and time that can be given to a paper such as this.

Before describing the mechanism for automatically regulating the supply of steam to the engine, I hope to be excused for comparing the principles involved therein, as against the method of governing the engine by throttling or reducing the pressure of steam, and the relative advantage of the former over the latter. In engines fitted with automatic expansion gear, the steam valves are so controlled by the governor as to cut off the steam from zero, up to, say five-eighths of a stroke, the cut-off taking place earlier or later, to accommodate the varying resistance to the piston's travel and the pressure in the boiler; the object is to obtain the full boiler pressure at the beginning of the stroke, maintain it to the point of cut-off,

and leave the rest of the stroke to expansion. Almost all engineers agree as to the superior economy of the automatic expansion (over that of the throttling) engine, yet I do not think it strikes the majority the great saving in the expense of fuel there is, compared to those engines fitted with gear wherein the point of cut-off is invariably relative to the stroke of the piston.

In the best possible type of throttling engine, on account of the bends and passages the steam has to pass through, the initial pressure in the cylinder never attains anything like the boiler pressure. The effect of this is that when a considerable load is thrown off the engine its speed is increased; on the contrary, when an additional load is put on the engine its speed is diminished.

Now, every stroke an engine makes above its normal speed is a waste of steam, and if the engine be large, a vast waste of fuel takes place; on the other hand, a loss in speed reduces the production of a whole factory in direct proportion to that reduction of speed, the loss of one revolution in twenty reducing the capacity of every machine five per cent. A variation of one revolution in five in a throttling engine is common, and in most cases is unavoidable. There are some engineers who still think that this class of engine can compete with the automatic cut-off engine, but it is, nevertheless, a remarkable fact that they take every precaution to avoid throttling in the passages. Happily these relics of a bygone age are becoming fewer in number. If the practice of estimating the efficiency of a steam engine by its consumption of steam were more common in this country than it is at

present, we should hear very little of "throttling." The present practice of estimating the efficiency by the coal consumption (involving as it does the efficiency of both the engine and the boiler), is fair neither to the maker of one nor the other.

This has been pointed out again and again by writers, and with the number of trained engineers who are capable of making such tests it is surprising that it has not become the regular rather than the exceptional practice.

I give two diagrams, A and B, illustrating a typical case, and showing the advantage following upon the adoption of an automatic cut-off gear when applied to an engine previously governed by a throttle valve.

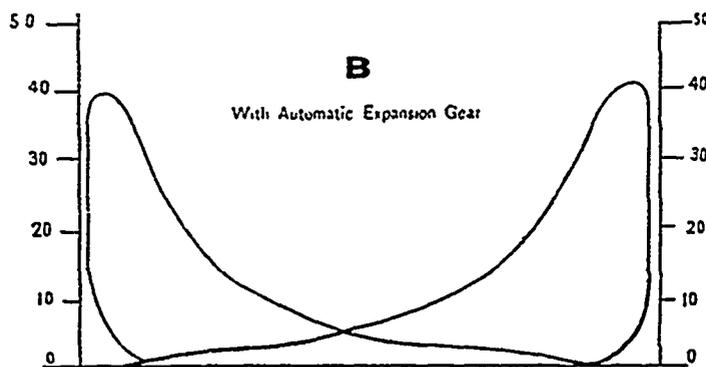
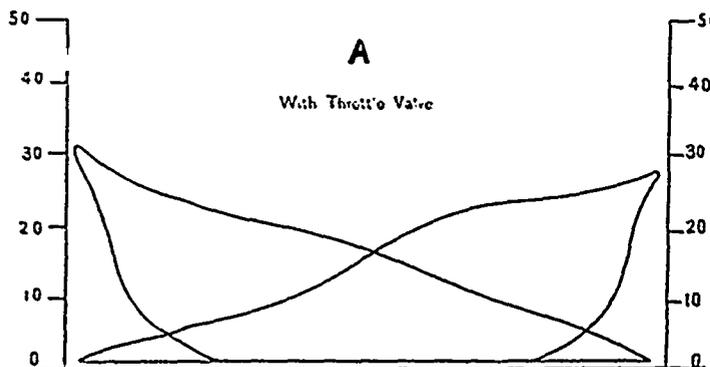
The steam consumption accounted for by diagrams neglecting loss through radiation, etc., (which is assumed to be equal in both cases), gives a balance in favor of expansive working of about 20 per cent.

I am well aware that there are engines working and controlled by throttle valves which give low consumption of fuel, but as a rule they are working under most favorable conditions.

I lately inspected one of this class in an Oldham cotton mill, admirable in every detail as far as workmanship was concerned. Engine and boilers were new, the latter being placed as close to the engine as practicable. The consumption of fuel (common burgy) was 2.1 lb. per indicated horse power; a portion of the steam, however, was used in heating the mill, etc., so that the precise amount due to engine I could not ascertain.

HORIZONTAL HIGH PRESSURE ENGINE.

Cylinders, 20 in dia Stroke, 3 ft 6 in Speed, 50 revs per minute



The Foote Intermediate Speed Regulator.

This apparatus is designed for use on line and counter shafting, to equalize the power delivered by the engines, water wheels, and electric motors; insuring, it is claimed, an absolutely unvarying speed to electric generators, or other purposes where a very steady and uniform revolution of shafting or machinery is desired. The manufacturers especially recommend the device in electric railway works, where the variations of load are so great, causing the engines to run either above or below their nominal rated speed as the load may be greater or less, as the case may be. One application of this device, which is of special interest, is its use in connection with water wheels. It is a well known fact that there is not a satisfactory governor for water wheels in existence; and with changing loads and different loads of water it is impossible to obtain the required uniformity and regularity of speed demanded in

