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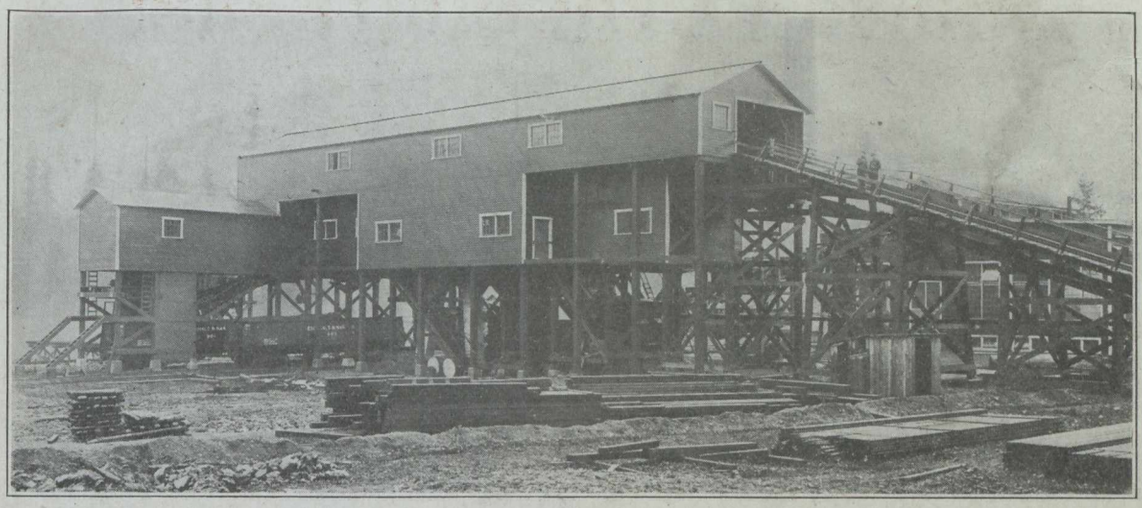

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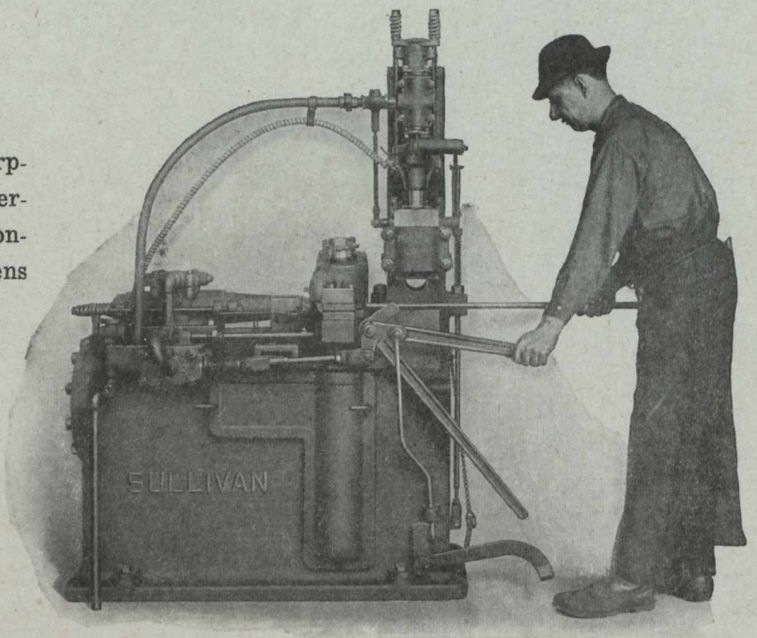

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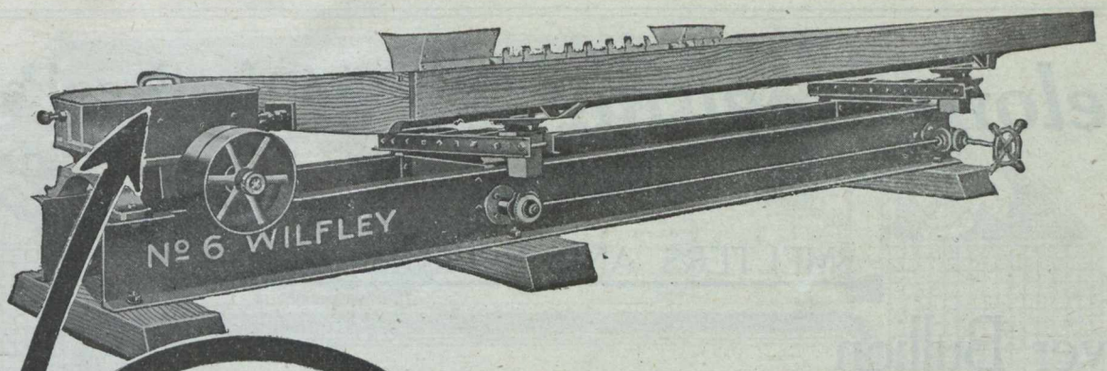

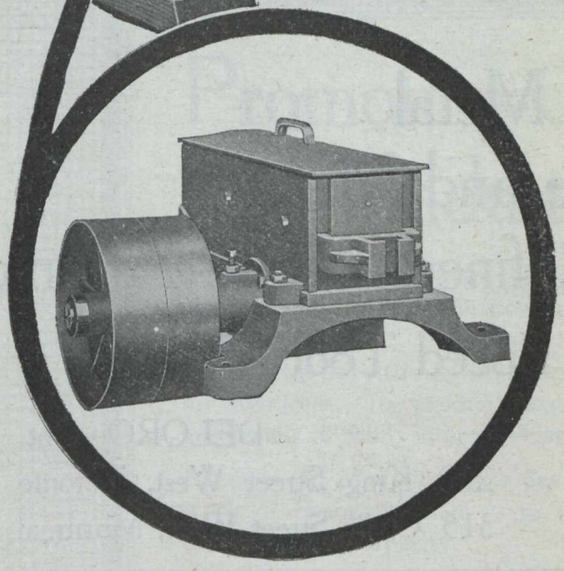

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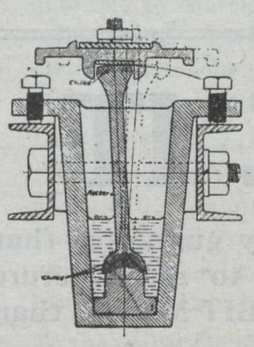

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EDITORIAL

OUR PLATINUM AND PALLADIUM OUTPUT.

As pointed out by the "Toronto World," the recent reports of the Mines Department, Ottawa, and the Bureau of Mines of Ontario give little information concerning our production of platinum and palladium.

In the tabular summary of mineral production of Ontario for 1918, platinum and palladium do not appear at all, in spite of the fact that Ontario is a very large producer of ores containing these metals. We understand that the reason for this omission is that producing companies are not required to make the necessary returns.

In the tabular statement on mineral production of Canada, palladium does not appear, while the production of platinum is given as 39oz. This is, if anything, worse than the Ontario report for it gives the impression that the production of platinum has been reported and that it is only a very small amount.

In his notes on the various metals, however, Mr. McLeish, who compiles the Dominion statistics on mineral production says: "The recorded production of platinum in 1918 was 39 crude ounces (25 fine ounces) valued at $2,560, as against a production in 1917 of 57 crude ounces, valued at $3,823, and was all obtained from the placer gravels of the Similkameen district, British Columbia.

"Undoubtedly the most important sources of the metals of the platinum group in Canada are the nickel-copper ores of the Sudbury district, in Ontario, which are smelted at Copper Cliff and Coniston, and refined at Port Colborne, Ont.; New Jersey, United States; and Wales, Great Britain. A definite record of the total recovery of the metals of the platinum group and of gold and silver from these ores has not been obtained. Unquestionably there is, at least, a partial recovery of these metals in connection with the refining operations."