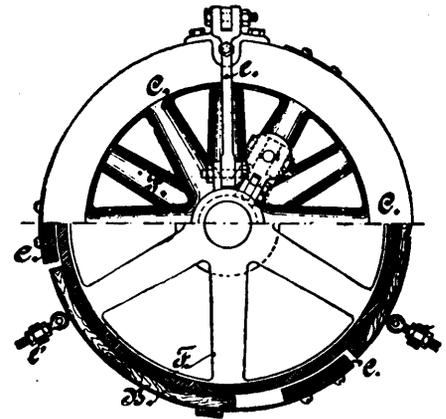
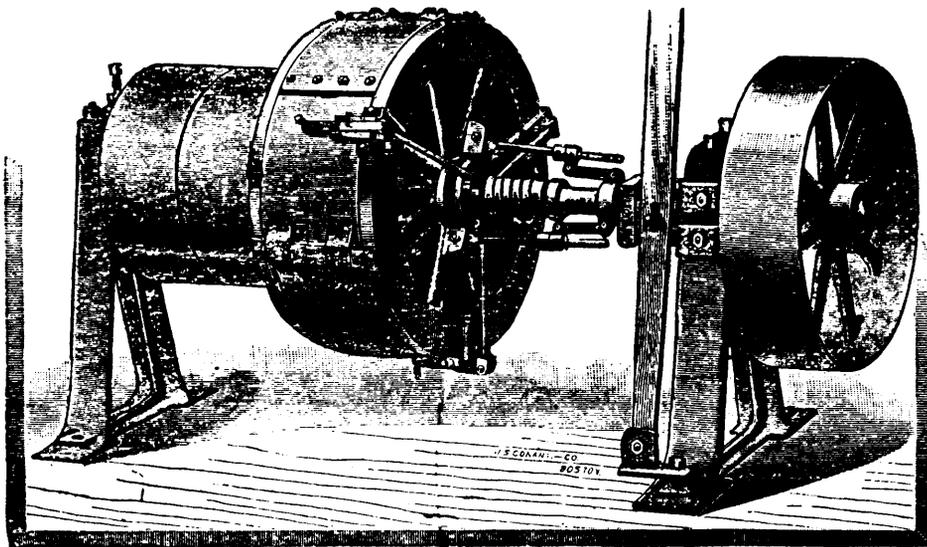
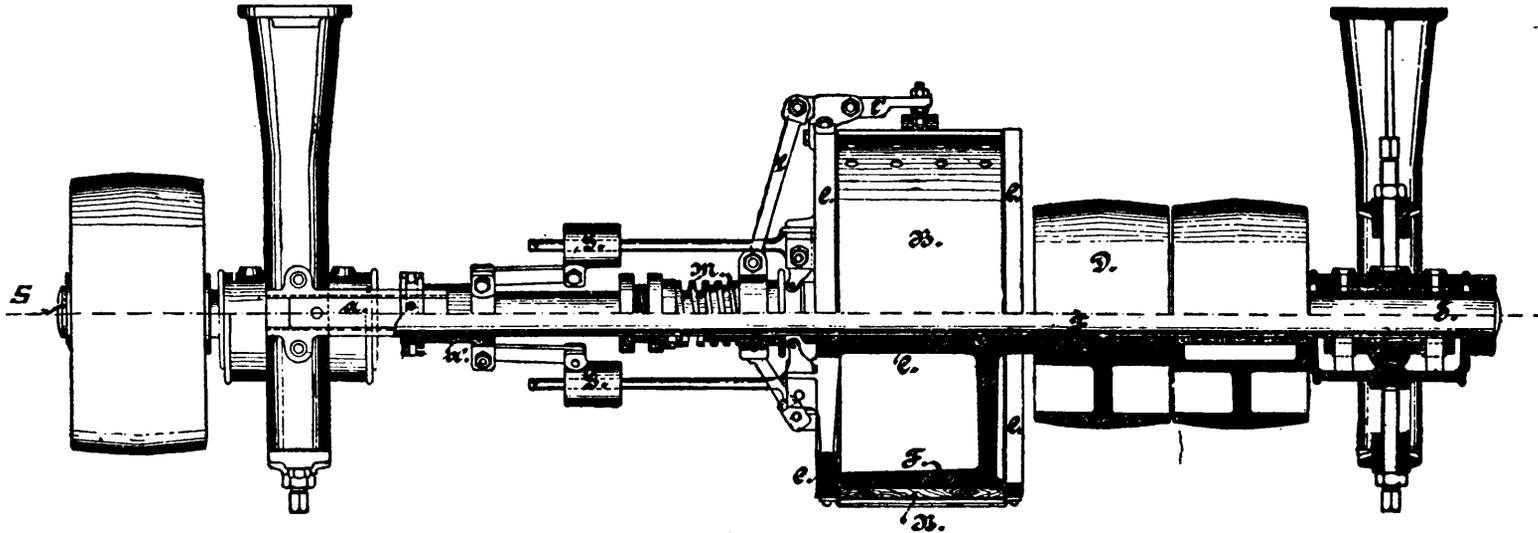
dynamos and electric generators. Water power promises to become an important factor in electric railway works, because of the possibilities of transmission which makes available power, which is in some cases to be obtained at a very small expense.

The description of the regulator as shown in the sectional view is as follows: The main features are a friction coupling between a driving pulley and the shaft to be driven, and a governor which regulates the amount of pressure on the friction surface. As shown, the apparatus is in the form of a countershaft, D is the driving pulley, and is keyed on a projecting sleeve to which are attached the bands bearing on the friction wheel, and forming one portion of the machine. When the friction surfaces are not in contact, it is free to revolve independent of the shaft S S.

The brake shoes B, which are made of leather, backed by wood and sheet steel, are brought in contact with

the friction wheel by the spring M, which acts through the levers L and L, which have their fulcrums on the carrier C, which is fast to the shaft S S. The arms of the governor G G at their fulcrums have an extension at right angle, which presses against the spring M, diminishing the pressure brought to bear on the brake shoes through the medium of the levers L and L.

The tension of the spring M and weights on the arms of the governor are determined and adjusted according to the speed and powers required. It is understood that the speed of the driven D is somewhat in excess of the speed required for the shaft S S. The arms and weights of the governor when in revolution fly outward, owing to the centrifugal force and compress the spring M to such extent as will allow of the proper amount of friction to give the desired speed. Chandler & Wittlefield, Room 40, Marine Building, Chicago, are the general Western agents.



Pit-Shafts in American Collieries.