Why is there no record of output of platinum and palladium?

AN EXPLORATION SCHEME.

The "Winnipeg Telegram" in an editorial on March 18, proposes that the Government should undertake a survey of the mineral resources of Western Canada. The scheme involves the engagement of a hundred or more mineralogical experts by the Government, each to be sent out in charge of a party of returned men previously given educational training in prospecting by a three months' course in the university. The country would be divided into sections and the work carried on systematically. It is argued that the country might in this way provide remunerative occupation and vocational training for a large number of returned soldiers.

We agree with the "Telegram" that a more systematic and detailed survey of our mineral resources is needed and that it should be undertaken as soon as possible, as every day that development is delayed means a loss to the country.

To put into effect such a proposal would, however, necessitate a great change in the Government's attitude with regard to the employment of technical men. The present policy of the Government is to discourage technical men from entering its employ. The present employees of the Mines Department receive ridiculously small salaries, considering their qualifications. So long as the present rate of pay continues we need expect few applicants for such positions. If the Government is unwilling to pay adequate salaries for competent men to take charge of such explorations as proposed, the work would be done in an unsatisfactory way.

THE ROYALTY ON ORES.

In commenting on the weak points of the present mining regulations applicable to lands administered by the Department of the Interior, The Pas Herald says: "Another point in the Dominion regulations that scores heavily against them, is the royalty upon ores produced from these lease-held claims. The amount of royalty is not stated, and is to be fixed by the minister as he thinks best. This is an outstanding bad feature of the regulations, and is in itself quite sufficient to make capital chary of coming in."

There is good ground for this criticism. The Minister may have the best of intentions and may never impose unresanoble royalty. We have no good reason to assume that he would so discourage desired development of our mineral resources. But the failure to place a limit on royalties is tantamount to reserving the right to expropriate all profits. The mere fact that such a thing is possible under the law is sufficient to keep investors out of the country.

No law that does not recognize the hazard capital takes in development of mineral properties can be satisfactory. When a company develops one property successfully there is too often a demand that the operators should not be allowed to make large profits. The public seems unwilling to admit that those who spend money in developing mineral deposits should be greatly rewarded if successful. Our contention is that the only justification for the large expenditures which are made for exploration and development is that those who are successful are well repaid for their enterprise.

If the Government reserves the right to impose heavy royalties, the odds against the prospector are increased. How can we expected anyone to risk money in developing prospects if there is no hope that any of the prospects will prove to be very profitable?

It is, of course, quite proper that those who make fortunes from the development of our mineral resources should contribute largely to the public treasury. They expect to do so. But if the venturesome are discouraged there will be little development and our mineral deposits will be idle until a wiser generation sees that laws which cause delay in development are costing the country great loss.

The parts of the country whose mineral resources are administered by the Department of the Interior are not being developed as rapidly as they should be. If the Department is anxious to see that development is speeded up, it should see that objectionable features of the regulations are altered.

THE PROPOSED MONOPOLY OF WESTERN OILFIELDS.

Some time ago the Shell Transport and Trading Company made an application to the Department of the Interior for exclusive rights to explore a quarter of a million square miles of land in Northern Alberta and part of the North West Territories. At the termination of five years after declaration of peace the company would select 25,000 square miles of this territory for its own purpose. We understand that the first proposal was turned down; but that another attempt to put over this preposterous scheme is being made. It has been intimated that the proposal is considered worthy of consideration.

We do not wonder at the Government entertaining a proposal that would seem to provide a way for more rapidly developing our resources. It is the duty of the Government to speed up development if it can. We strongly object, however, to any such scheme as this. Companies that will not conform to our regulations should not be given any special privileges. We do not believe that our mining regulations are perfect, but we do believe that all who wish to develop our mineral resources should be governed by those regulations. The regulations need some amending; but Canada should not countenance the granting of special privileges to any company.

Strangely enough it is possible for our government to grant such proposals as are asked for by the Shell Transport and Trading Company without any proper consideration of the merits of the proposal and without any publicity. By order-in-council the monopoly could be granted without anyone outside the Council having a chance to object. The Government does not even acknowledge that it owes it to the country to obtain the opinion of qualified men as to the merits of the proposal.

Under the circumstances it is impossible to learn what is going on at Ottawa. From what information has leaked out it is obvious that there is a good chance of our Government making a serious mistake in this matter. Those who are responsible will do well to consider whether they should place so low an estimate on the value of public confidence. To restore confidence there is needed a declaration of policy. We would like to see an announcement from Ottawa that the Council disapproves of such action as is contemplated in the proposal of the Shell Transport and Trading Co. Less order-in-council government in all matters relating to disposal of natural resources is to be desired. It is bad enough to have mining regulations subject to order-in-council changes, but it is far worse to ignore those regulations when it is desired to favor certain companies.

UNITED STATES WILL PAY FOR LOSSES INCURRED BY "WAR MINERALS" PRODUCERS.

Former Senator J. F. Shafroth, of Colorado, Philip M. Moore, St. Louis, Mo., and former Representative M. D. Foster, of Illinois, were appointed by Secretary of the Interior Lane as members of the commission that will have charge of the payment of the losses incurred by mining men in the production of manganese, chrome, pyrites, and tungsten for war purposes.

During the war the Interior Department, the Emergency Fleet Corporation, and the War Industries, War Trade, and Shippings Boards insistently urged the mining men to produce these materials to supply the urgent needs of the nation for war purposes. When the armistice came, these mineral producers, as a result of their response to the demands of the Government, had on hand ready for delivery quantities of these materials, for which there was no peacetime market.

Congress set aside the sum of $8,500,000 to meet claims for these losses, which must be filed within three months after the passage of the act. The law states that the claims must have been incurred between April 6, 1917, when the United States went to war, and November 12, 1918, when the armistice was signed. The Secretary of the Interior is charged in the act with taking into consideration and charging to the claimant the market value of the minerals on hand November 12, 1918, and also the salvage or usable value of the machinery that was installed to produce these war minerals.

Mr. Moore is a former president of the American Institute of Mining Engineers, and a well known engineer.

Mr. Shafroth was a member of the Senate Committee on mines and mining of the Sixty-fifth Congress and Mr. Foster was chairman of the House Committee on mines and mining.

UNITED MINE WORKERS' CONVENTION.

With further reference to the recent annual convention of District 18, U.M.W. of A., one of the important questions discussed was the renewal of agreements, one of these, that between the miners and the management of the Crow's Nest Pass Coal Company, Fernie, B. C., being due to expire on the 31st of March. It was announced, in this connection, that a policy committee meeting would be held at Indianapolis on March 18th, which would be attended by representatives of all districts. It was decided, therefore, that the operators should be approached with a view to arranging for an extension of the present contract, the high cost of living commission award being paid on the wages. This was agreed upon in order that the demands of District 18 could be made to conform, in some degree, with those of the miners of the United States and possibly those of Great Britain. Representatives appointed to represent the district at this meeting are: P. M. Christopher, district president; Robert Livett, international board member; Frank Wheatley and Alex. Susnar. International Organizer David Rees also will attend. These delegates were instructed to endorse the proposals contained in a circular by Frank Farrington, president of the Illinois miners, for a six-hour day and a five-day week.

In the conference with the operators, which took place subsequently, Fuel Director W. H. Armstrong presided and the utmost good feeling prevailed. The operators agreed to postpone negotiations pending the meeting of the policy committee, and a further meeting with the operators is to be arranged as soon as possible after the return of the District 18 representatives.

Two noteworthy changes made in the constitution of District 18 Organization by the Convention were that conventions and election of officers should be held biennially instead of annually.

Preliminary Report of an Investigation into the Concentration of Graphite from some Ontario Ores

By the Staff of the Department of Mining Engineering, University of Toronto.