Mr. W. S. Gresley, M.E., in his notes on Coal and Coal Mining in North America, states that he only knows of one circular or even oval shaft, and this is in the northern district of the anthracite coal-field. Shafts are invariably made rectangular in the States. Why the writer cannot now discuss. Brick or stone walling is never used, but timbering from top to bottom. We can only recollect coming across one single case of an arched inset or pit bottom. Wet ground is secured with solid timber cribbing, and a wall of cement is often formed behind it several feet thick. The longest shafts the writer knows are 12 ft. by 53 ft. in the clear by 1,060 ft. deep; another (just completed) is 14 ft. by 48 ft. by 1,160 ft. deep. These are anthracite shafts. They are divided into six compartments, viz.:—Four cageways (for two pairs of winding engines), a pump division, and an air or fan compartment. Three or four compartments, however, are usual—namely, two for cages, one for fan, (bratticed off of course), and one for the pumps. Double deck cages are never used, and one tub or car only is hoisted at a time, but the capacity of the cars is very large, from 1 ton in thin seams to 4 tons, or say, 160 cubic feet in thick workings. Steam locomotives are often employed for hauling trains on the main roads, along tunnels (drifts, stone headings, cruts, etc.), and on surface between pit-tops, mouths of inclines or footrills, called "slopes" here, and the "breakers," a breaker being a huge timber building containing crushing and screening and washing machinery for preparing the anthracite for market. These locomotives are of the saddle-tank type, and usually have 9 in. cylinders by 14 in. stroke, and weigh 8 to 9 tons in

running order. They are considered equivalent in effective work to from fifteen to twenty large mules, according to varying conditions of work and place. The gauge of track is from 3 ft. to 4 ft. From ten to twenty-five cars are hauled per trip, equal to from 25 to 100 tons load. Coal is the fuel consumed. Average speed about six miles per hour. The air is, of course very much vitiated where locomotives are used, but their use is restricted to places where foul air is passed direct to the returns. Electric locomotives and rope haulage are gaining favor gradually.

Foaming in Boilers.—When boilers are new and first used, they are liable to foam, in consequence of grease or oil left in them during their manufacture. The simplest remedy for this is to put from one-half to one pound common washing soda in the boiler when first filled with water. After steam has been raised and the soda has neutralized the oil and grease, draw the fires, and when the pressure of steam has become reduced to not exceeding five pounds, blow out of the boiler, then fill with fresh water, adding a very small quantity of soda to neutralize any grease remaining within the boiler. The general cause of boilers foaming is using the steam faster than the fires are generating it, as any boiler can be caused to foam by drawing the steam from it faster than it is generated. The remedy in this case is to close the throttle so as to reduce the quantity of steam discharged in proportion to the amount being produced, increase the fire so as to make more steam, and the quantity available for service will be in accordance, without danger of foaming. The steam gauge is a valuable guide in this matter. The more dirty the water become, the greater necessity of attention to

the fire, as dirty water will not produce steam so readily as cleaner water.

Cheapening of Aluminum.—Mr. Eugene H. Cowles, President of the Cowles Electric Smelting & Aluminum Co., of Lockport, stated that their new process of electric reduction of pure aluminum directly from the ore has reached such a stage as to enable them to produce metal, 98 per cent. pure, at a cost of \$1.25 per pound. It is proposed to utilize the entire Lockport plant for the production of aluminum by the new process, and the capacity of the works is estimated at from ½ to ¾ ton per day. The production of aluminum in alloys of iron and copper will be abandoned at these works.

Mr. Benjamin Ford, boiler inspector, Pittsburgh, Pa., has just patented a device which has considerable promise. He proposes to replace the present style of boilers by a tubular steam generator, which will use common coal slack for fuel; which occupies about half the space required by ordinary boilers; costs about 25 per cent. per horse-power less; almost perfectly consumes all smoke, and the worst accident that can happen it will be a rupture of one of the tubes, which can be replaced quickly and at small cost by any mechanic. The fire is directly applied to the series of tubes containing water. There is no outer shell to explode; the compactness, portability, economy of fuel and perfect safety of this invention will at once recommend it to the manufacturers and users of steam. Mr. Ford's life-long experience and study of steam power guarantee the practicability of the new apparatus.

IRON, STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, January 28, 1891.—The year opened with business very quiet in both the American and British markets.

The stringency in financial matters had a very depressing effect on prices, and this was especially felt in the Scotch pig iron warrant market, in which there is usually so much speculation. In spite of the great reduction in stocks there was a steady decline in prices during 1890, and warrants, which opened at 66/ in January, closed at 46/ in December. This decline was quite unlooked for, as the natural tendency, on account of the strong statistical position of the market, would have been to increased values.

The strike of the blast furnacemen in Scotland still continues, and at present there are only six furnaces in operation, out of a total of 140 built.

The following statistics, taken from Messrs. Jas. Watson & Co's. yearly report of the pig iron trade for 1890, will be of interest, as showing the large falling off in production and stocks during the year:—

	1890.	1889.
Stocks in public stores and makers' yards, 1st January	1,035,840	1,244,433
Production of pig iron	798,333	998,928
Consumption and export of Scotch pig iron	1,834,173	2,243,361
	1,220,728	1,207,521

Stocks 31st December, (tons)..... 613,445 1,035,840
Showing a decrease on the year in stocks, of over 400,000 tons.

This points to higher figures in the immediate future. How this will affect business with Canada is difficult to say, as within the past few years a new factor has come in, which promises to have a great effect on our market in future. There is the production of American pig iron, which is finding a ready sale in Western Ontario, where on account of more favorable freight, it can be laid down very often at a lower figure than Scotch. This will likely continue, as American furnaces are, to-day, turning out more than their own markets demand, and prices in consequence keep extremely low. In Eastern Ontario and Quebec, Scotch iron still competes favorably with American. Stocks are not at all large, and Summerlee is quoted at \$23.50 to \$24 ex-yard, Montreal. It is not expected that prices will be any lower on the opening of navigation.

The Finished Iron trade is quiet. Canadian manufacturers are quite able to supply the demand for the ordinary quality of bars. The iron turned out by the Montreal, Hamilton and Toronto mills is of excellent quality, the material used in its manufacture being well selected.

Prices of sheet iron and hoop iron continue weak in sympathy with the general market.