The beneficiation of graphite ores is recognized as one of the difficult problems of the art of ore-dressing. Unlike many minerals, graphite has no method of concentration that might be called standard; each mill has its own method, the mills between them employing nearly every known means of concentration. In addition there are a number of carefully guarded secret processes.

The difficulty in the production of graphite arises from the nature of the graphite itself, and from its mineral associations, which difficulties are complicated by exacting market standards.

Graphite occurs in two forms; crystalline and amorphous. Either form may occur as a massive variety, or as a disseminated mineral. Most of the Ontario graphite ores are of the crystalline and disseminated type, the graphite occurring as flakes varying in size from one-half inch in diameter down to dust. In Ontario are large deposits of graphite bearing rocks, yet in 1917 only about 4,000 tons of graphite was marketed, of which approximately one-third was of the best or crucible grade. This investigation was made to elucidate the principles underlying the concentration of graphite and possibly to make commercial propositions from some of the at present valueless deposits.

It is estimated that more than one-half of the graphite consumed in the world is used for the manufacture of crucibles. As graphite suitable for crucible manufacture commands a very much higher price than other grades, this investigation is limited to the production of crucible-grade graphite.

The specific gravity of naturally occurring graphite varies from 2.1 to 2.9 according to its purity, an average being 2.6; the specific gravity of the most commonly associated minerals is from 2.6 to 3, consequently complete separation of the graphite from its mineral associates by gravity methods alone is impossible.

The cleavage of graphite is so perfect that the mineral splits readily into flat scales. In wet gravity concentration methods this flakiness causes the migration of the graphite to be extremely erratic and a process depending on the flakeyness is apt to be complicated by the presence of mica or chlorite, both flaky minerals and commonly found with graphite.

Graphite is a very easily floated mineral and almost any of the systems of flotation can be used to make a good recovery. Unfortunately, mica, pyrite and calcite, common gangue minerals, are not difficult to float and these with the unavoidable middlings, are recovered more or less with the graphite.

Other processes, as electrostatic separation and chemical methods, which are used to some extent, are undesirable on account of high cost of operation or of difficulty in manipulation.

It can readily be seen from the foregoing considerations that no simple process of milling graphite is possible, that any method of procedure must consist of crushing to liberate the flake; gathering of the flake and final recleaning of the impure flake. In this operation some regrinding is almost unavoidable, and because of the large size of flake desired, coupled with the softness of the graphite, the methods employed for crushing both the original ore and the recovered concentrates become of prime importance.

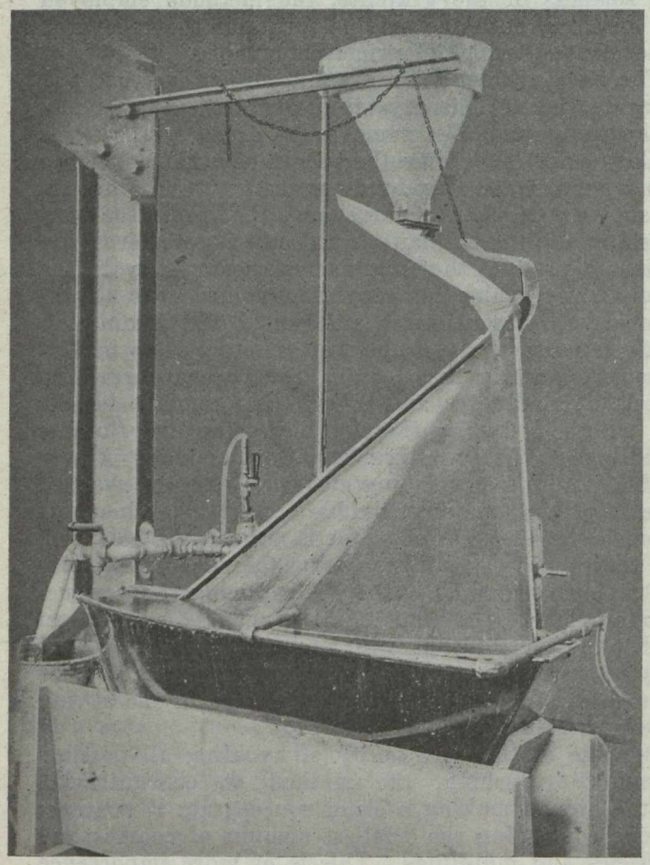
The ideal grinder for a graphite ore is one that will separate the various crystal grains with a minimum of crushing and also remove the freed graphite as rapidly as possible from the sphere of action. Such a grinder will make a granular product with a minimum of slimes. Of existing crushers, the rolls for dry crushing and the ball mill or rod mill for wet crushing deliver a product that approaches most nearly to the ideal. Wet crushing for graphite ores has some advantage over dry crushing in addition to the elimination of dust, particularly if the wet grinding is to be followed by a wet process of flotation, because graphite is soft and adhesive and in grinding tends to smear the gangue particles thereby increasing the flotable middlings. With wet grinding this tendency is negligible. With wet grinding also the flakes are washed free from dust, making possible a cleaner product. If a considerable excess of water is used in the ball mill, the flakes are washed away from the sphere of grinding action very rapidly, thereby reducing the destruction of flake to a minimum. Of course a mill run under these conditions will be inefficient considered only as a crusher, but any loss in capacity will be more than made up by the resulting increase in the saving of coarse flake.

Because of the desirability of avoiding all possible subsequent crushing, the method of concentration should aim at making a clean concentrate if possible, or one containing the smallest amount of coarse sand particles and middlings. This is of more importance even than a high extraction of the graphite from the ore, for a complete extraction is valueless if the flakes are so small as to lose their commercial value. For this reason, in choosing a method of flotation for trial in these first experiments, weight was given to the need for oil and that one was chosen which called for the least amount of flotation agent. Since all the commoner flotation processes call for oil, and as the use of oil appears to entail some gangue being floated, these methods were laid aside in favor of some form of skin flotation which may be used without frothers or oilers. Skin flotation on a dry product was considered as out of the question, the float being invariably dirty and also entailing the disadvantage of requiring the drying of a considerable tonnage of rock, whereas a wet process of flotation following the wet grinding would call for the drying of only a comparatively small quantity of graphite. Also, the disagreeable dust would be eliminated to a great degree in a continuously wet process. So the object sought was to combine a wet grinding method with a wet skin flotation process and to follow up with a wet recleaning and grading system.

The apparatus used for the experiments were laboratory machines described in the following paragraphs.

The crusher for small lots consisted of an iron pot revolving on an inclined axis. Into this pot can be placed iron balls of various sizes from 5 inches diameter down. The capacity of the mill is 2 Kilo's of ore per charge. This mill was used for grinding the ore for most of the tests and for regrinding middling and concentrate. For larger quantities a ball mill of 2 ft. 6 in. by 2 ft. inside measure was available. Another small rod mill 12 in. by 18 in. was used for some tests.

The flotation process used is a modification of the old Bradford process in which the pulp flows down an



Concentrating Machine—Front View.

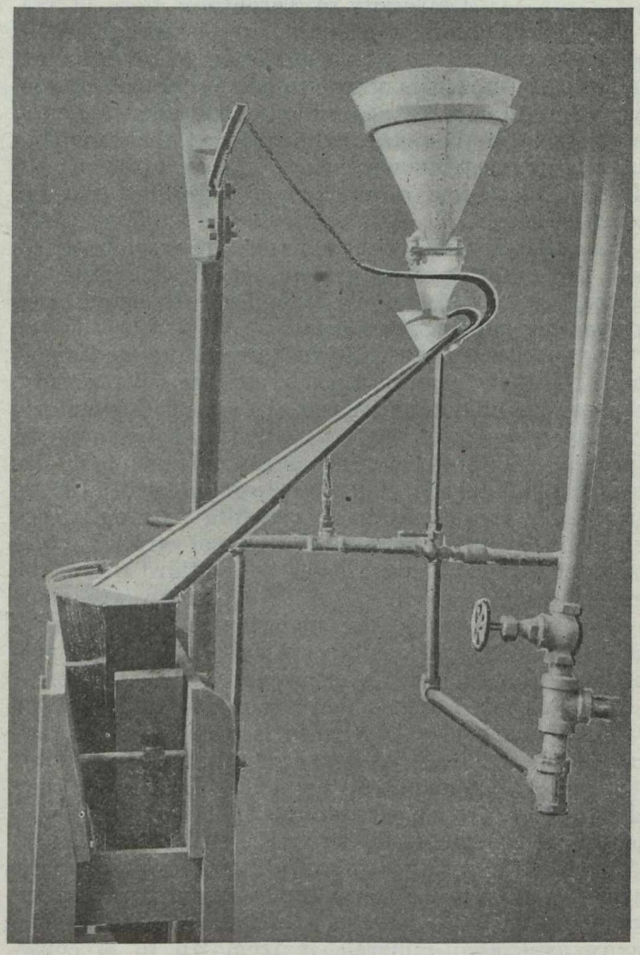
inclined plate dipping beneath a surface of water. The actual machine used is described in the Canadian Mining Journal of July 1st, 1917. Figures 10 and 11 are photos of the machine. No comparative work was done on the selection of flotation oils. The only oils used were coal oil and occasionally small proportions of rosin oil. The quantities used were so small that no greasiness was at any time noticed on the graphite. The amounts of oil varied between 2 and 16 drops per kilogram, the maximum being ¼ lb. per ton of ore.

The screens used throughout were according to Tyler's Standard Screen Scale.

The ore selected for most of the experiments was a hard granite ore found in Ontario. The bulk of the rock is a pale pink orthoclase, changing in places to microcline. Considerable biotite is present with pyroxenes, pyrite and occasionally horn blende and specks of titanite. The graphite occurs as scattered flake, ranging in size from ⅜ inch down to dust, with a few rich bands of almost solid graphite varying in thickness up to two inches.

A quantity of this ore was crushed in a gyratory crusher to pass 1 inch and further crushed to pass ⅜ inch. This was sampled and divided into lots of about 2 kilograms.

A screen analysis of one of these lots showed that the sizes coarser than 8 mesh contained practically no free flake, the 8/10 mesh a few and the 10/14 mesh and smaller sizes contained much free flake. The proportion of attached particles diminished with the decrease in the size of particles until at 65 mesh the true middlings were comparatively few.



Concentrating Machine—Side View.

Details of Some of the Tests.

For convenience of reference the tests are numbered consecutively, though only a very few of the experiments are detailed here.

Experiment No. 1.

One kilo of the ore was ground wet in two stages until all the gangue passed 10 mesh. During grinding 4 drops of coal oil were added to the pulp in the mill and the oiled pulp was then floated without extra oiling. The resulting graphite assayed 65% carbon. The tails were re-oiled with 4 more drops of oil and re-floated until the finer sands were clean, most of the remaining visible graphite being in thick pieces coarser than 14 mesh. The resulting float was very dirty, being largely made up of true middling.

Experiment No. 2.

Like No. 1 except that only one half of the amount of oil was added to the mill during grinding. The results were much the same as in the first trial.

Experiment No. 3.

The grinding was done as before, but with no oil except the traces remaining in the crusher from the

previous grindings. On flotation the first unoiled float looked clean, and assayed 79.3% as against 65.0% of the first test. These three tests showed that even small quantities of oil greatly increase the amount of gangue lifted, which, in view of the subsequent crushing, is undesirable. Therefore, all later grindings were made without any oil.

These tests had produced a quantity of material containing considerable gangue and tests were made to get an idea for a suitable treatment for such dirty concentrates.

Experiment No. 4.

The low grade oiled floats from Experiment No. 1 were reground wet without further oil until the gangue passed 65 mesh and then screened, the oversize being a clean looking flake. The undersize was refloated giving a concentrate that was not particularly clean.

Experiment No. 5.

The very dirty second float from Experiment No. 3 was re-ground and re-screened as before at 65 mesh, the oversize mixed with a quantity of tailings was refloated, resulting in a clean tailing but a dirty concentrate. This concentrate was re-ground till the gangue passed 80 mesh and then screened, giving a clean flake and a tailing from which repeated flotations failed to obtain a clean product. The assays of these combined experiments are given in table 1 and 2. These results indicated, what later trials confirmed, that re-flotation alone is not sufficient to clean a concentrate and that re-grinding followed by screening will give a clean flake.

TABLE 1.—(Combined Results of Expts. 1 & 4.)

Size mesh	material used	product obtained	weight	assay % carbon	Remarks
	ore		1000	6.9	
−10					
+65	1st float	flake	36	87.0	material from Expt. 1, ditto.
+65	2nd float	flake	20.3	84.5	
−65		flake	10.5	68.0	
		tailing	862	.76	

TABLE 2.—(Combined results of Expts. 3 & 5.)

Size mesh	material used	product obtained	weight	assay % carbon	Remarks
	ore		1000	6.9	
+65	1st float	flake	39.2	79.3	Materials from Exp. 3
+80	2nd float	flake	37.8	86.4	
−80		flake	8.0	59.3	
		tailing	852	.55	
		loss	73		

Experiment No. 6.

Experiments on other ores at other times had shown that cleaner concentrates could be obtained from skin flotation by grading the material into several sizes and treating each size separately. Quality of product being the main essential in the production of graphite, trial was made of material graded by screening into four lots and each lot treated separately, viz.: The ore was crushed without oil until the gangue passed 14 mesh, the oversize was clean flake and was reserved without further treatment. The next size 14/48 mesh was oiled with coal oil and floated. The first float was clean except for a few attached particles which were liberated by a light re-grind and re-flotation: the tailing was almost pure mica. A second flotation of the sands with more coal oil and a third with a mixture of coal oil and rosin oil gave dirty floats which were re-ground and screened at 80 mesh, giving a flake and an undersize which was added to the rest of the −80 material. The size 48/80 was treated similarly. The combined undersize through 80 mesh was floated once without oil and once with oil, though no particular attempt was made to obtain a very clean product. The result of the treatment of the whole lot is given in table 3 the products being combined for assay.

TABLE 3.—(Combined results of 4 lots of Exp. 6.)

Size mesh	material used	product obtained	weight	assay % carbon	Remarks
	ore		2000	6.9	
+14		flake	5		contained no gangue.
14|48		ore	1000		most of the flake in this size.
48|80		ore	600		
−80		ore	395		includes finest slime
+48	screened	flake	83.8	91.8	+14 flake added.
48|80	ore products as above	flake	29.0	85.6	
−80		flake	12.4	74.2	
		tailings	1874	1.4	

This gives a recovery of 112 lb. per ton of ore, of graphite flake of 90% carbon and +80 mesh size. This is a larger recovery and a higher grade of flake than was obtained in tests without grading, and is almost 74% of the total graphite of the ore recovered as a high grade crucible flake.

Experiment No. 7.

The ore of this test was low grade with the same hard siliceous gangue as the ore of the previous test. Both it and the ore of the next test were considered to be of doubtful commercial value. This experiment and experiment 8 were intended as trials in the recleaning of flake. The flotation proceedure was the same as in the previous test. The result is given in table 4:

TABLE 4.

Size mesh	material used	product obtained	weight	assay % carbon	Remarks
	ore		2000	4.4	
+80		flake	96	67.4	This assay
−80		middlings	31.5	31.9	is much
+200		tailings	1514	.4	lower than
−200		slimes	358	1.9	the appearance indicated.
+80	flake		96	67.4	
+80		flake	56	88.1	this flake
85|150		middlings	14	59.1	looked clean under the microscope.
−150		dirt	26		this was a low grade brown product largely of mica.