On account of the large importations of tinplates into the United States, which will continue until the new tariff comes into operation on 1st July, 1891, the market has kept very firm for some time, and prices are still high. In this connection it is interesting to note that the United States took 6,253,000 boxes last year out of the total exports of 8,343,000 boxes from England. It is difficult to say what effect the altered tariff will have on this industry, as there does not seem to be any haste to start the manufacture of tinplates in the United States.

Montreal, January 28, 1891.—All reports from abroad emphasize the unsatisfactory and lifeless condition of the iron and steel trade at the opening of the year, and in any suggestions of an early improvement it is to be feared that the wish is the father of the thought. In the almost total absence of actual transactions, quotations can be considered as only nominal, and whilst in the present moderate demand buyers could probably secure further concessions, it is equally apparent that if any large demand should set in, buyers would by no means have matters their own way—in fact there is every ground for believing that it will require but a very slight general improvement in the demand to cause a very considerable rally in values. Nothing can be more eloquent in this regard than the fact that the stocks of pig iron in store in Glasgow, which on Dec. 31, 1889, were 1,035,840 tons, were on Dec. 31, 1890, only 613,445 tons, showing a decrease of 422,395 tons; the reductions have since continued at the rate of 5,000 tons per week. An important factor in the continued dulness of the trade is to be found in the serious strikes in Scotland, which are having a most disastrous effect. The new steel-works of the Calderbank Co. expect to be in operation early in the Spring, and will prove an energetic competitor for the Canadian trade, the value of which appears to have been undervalued by some of the other Scotch steel-works, to judge by the unsatisfactory and dilatory execution of orders in the past. It is expected that the demand for steel rails for Canada will be somewhat in excess of last year, and some important enquiries are already in the market. We quote: 25 lb. steel tee rails f.o.b. Liverpool, £7 2s. 6d.; 40 lbs. ditto. f.o.b. Bristol, £5 15s.; 56 lb. ditto. f.o.b. Liverpool, £5. On the whole the import trade is about as dull as it can be in January, buyers preferring to await developments on the other side; added to this is the uncertainty as to possible changes in the Customs duties which always unsettles trade so seriously at this time of the year.

There are rumours and reports of various changes which may or may not be made; amongst others it is known as a fact that the Canadian makers of wrought iron pipe are making strenuous efforts for a change in the duty on this important article, although it now has to pay a duty of somewhat over 60 per cent.

A great deal of inconvenience is being caused to importers by the ice blockade of Antwerp, the port having been officially closed since about Christmas, and a large quantity of goods for Canada are lying there awaiting the re-opening of the navigation.

Scotch Pig Iron Warrant Market.—Below is given a comparative table of the position of the Scotch warrant market.

	Scotland.				
	1891.	1890.	1889.	1888.	1887.
Price of Scotch warrants, Jan. 13.....	47/-	61/9	41/1½	41/4	47/2
Furnaces in blast in Scotland, Jan. 13.....	6	88	78	84	75
Quantity of iron in public stores.....	579899	925352	1032485	942782	841211
Shipments of Scotch pig iron for week ending Jan. 10	3086	8288	6050	5686	9215
Do. since beginning of year..	6508	19351	19119	17976	23104
Middlesboro' iron imported at Grangemouth, week ending Jan. 10.....	3588	2480	2554	5408	6110
Do. since beginning of year..	6133	7320	16459	12368	17898

	Cleveland.				
	1891.	1890.	1889.	1888.	1887.
Price of Middlesbro' No. 3, warrants on Jan. 13.....	42/3	61/6	33/5	32/-	38/9
Furnaces in blast in Middlesbro' district.....	101	103	98	95	85
Quantity of iron in public stores.....	120148	184815	254931	348833	317230
Shipments of pig iron from Middlesbro' for week ending Jan. 13.....	11565	13080	9472	10269	8155
Do. since beginning of year..	16466	21709	25292	21955	17269

	West Cumberland and North Lancashire.				
	1891.	1890.	1889.	1888.	1887.
Price of hematite M/Nos. warrants.....	52/11	78/1½	44/3½	43/7	51/3
Furnaces in blast in W. Cumberland and N. Lancashire.....	50	56	49	51	47
Quantity of iron in public stores.....	210813	382902	421835	411839	248557
Shipment of hematite iron for week ending Jan. 13.....	7805	9309	9925	9578	7845
Do. since beginning of year..	14260	31780	25339	24986	18259

* Connal's & N. E. Rly. Co's.
† Workington, Maryport, and Barrow.

Cleveland, O., January 28, 1891.—Two questions are agitating the iron market at present. To what extent will the ore business be affected by the depression in business, and to what point will ore prices fall! As regards the first, it may be possible to arrive at some conclusion, for the continued idleness at the furnaces implies a corresponding reduction in activity in the ore regions. Thus if the furnaces should not go into blast again until the end of March, the cutting off in the ore supply would not be less than a million tons, and this is only a fraction of the reduction that may be expected in the season's output. Bearing in mind the large quantity left over last year, some conclude that the figures for 1891 will be about six million tons, while others again, and not without reason, prophesy still smaller production. One thing is certain, namely, that much less ore will be received this year than last, and it will be sold at a much closer profit margin. All interested agree that the stability of the market depends upon economic production and close profits. There must be cheaper ore, cheaper transportation by water and rail, cheaper coke, and possibly cheaper labor. The last named point may be the easiest to settle as the skilled mechanics employed in the iron trade will much prefer a slightly lower scale with steady employment to a higher scale coupled with idleness. The ore men are willing to make every reasonable concession, and the vessel interests will, it is presumed, fall into line. The railway situation will take care of itself, the decrease in the freights serving as a convincing argument in favor of a reduction in the tariff, while the coke syndicate is at this time unpleasantly realizing the force of the long standing demands at the hands of the furnacemen. Pig iron is to be had in plenty, at very low quotations, nearly every one of the furnaces that went out of blast having large stocks on hand that they are anxious to sell. Manufactured iron has dropped off a trifle, and both sales and prices are weaker in all the lines. Prices are nominally steady.

Specular and Magnetic Ores.