In experiment No. 8 the ore was like that of No. 7 except that the original graphite flakes were smaller, most of the flakes passing 28 mesh. The procedure was as before except that flotation was added as part of the recleaning process. Table 5 gives the extraction before recleaning.

TABLE 5.

Size mesh	material used	product obtained	weight	assay % carbon	Remarks
	ore		1350	4.7	
+80		flake	61	68.1	
−80		middlings	46.5	20.7	
+200		tailings	1147	.9	
−200		slime	96	2.6	not treated

The regrinding and screening through 80 mesh of this +80 mesh flake raised the assay to 80% carbon, a second regrinding brought the assay to 85%; but at the expense of heavy loss in quantity, only 35 grams remaining from the original 61. A second test was made on the ore, an effort being made to avoid the necessity of such excessive grinding. The ore was graded as before and floated, giving a +48 mesh flake and a middling. This middling was re-ground and refloated, the floats being added to the first flake, and

the concentrate was used for the recleaning test. A light regrind to crack the true middlings was followed by screening, giving a +48 mesh flake assaying 85% carbon and a 48/80 mesh flake assaying 71% carbon. An attempt was made to separate the 85% flake into two parts by flotation, one of which should be sufficiently high grade as not to require recleaning. This was not found to be possible, the difference in assay between the floats and the sinks being so small in every case as to be negligible. Regrinding the sinks and screening gave a product assaying 88.43% carbon, while similar treatment of the floats gave a product assaying 88.40% carbon. These two last when reground and screened gave a product assaying 94% carbon. This shows that regrinding is a necessary part of the recleaning and that reflotation alone is not sufficient.

Screening, particularly of fine sizes, is not a desirable process and grading can often be better performed by classification when used as a preliminary to other processes. In the case of graphite, classification would appear to have a further advantage over screening in that it might be possible to remove a large part of the purer flake from the coarser sizes of gangue to the finer sizes of gangue and thus avoid a considerable loss of flake in the grinding of the coarser portion of the gangue, which portion is the larger part of a properly ground graphite ore. In some cases it might be possible to remove a part of the gangue directly as tailing without treatment, though on the ores tried this was not possible.

Some of the advantages of classification over screening for graphite ores are shown by Experiment No. 9. A quantity of the ore as used in the first experiments was crushed in a ball mill until the gangue passed 8 mesh. This pulp was divided by a hydraulic hindered settling classifier into lots, each lot being treated by flotation, followed by regrinding and screening as the method of recleaning. The results are shown in table 6. This table shows well the increase in the amount of dirt floated with the increase in the amount of oil, also the assay of the first float is higher than anything obtained either without grading, or with screening as a means of grading. A screen analysis of some of the products shows that following grading by classification, screening alone will remove a large part of the dirt. See table 7. As shown by this experiment, H. S. classification followed by screening of some of the products is capable of giving a considerable quantity of flake that does not require regrinding; which means a saving of the larger and more valuable flake. In this particular case, by combining the first float of the 35/80 mesh lot with the clean flake obtained from screening the second and third floats of the same lot (product 8, table 6, and products 7 and 9, table 7), was obtained a flake assaying 92% carbon and in quantity approximately one-third of the total recovery expected from this ore.

TABLE 6.

gangue size mesh	material used	number	product obtained	flotation oil per Kilo	Weight	Assay % of carbon	Remarks.
	ore			none	24554	6.9	
8|35	ore	1		none	5679		C.O. = coal oil, R.O. = rosin oil.
		2	1st float	none	24	76.7	some middlings, no free dirt.
		3	2nd float	2 drops C.O.	109	86.7	much true middlings.
		4	3rd float	none extra	10.5	64.0	much true middlings.
		5	4th float	6 C.O. 4 R.O.	348.5	39.2	very dirty.
		6	tailing		5187	1.4	contained thick lumps of graphite.
35|80	ore	7		none	6614		
		8	1st float	none	228	96.2	very clean flake.
		9	2nd float	2 drops C.O.	314	68.6	much true middlings.
		10	3rd float	6 C.O. 2 R.O.	300	22.1	very dirty.
		11	tailing		5772	1.0	
80|300	ore	12		none	7119		
		13	1st float	none	713	81.5	flake fairly clean to the eye.
		14	2nd float	2 drops C.O.	212	41.4	dirty.
		15	3rd float	6 C.O. 2 R.O.	155	29.4	very dirty.
		16	tailing		6139	.8	
—300	ore	17			5142		not treated.

TABLE 7.—(Screening of products of table 6.)

material used from table 6)	number	product obtained	size mesh	Weight.	assay % carbon.	Remarks.
No. 2, 3, 4, & 5 all 8|35 floats	1					all these products contained so much middlings that screening would not give a clean flake.
	2					
	3					
	4					
No. 8 1st 35|80 float	5	clean flake		228	96.2	this was very clean except a few grain in the 65|80 mesh size.
No. 9 2nd float	6			314	68.6	
	7	clean flake	—28	143	88.9	clean to the eye.
		middlings	28|35	171	51.7	dirt present mostly as true middlings.
No. 10 3rd float	8			300	22.1	
	9	cl. flake	+28	52	83.2	good flake.
	10	middlings	28|35	58	19.3	mostly true middlings.
	11	dirt	—35	190	6.2	largely composed of mica.
						The distinction between these three products was very marked.
No. 13 1st float 80|300	12			713	81.5	these were not assayed, but the difference in appearance of these three products was also very pronounced.
	13	cl. flake	+65			
	14	middlings	65|100			
	15	dirt	—100			

The ore used in the previous tests was a siliceous ore of which the feldspar and quartz gangue minerals are not easily floated, while the previous tests show that the free biotite present did not present any difficulties with the method of treatment adopted. A test (Exp. 10) similar to the last was made on an ore of a different type, an altered limestone, the carbonates of which are much more easily floated than the silicates. It was considered that it might be more difficult to obtain a high grade flake without considerable regrinding and loss of flake. The actual work showed that the loss was not as great as expected; that while the floated graphite was not quite as high grade as that from the other ore, the greater ease with which calcite particles could be crushed made possible a large recovery of a high grade flake. The details of the extraction are given in table 9 and a summary of the recovery in table 8. The original ore assayed 14.6% carbon, the recovery of crucible flake was 232 lbs. per ton of graphite assaying 90% carbon which is a recovery of 71.7% of the total carbon present in the ore. When allowance is made for the original flake of smaller size than 80 mesh and for the inevitable losses in grinding due to the breaking up of the larger flake it will be seen that this is a very good recovery. A treatment of some lumps of the original ore with acids and subsequent screening of the flake showed that approximately 3 per cent. of the original flake was less than 80 mesh in size, which makes the recovery of possible crucible flake 74 per cent.

TABLE 8.

Size mesh	material used	product obtained	weight	assay % carbon	Remarks
—14	ore		1940	14.6	mesh size of gangue only.
+80		crucible flake	224.8	90.5	total of all +80 flake.
—80		flake	111.2	20.3	no attempt at cleaning.
		tailings	1604	2.0	slimes included.

In all the tests made, only rarely was it found possible to obtain a concentrate of graphite of such high grade that no further cleaning was necessary. Also it was found that re-flotation alone is not sufficient and that a combination of screening and flotation, while applicable sometimes, was generally useless without some regrinding of the flake.

The usual procedure in the recleaning of graphite is to grind dry between buhr stones. This method is open to the objection of being very destructive of the larger flake on account of the twisting and abrading character of the grinding action. For this reason in some mills an attempt has been made to substitute fine rolls for the buhr stones. Rolls fine enough to grip flake graphite are expensive and costly in upkeep and are not well adapted for wet crushing. A rolling action is better than a twisting one because the flakes will split and roll out flat rather than break thus liberating any enclosed mica without much reduction in the size of the flakes. Wet grinding of flake in addition to the advantages accruing to a continuously wet process has possibly a further advantage in that by dry grinding methods flakes of mica may be simply smeared with graphite and thus hidden instead of being removed. The wet grinding tests showed a possible additional advantage of wet grinding over dry grinding in the preservation of the character of the surface of the flake. This will be referred to later.

The regrinding of the flake and middlings of the previous tests was done in the small pot and ball mill described before. This mill combined the rolling action of a roll and the washing action of a considerable quantity of water, the water preventing the smearing action of the graphite and also to some extent acting as a classifier in removing the lighter flake from the grinding face, the lighter flake presumably not requiring any regrinding. The absence of smearing was well shown in one experiment, of which the details are not given, in which a clean looking coarse flake assaying about 75% and sized between 10 mesh and

TABLE 9.

size mesh	material used	product obtained	weight	assay % carbon	flotation oil.	Remarks.
—10	ore		1940	14.5	none.	
+10		flake	13	89.2		Removed by screening. 100% clean to the eye.
10|28	ore		825			
		1st flake	70.0	76.7	none.	H.S. classifier product.
		2nd float	61.5	47.3	2 drops C.O.	few true middlings. 99% clean to the eye.
		3rd float	112.5	10.8	6 C.O. 2 R.O.	
		tailing	582.0	2.4		contains much fine true middling.
	Recleaning of 10|28 2nd float.					
10|28	float		6.54	47.3		reground and screened through 48 mesh. undersize added to the 28|80 lot. All sizes smaller than 48 mesh were very dirty.
+48		flake	32.5	93.5		
—48		middling	28.0			
28|80	ore		832			All—80 mesh material removed by screening.
		1st flake	122.0	70.9	none.	
		2nd float	70.0	g5.7	2 drops C.O.	
		tailing	640.	2.7		contains much fine true middling.
	Recleaning of 10|28 and 28|80 1st flake combined.					
10|28	flake		192			reground and screened through 80 mesh undersize added to final —80 flake.
+80		flake	142.8	93.9		
—80		flake	49.2			
	Recleaning of 10|28 and 28|80 mesh last floats combined.					
10|80	float		182.5		none.	reground and screened through 80 mesh, undersize added to next lot for flotation, oversize floated and sinks added to the final tailings. The sinks were mostly mica.
+80		flake	36.5	77.8		
+80		tailing				
—80		middling				
80|300	ore		390.5			
		1st float	42.0	35.9	none.	no attempt made at recleaning.
		2nd float	20.0	7.1	2 drops C.O.	
		tailing	428.5	.53		
—300	slimes		53.5	4.9		not treated.

48 mesh was reground and refloated. The resulting graphite flake assayed over 90% while the tailing was pure mica, the separation being very clean and distinct. The absence of the smearing action on the reground material means that it is possible to return such a product into the general circuit of the mill without the dirt being refloated by the graphite smears and reappearing in the concentrate.

The small pot and ball mill is suitable for only small quantities. Trial was made of a larger mill built more after the style of commercial machines. This mill is a small tube mill 12 inches diameter and 18 inches long with continuous feed and central discharge. In operation it was charged with about 50¼ inch diameter steel rods. This weight of rods is only a small part of a full charge of rods for the mill; but it was found quite sufficient as selective grinding is desired, only the heavier flakes and the coarser middlings requiring treatment. To aid the selective action a considerable excess of water was used. This mill used intermittently did the regrinding of the products of table 9. The results were considered satisfactory both as to the effectiveness of grinding and the preservation of the character of the flake.

Fig. 1.—Graphite before burning Flake from product No. 2, Table 6.

A quantity of dirty graphite and middlings had accumulated from the previous work and this was made use of to get an idea as to the operation of the mill used continuously. The middlings were first run through the mill and then screened at 100 mesh, the undersize was brown and contained only a small part of the graphite and assayed between 4% and 5% carbon. The oversize was added to a lot of flake and this reground in the mill. The mill was started with water only and then the flake fed in at a rate of 50 lb. per hour. The mill was stopped one minute after the last of the graphite was in and the mill emptied. The results showed that the capacity of the mill on such a graphite material is large and the grinding efficient, even with as small a rod load as was used. In this particular instance the raising of the assay of the +80 mesh graphite from 79.5% to 95% carbon shows that the mill was operated much under capacity and the graphite consequently much over-ground, resulting in an unnecessary destruction of flake. Owing to an accident the complete returns cannot be given, but table 10 gives a summary of the results of the last regrinding.

Fig. 2.—Mica remaining after the burning.

TABLE 10.

Size mesh	material used	product obtained	weight	assay % carbon	Remarks
10|100	original flake		4920	70.6	
+80		flake	3670	79.5	Screen sizing test before regrinding.
—80		flake	1250	64.3	
+80		flake	1915	95.0	Screen sizing test after regrinding.
—80		flake	3005	56.7	

Confirmatory evidence of the impossibility of avoiding regrinding, apart from the regrinding of gangue which may be visible as middlings, is given by physical examination of some of the flake. Repeatedly in making these tests graphite products were obtained that to the eye and to the feel of the fingers were clean and in some cases the microscope failed to show the presence of any dirt, and yet the assays were often disappointingly low. This invisible dirt consists of some minute particles of quartz, etc., embedded in the

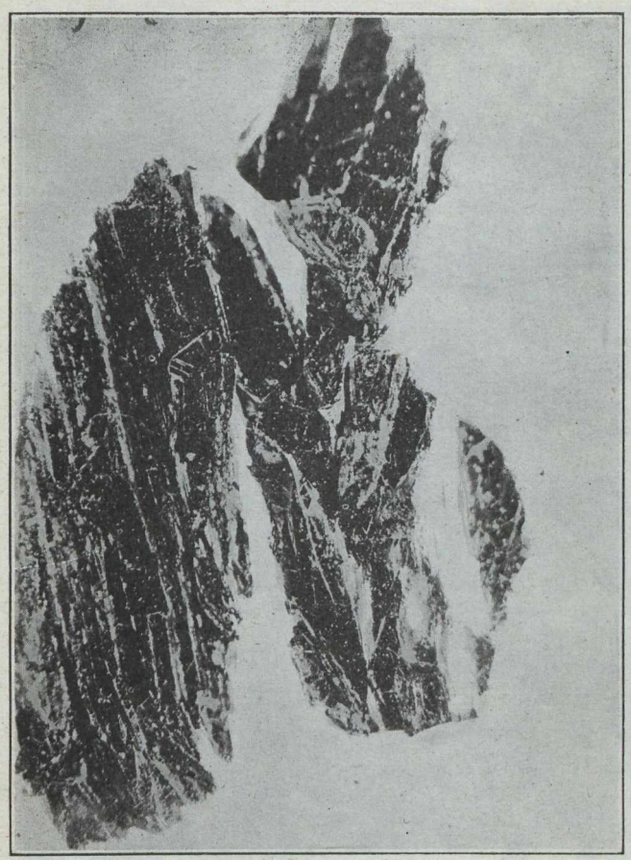


Fig. 3.—A raw unground flake.