Bessemer.....	66@69%	\$6.00
"	60@64%	5.00@5.50
Non Bessemer.....	66@69%	5.00@5.50
"	62@65%	4.50@5.00
"	57@60%	3.75@4.25

Soft Hematites Dried at 212°

Bessemer.....	62@65%	\$4.75@5.25
"	58@61%	4.25@4.75
Non Bessemer.....	55@63%	3.50@4.25

Above prices are for deliveries on docks at Lake Erie ports.

Lead.—The offerings in New York have been rather heavy, and the desire to sell on the part of the refiners somewhat marked, the market therefore inclining downwards. English consumers have shown a great deal of reluctance to buy even at the low prices and the market

closes at about 4.30c, at which the last sales were reported. It is not probable, however, that values will go much lower, as the position of lead continues to be a sound one, and a rally is likely to set in as soon as buyers come into the market to supply their wants, and that seems not far distant.

The London market has also declined recently—Spanish being quoted at £12 15s. and English at £13.

At St. Louis the market has been sagging off, with few transactions and closing dull at about 4.10c.

Iron Trade Prospects.

(From the Colliery Guardian.)

With the statistics of production of some of the chief districts producing iron in the United Kingdom, and the Board of Trade returns for the past year before us, there are some indications of the course of trade during the last twelve months which throw some light upon the immediate prospects of business. There has been the highest production of pig iron known in the history of the Cleveland district, but that in Scotland—in consequence of the strike there—has been the lowest for many years. And in both the stocks that had previously accumulated have fallen—very considerably in the case of Scotland, so that the makers have reduced the amount of dead stock that they have held. The Board of Trade returns are rather different, for they show that there has been for the past year an increase in the total tonnage of iron and steel that has been exported, but for the latest months of the year there has been a falling off, so that the higher figures of the earlier months have not been maintained later in the year. For the year, moreover, two important branches of the trade show decreases in the exports—though not to any very serious extent—and in both instances the decreases are heavier in ratio in the last month of the year. It is quite evident that there has been in the latter part of 1890 an alteration which, if it were continued, would considerably affect the iron and steel trade of the kingdom. The home consumption of iron is proved to be large, because without so extensive a consumption the stocks would not have decreased in the manner that they have done. And for the present that large local consumption seems likely to continue in the total, though it is quite probable that some of the constituent trade items may experience a change. The shipbuilding trade, for instance, has not so bright an outlook and without the placing of new orders for ships in the course of a few months, there will be a diminution in the amount of iron and steel that that industry will use.

But the weakening element in the iron trade—the enormous stocks of pig iron that had accumulated—has been further and considerably lessened, and to the extent of the reduction, it is certain that the position of the iron trade is much better. There are as yet no signs of the conclusion of the long strike in the crude iron trade of Scotland, and whilst the production of that country is almost completely suspended, it must be expected that the stocks in other districts must continue to fall. The price has certainly not made the movement in the market that had been expected, but on the other hand, it will have been noticed that the realised price of pig iron in Cleveland has certainly advanced for the last quarter of the past year in a very satisfactory manner. What the future may bring in this respect cannot be said, but the action of the Cleveland ironmasters having to claim a reduction of 12½ per cent. in the wages of the miners, must be looked upon as one of the indications that cannot be considered a good augury. The market price of pig iron, however, has fallen in the time of financial trouble much more rapidly than the cost of production, and the Cleveland ironmasters evidently intend to alter this in some degree. The iron trade, as a whole, is as yet in a very languid condition, and it is impossible to say how it will turn—though, since the publication of the Board of Trade returns, and those of the iron trade in the two great centres we have named, the disposition has been to take a more favourable view of the prospects, both of the trade as a whole, and especially as regards the prices. It is growing evident that the active condition of the coal trade is likely to preclude any reduction of moment in the price of coke, and thus the producers of pig iron must either look for lower cost of production in some other way than in that of the fuel, or they must try to have the price of their products in some way increased. The reduced stocks would give some ground for the latter, if the demand continues as large, but with a possible shrinking in the demand for ship-building purposes, it is likely that, at any rate, the reduction in the stocks will not be so rapid in the future as it has been in the past. Still, there is no likelihood just now of increase in the production, except when the long strike in Scotland approaches its close.

How far the demand may be maintained for iron and steel from other countries is a question of some importance. We must expect that after current contracts have been concluded less will be sent to some of the South American countries, which have for the time being in a large degree exhausted their credit. But there are counter-balances that are very probable. Orders for rails have been booked from countries that have been for some time out of our market, and should the raw material be maintained here at a low price such orders may be repeated,

for the difference between the value of labor here and in some of the Continental countries is being reduced now—to our probable benefit. Australasia is again more prosperous than she was, and is likely to take more iron for railway and allied purposes from us in one form or other; and over the world generally, though the shipbuilding demand may be less, the demand for railway purposes shows signs of growth, though it may be that for some of the countries we may only receive the orders for iron and steel in their earlier stages of manufacture.

On the whole, we are not inclined to take a pessimistic view of the prospects of the iron trade, though undoubtedly the industry will need to have some alteration in costs to fit it to meet the change in the views of the buyers as regards price. In most countries there has been a very large circulation of money, and that circulation means fuller employment for steamships and for railways, larger constructive works and an increased consumption of pig iron. As the price is made more reasonable, the ultimate tendency is towards increased sales, and with the reduced stocks that there are now at the greatest of our producing centres, there will be in all probability for some time to come a large production, which will not be deterred by the fact that money is now cheaper and more plentiful than a month or two ago.

Blast Furnaces.—Of the 128 charcoal blast furnaces in the United States, 61, with a weekly capacity of 12,459 tons are in operation, and 67, capable of turning out 9,262 tons weekly, are out of blast. Of the anthracite furnaces, 102 with a weekly capacity of 41,952 are in blast, and 60, capacity 19,316 tons, are out of blast, and of 242 bituminous or coke furnaces, 143, producing 109,870 tons weekly, are in operation, and 99, with a product of 57,484 tons are out. Thus of a total of 532 furnaces of all kinds, with a weekly capacity of 250,343 tons, 306 producing 164,281 tons are in operation, and 226, capable of producing 86,062 tons, are out of blast.