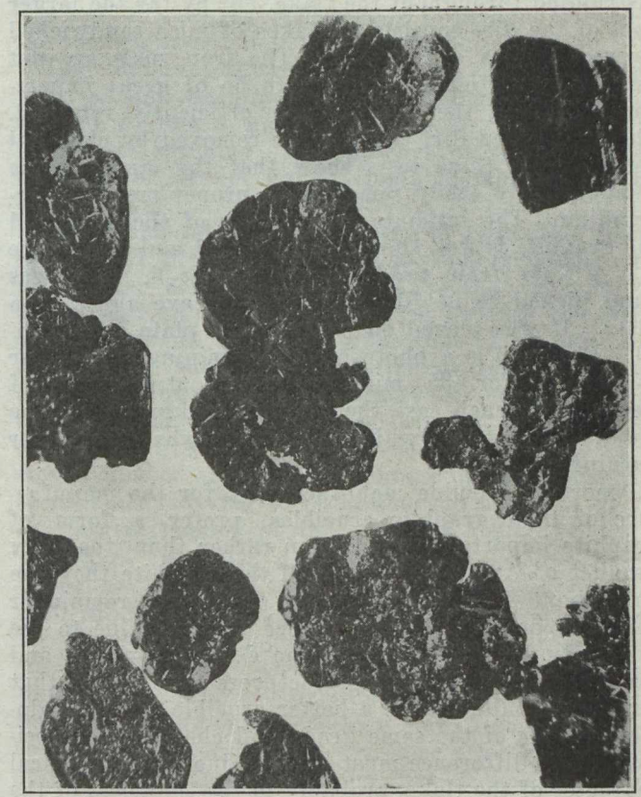


Fig. 5.—Wet ground flake. (Compare with Fig. 4.)

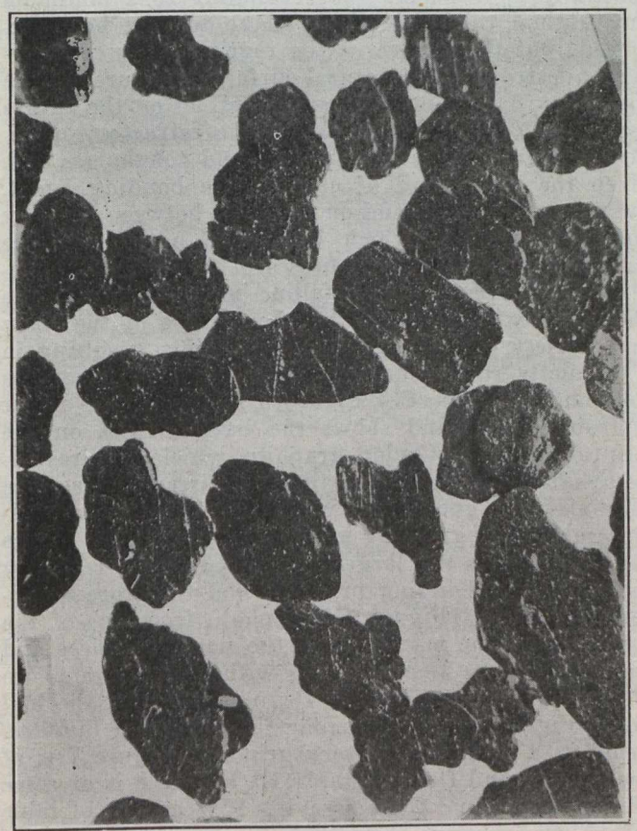


Fig. 4.—Crucible grade graphite. Dry ground. (Note rounded edges.)

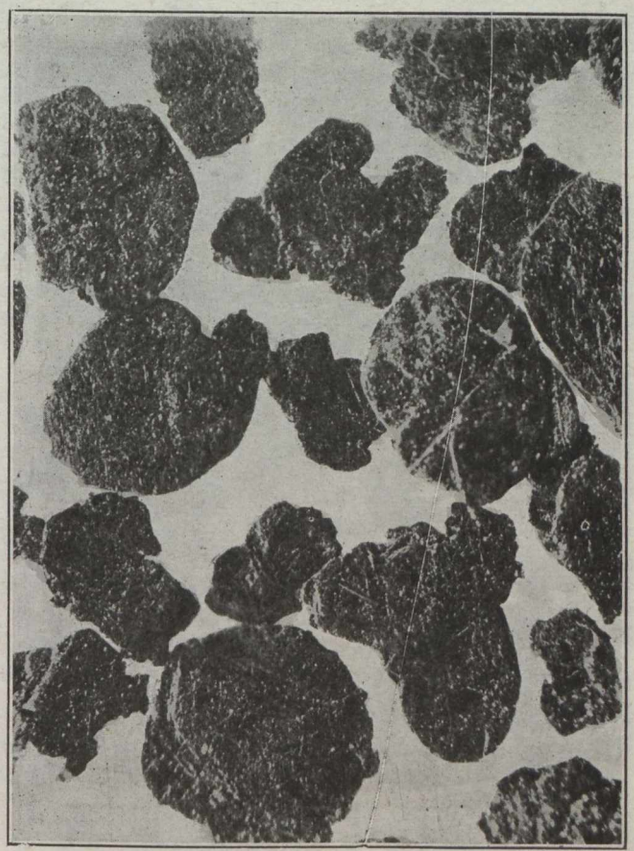


Fig. 6.—Wet ground flake that has been given a slight regrind.

flake and some iron compounds, very often as oxide, distributed throughout the flake, but by far the larger part of the dirt consists of flakes of mica sandwiched between flakes of graphite. The iron rusts are not usually in sufficient quantity to be of great importance provided the mica can be efficiently removed. The distributed dirt can only be removed by chemical means while these tests show that the mica can be comparatively easily removed by proper means of regrinding. The intimate relationship of the mica and the graphite is well shown by figures 1 and 2. Figure 1 is a flake from product No. 2, table 6. This was hand picked to be 100% pure to the eye aided by a glass. It was placed on an alundum plate and burned. Figure 2 is a photo of the remaining mica after combustion for 35 minutes in an atmosphere of oxygen. In each case the mottled background is the alundum plate on which the flake was placed for burning.

American crucible manufacturers, for the manufacture of their graphite crucibles, prefer a form of graphite imported from Ceylon rather than the flaky product of American origin. Of the graphite they use only about 20% is of domestic origin, the remainder being imported. This preference is partly due to the at one time unreliability of the domestic grades and production; but the manufacturers also state that Ceylon graphite makes a better crucible than the domestic flake of the same grade and chemical composition. This difference must then be due to the physical character of the flake, probably to the thickness of the flake and to the nature of its surface. With many graphites the thickness of the flake, and with all graphites the character of the surface, depends on the

Fig. 7.—Wet ground flake of Table 1. (Square fragment of orthoclase in centre.)

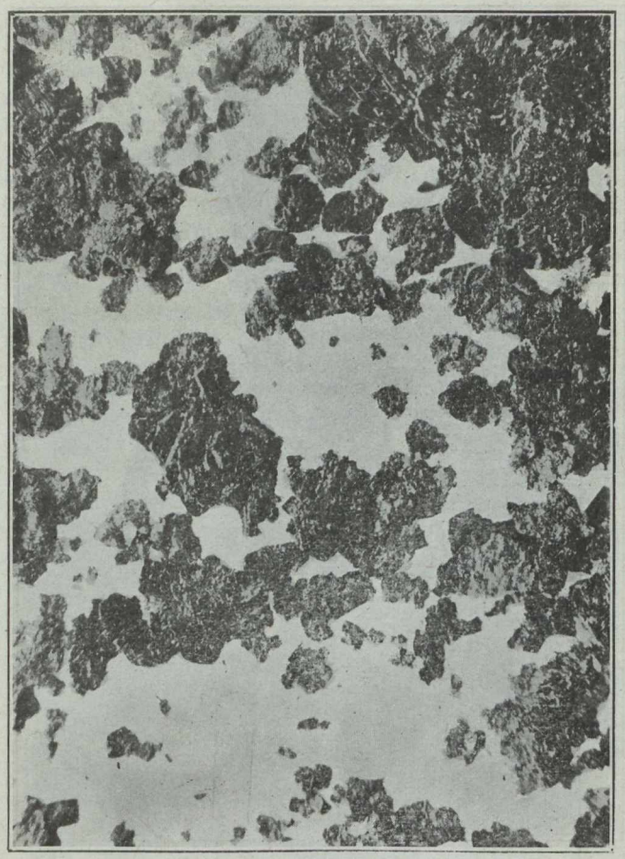


Fig. 8.—Wet ground flake of Table 10.