Profits of American Iron and Steel Companies.—Whatever other particulars may be given to the world, the profits of manufacturers are with, very few exceptions, an unknown quantity. The subjoined table of the profits of certain American iron and steel companies have been compiled by a Mr. Dale, who guarantees their exactness:

FIRM.	CHIEF PRODUCT.	TURN-OVER.	PROFITS IN 1890.
		Tons.	\$
Pennsylvania Forge.....	Muck iron..	8,000	24,000
Chess, Cook & Co.....	"	9,600	45,000
Clinton Mill.....	"	8,500	35,000
Pittsburgh Forge & Iron [Railway Works.....	supplies..	20,000	50,000
Elba Ironworks.....	Muck bars..	28,000	65,000
Keystone Mill.....	"	36,000	100,000
Millvale Mill.....	Ske'p, etc..	30,500	140,000
Republic Ironworks.....	Iron.....	64,500	175,000
Vesuvius Mill.....	"	42,000	100,000
Soho Mill.....	Iron & Steel	45,000	450,000
Sligo Mill.....	Iron plates.	31,500	100,000
Lindsay & McCutcheon.....	Muck bars..	32,000	100,000
Painter, Sons & Co.....	"	77,000	200,000
Zug & Co.....	Iron.....	45,000	144,000
Lloyd, Sons & Co.....	Various iron	20,000	150,000
Solar Works.....	Iron & Steel	31,000	100,000
Brown & Co.....	"	29,000	300,000
Howe, Brown & Co.....	Steel.....	15,000	400,000
Shoenberger & Co.....	Iron & Steel	48,000	750,000
Singer Nimick & Co.....	"	28,000	500,000
Spang, Chalfant & Co.....	Iron pipe..	37,700	800,000
A. M. Byers & Co.....	Pipe, etc..	40,000	900,000
Park Bros. & Co.....	Fine steel..	83,500	2,000,000
Oliver Iron & Steel Co.....	Iron & Steel	100,000	1,500,000
Jones & Laughlins.....	"	120,000	2,400,000
Carnegie & Co.....	"	550,000	5,000,000
Linden Steelworks.....	Steel.....	20,000	400,000
Miller, Metcalfe & Parkin.....	"	15,000	500,000
La Belle Steel Mill.....	"	7,500	150,000
Spang Steel & Iron Wks.....	"	30,000	600,000
Glendon Spike-works.....	Spikes.....	25,000	125,000
Pittsburgh Tubeworks.....	Tubes.....	15,000	450,000
Pennsylvania Tubeworks.....	"	70,000	2,000,000

Allowing that these figures are even approximately correct, the prosperity of the American iron and steel manufacturers must be a cause of envy in other less fortunate producing centres.

Coal Output of Europe.—An interesting comparison of the output of coal in the last thirty-five years from the four great European producing countries of England, Prussia, France and Belgium, together with the number of men employed, and the number of tons raised per man, is afforded below:

Total and average annual per capita output of coal in different countries.

GREAT BRITAIN—			
	No. of men employed.	Tons of coal raised. 1 = 1,000	Tons raised per man employed.
1855	242,719	67,711	278
1860	275,847	84,042	305
1865	315,451	99,720	316
1870	350,894	114,681	326
1875	535,845	135,439	252
1880	484,933	149,320	308
1885	520,632	161,901	311
1889	563,735	176,916	314
PRUSSIA—			
1855	55,544	7,740	121
1860	64,185	10,124	157
1865	85,514	18,592	217
1870	107,703	23,401	217
1875	160,462	33,520	209
1880	156,125	42,273	270
1885	193,948	52,977	273
1889	198,363	59,583	300
FRANCE—			
1855	54,322	7,453	137
1860	59,240	8,304	140
1865	78,735	11,600	147
1870	85,357	13,330	156
1875	108,921	16,957	155
1880	107,236	19,367	185
1885	101,616	19,511	192
1889	104,932	22,952	198
BELGIUM—			
1860	81,675	10,957	128
1865	82,368	11,840	144
1870	91,993	12,697	138
1875	110,720	15,011	135
1880	102,930	16,866	163
1885	103,095	17,437	169
1889	103,477	19,205	185

Improvements in Steam Hammers.—In Chemnitz, the great tool making center of Germany, there have been made some improvements in steam hammers that are worthy of notice, and in keeping with the tendencies of other steam machinery of our days. The hammers have two cylinders, and two piston heads of different area, that operate on the principle of a differential engine; the steam, acting first in the small cylinder to raise the hammer, is then exhausted into the large cylinder, to make the down or working stroke. Heretofore steam hammers have been wasteful machines, the steam being use without expansion, and the clearance in short strokes being lost. The differential plan seems a good one, if there are also arrangements to use initial steam both above the and below the piston when required.

The McKinley Tariff and the Sheffield Trade.—The quarterly returns compiled from official information, as to exports from the Sheffield district to the United States of America, prove that the cutlery manufacturers of that town have been very severely hit by the largely increased duties imposed by the McKinley Tariff Act. The total value of cutlery shipped from Sheffield during the last three months of 1890 was only £28,178, as compared with £74,970 in the previous quarter, and £62,350 in the corresponding quarter of 1889. These are comparative decreases of 62 and 45 per cent. respectively.

The Standard Oil Co, have now control, it is reported, of nearly every tank steamer carrying petroleum from the United States to Europe. With their recent purchases the company's fleet now includes 21 steamers of this class, having a total capacity of 24,435,000 gallons, or enough, it is claimed, to carry in 20 trips the entire year's exports.

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Mr. J. R. Gordon, C.E., who spent most of the season of 1890 investigating the nickel deposits in the vicinity of Straight Lake, a station on the main line of the Canadian Pacific Railway, about 47 miles west of Sudbury, reports very favorably of these properties. The deposits extend from about one mile north-east of the railway to about four miles southwest. Where the lode crosses the track in the Township of Moncrieff, the vein or deposit of nickel is nearly 20 feet wide. The vein varies in width from 10 to 20 feet, but in places is over 30 feet wide. At the western terminus of the lode in the Township of Craig, which is immediately west of the Township of Moncrieff, the width increases. The last showing is about 1½ miles from the Spanish River.

The Huronian rocks have been traced by Dr. Robert Bell, of the Geological Survey of Canada, for a distance of some three miles west of the Spanish River, and to South and West are gneiss formations.

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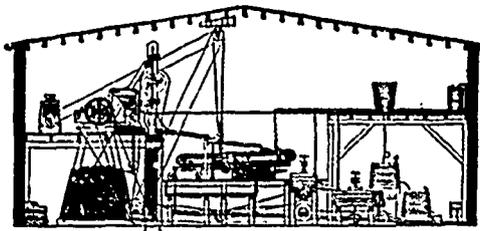
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" 10, " " 20	10c.
" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
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If not exceeding \$10	10c.
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" 20 " " 30	30c.
" 30 " " 40	40c.
" 40 " " 50	50c.

For further information see OFFICIAL POSTAL GUIDE. Post Office Department, Ottawa. 1st November 1889.



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2nd do ..	50c.	5c.	55c. do
3rd do ..	50c.	10c.	60c. do
4th do ..	50c.	15c.	65c. do
5th do ..	50c.	20c.	70c. do

Extra pay is allowed to a limited number of Blacksmiths, carpenters and other artisans.

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Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force, Regina N. W. T.



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Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19 an ounce, and in smelted gold valued at \$18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

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—OF—

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OTTAWA.



MINING REGULATIONS

TO GOVERN THE DISPOSAL OF

DOMINION LANDS CONTAINING MINERALS, OTHER THAN
COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a

valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

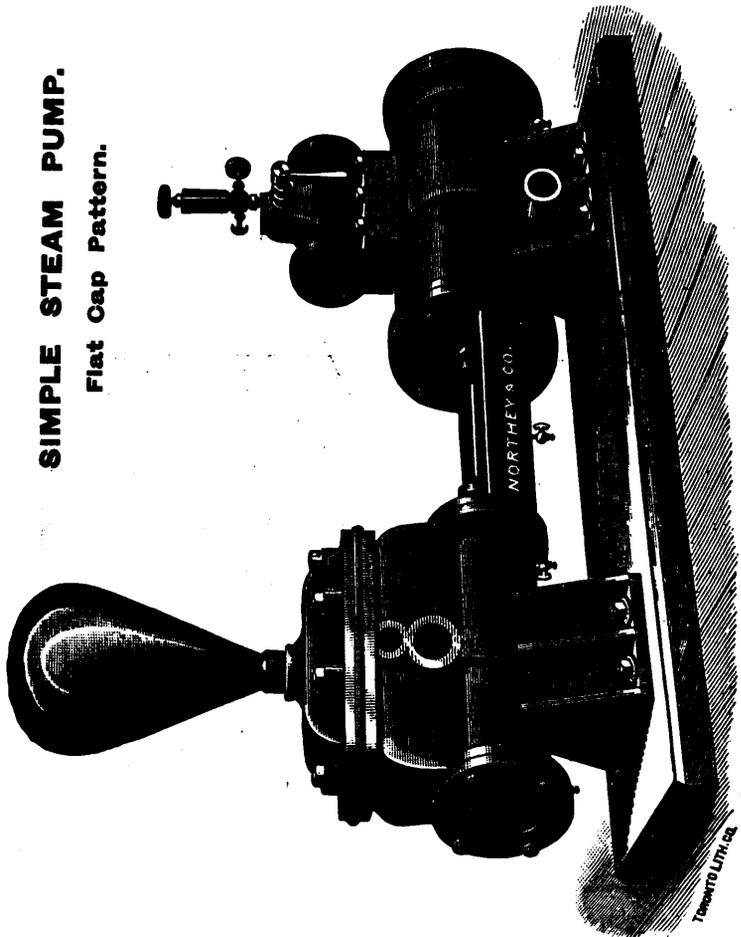
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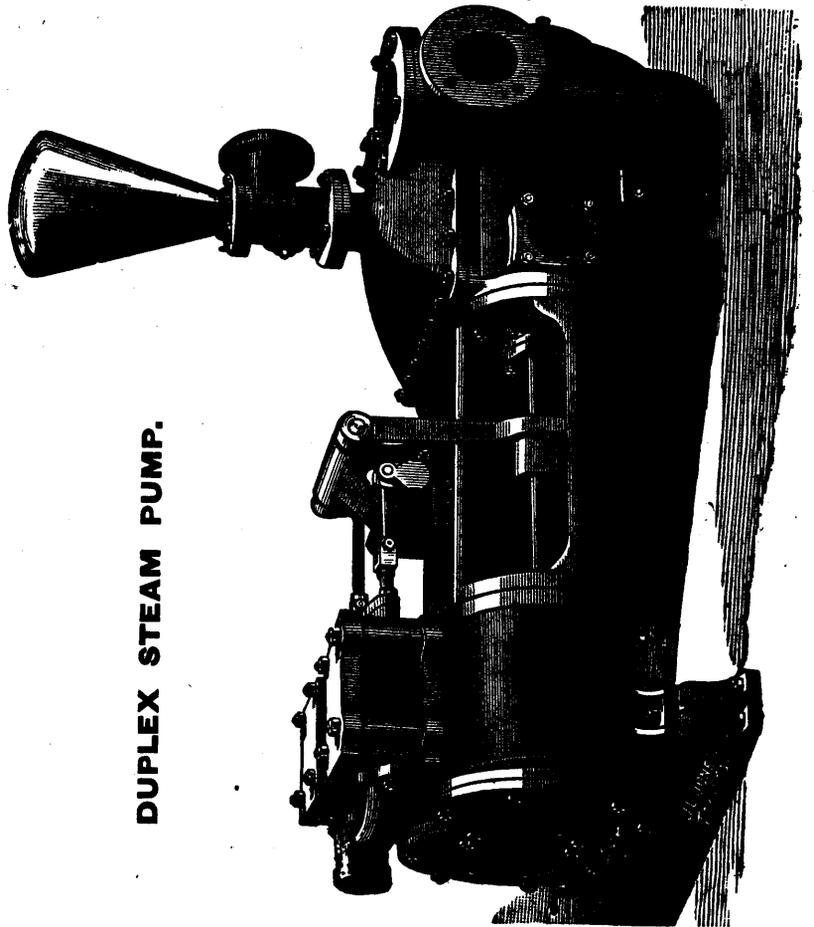
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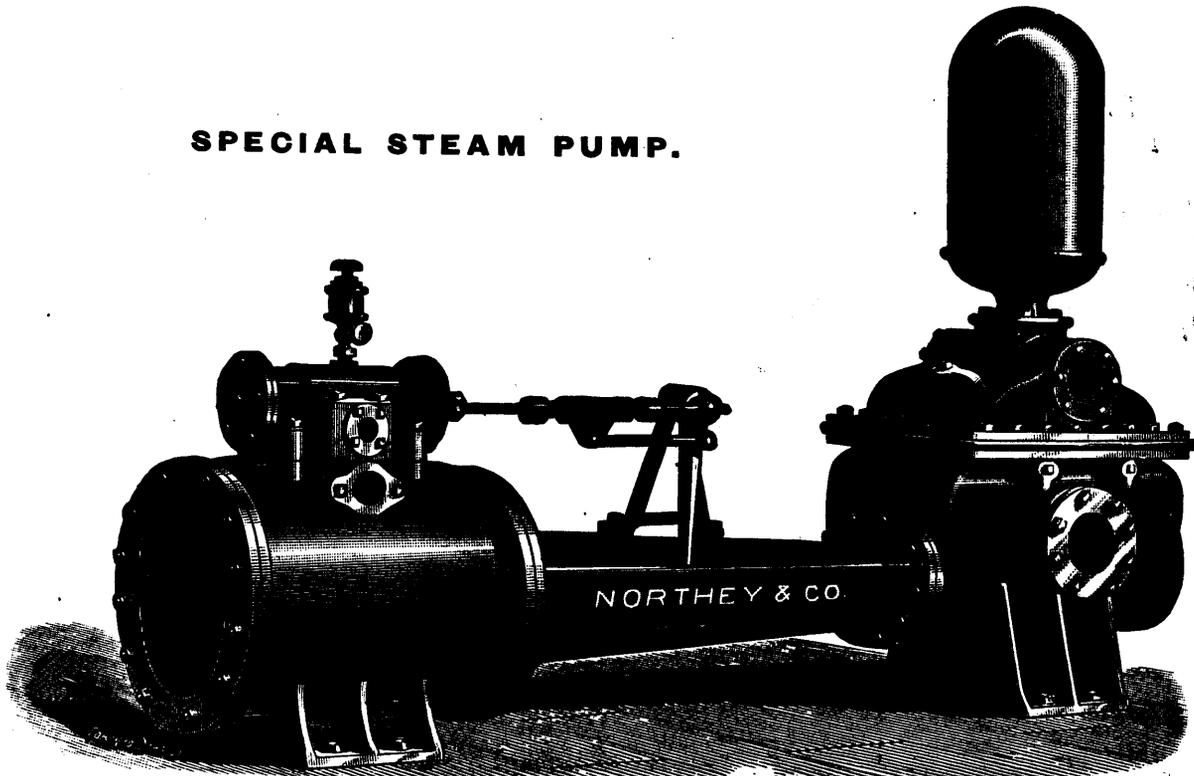
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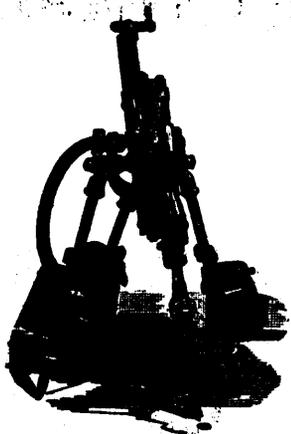


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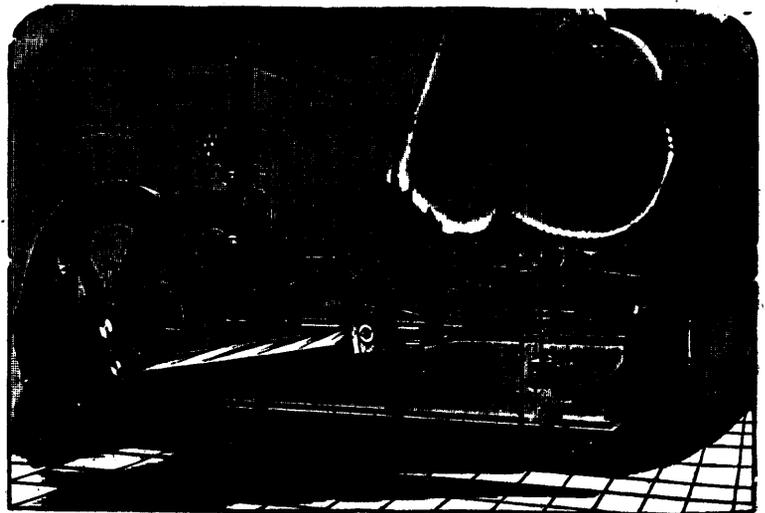
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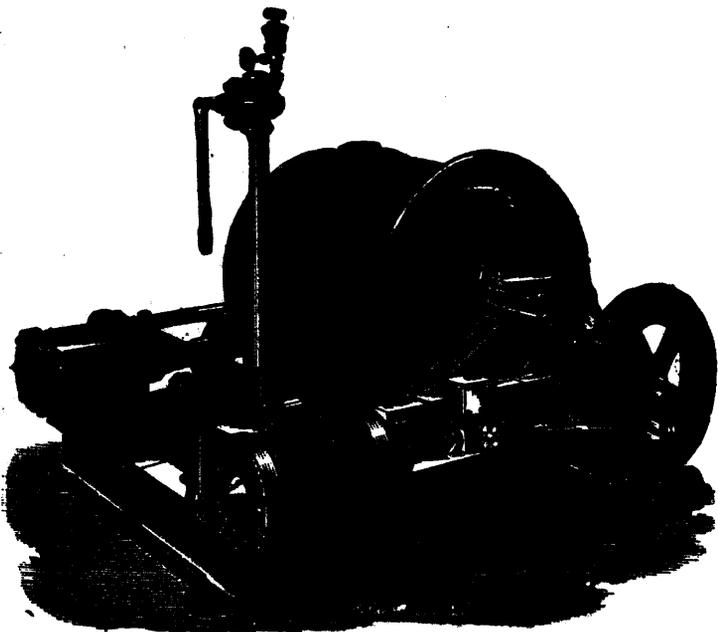
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