nature of the regrinding process during cleaning. Naturally by reducing the regrinding to a minimum the original thickness of the flake will be best preserved; but the nature of the regrinding by preserving or destroying the natural surface structures of the flake may have a most important effect on the future use of domestic flake. Next to the refractory qualities of a crucible is its strength and toughness, and, given the right kind of clay as the bonding agent, the strength will depend on the bond between the clay and the graphite, which bond will be best if the naturally occurring roughnesses of the flake are preserved. Graphite is crystalline and the crystalline character expresses itself on the surface of the flake in a variety of cleavage lines and facets, resulting in a distinctly rough surface which is the ideal surface for bonding purposes. Figure 3 is a photo of a raw unground flake and shows the irregularities on the natural surface. Ceylon graphite, which requires little grinding before use, retains these irregularities and thus makes a good bond with the clay. By the common method of grinding graphite between buhr stones the roughnesses are largely smoothed away, resulting in an inferior bonding property and therefore an inferior crucible. Figure 4 is a photo from one of the graphites on the market, note the smoothed faces and rounded edges. Compare this with figure 5, a photo of some of the wet ground flake taken from the ball mill. Figure 6 is of a similar flake given a light regrind in a rotary laboratory grinder. Figure 7 is of the wet ground flake of table 1. Figure 8 is of some of the wet ground flake assaying 95% carbon of table 10. Even excessive regrinding in a wet rod mill does not destroy the surface structures as is shown by the graphite of table 8 (figure 9) of which 43% of the

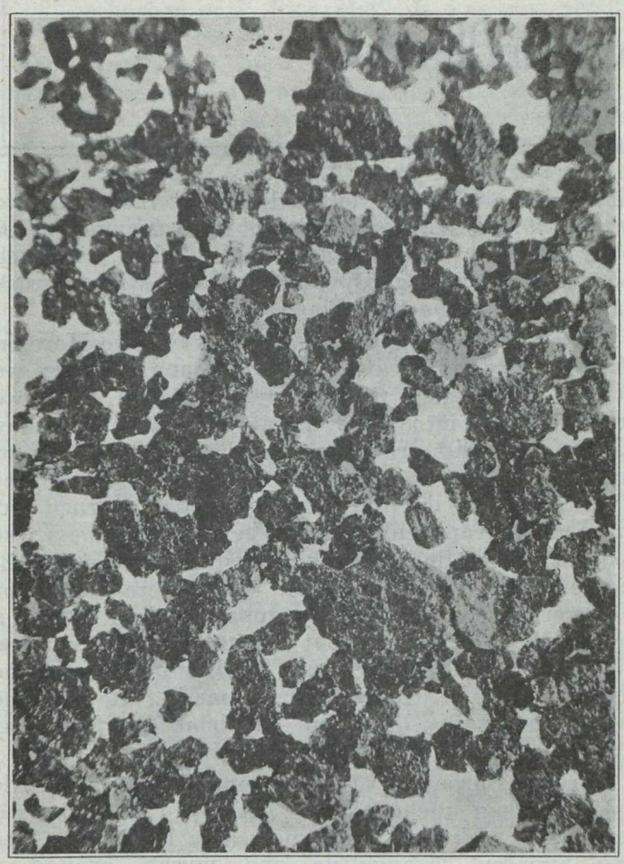


Fig. 9.—Excessively reground. Raised from 67% to 88%

flake was ground away in raising the assay from 68% to 85% carbon. Inspection of these figures shows clearly the differences in surface structure due to different grinding operations.

In these tests skin flotation was used because of its convenience and ease of manipulation, but the essentials of the system of treatment based on the results obtained will apply also to other systems employing other processes of flotation.

Proposed System.

From the results of the experiments a system of concentration for graphite ores may be outlined. The details are subject to variation and arrangement to suit the peculiarities of various ores; but in a general way the scheme is as follows:

1. Crush wet in a rod mill or a ball mill, using an excess of water and the minimum of crushing compatible with the liberation of the maximum of coarse flake.
2. Remove the large flake from the mill oversize by screening. With the smaller-flake ores this is not advisable.
3. Divide the sands by hindered-settling classification into several grades.
4. Float each grade separately and by stages, regulating the quantity of oil to the requirements of each stage, making concentrates middlings and waste.
5. Regrind the concentrates and the middlings separately in a rod mill with excess of water.
6. Screen wet, making a high grade flake and a dirty undersize to be returned for flotation.

This system offers some decided advantages over the older processes. The whole process is wet, eliminating the dust nuisance and avoiding the necessity of drying large tonnages of rock, saving the cost of heat and the handling required in the drying operation. The only drying that will remain to be done will be of the small proportion of finished graphite.

The minimum destruction of flake due to its rapid removal and the minimum of crushing required combine to produce a maximum of coarse flake from this method of crushing. The absence of smearing helps to keep the production of floatable middling at the lowest point.

Separation into grades, while not absolutely necessary, is an advantage in that it renders possible the flotation of some high-carbon flake that may not require re-grinding at all, and also because the sizing of the material helps the separation of graphite and mica in the subsequent flotation process, where the elimination of free mica is practically complete. Flotation by stages permits the adjustment of the amount of oil added, so that after the cleaner graphite is removed almost any desired amount of middlings may be obtained, leaving to be discharged as waste by far the largest portion of the ore as a coarse sand.

Perhaps the most striking difference between this system and the older systems is in the character of the final product due to the substitution of wet grinding for dry grinding, not only in the original crushing, but in the cleaning operation on the recovered graphite. Not only does the wet grinding, as proposed, split the flake, liberating the mica clean and in good condition for separation, and also doing some selective grinding as between graphite and dirt, but it does this work on the flake without destroying the original surface characteristics of the graphite flakes and so preserves its bonding qualities. The graphite flake produced by wet grinding in connection with wet screening is very different in appearance from the dry ground flake. The flake is thicker, it has a large proportion of the coarser sizes of flakes, and is more brilliant in appearance than dry ground flake because of its crystalline faces and the more efficient removal of the fine dirt by the wet screening. Graphite produced by this system should prove to be the equal or the superior of any flake at present produced.

The process as outlined is simple and does not call for an elaborate flow sheet. Any seeming complication due to flotation by stages is more apparent than real, and would be more than offset by the added recovery of only a few pounds of the high grade flake from each ton of ore.

PERSONALS.

Mr. Geo. C. Mackenzie has resigned his position in the Mines Branch, Ottawa, and will be general manager of Electric Steel and Engineering Co., Welland. He took up his new duties on March 14th. Mr. Mackenzie did splendid work for the Mines Branch.

Mr. A. F. Coyne, president and managing director of Northern Production Co., Ltd., and Mr. G. L. Stebbing, are in Toronto on their way to England.

Mr. E. J. Carlyle, brother of W. A. Carlyle, is now with the British America Nickel Corporation. He is located at Murray Mine.

Dr. E. L. Bruce, of the staff of the Geological Survey, is giving a course of lectures at the University of Manitoba during the second term.

-:- A Trip to Newfoundland -:-

By J. C. GWILLIM.

Newfoundland is, to most of us, a little known Crown colony and island, for few visit the island although we travel great distances in our own Dominion. My own acquaintance of this island does not entitle me to write a book upon it, for a week's travel began and ended it; but that week was full of interest and impressions, and technical readers may sometimes tolerate a "journey of observation," as Mr. T. A. Rickard calls it.

During the war many more or less obscure minerals were being sought for by the Imperial and Canadian Munition Boards. Many were the patriots who bombarded them with disclosures of the occurence of needed ores. In one case, Lloyd George, then Minister of Munitions, was besought to open up a molybdenite deposit, which the correspondent, a station agent in British Columbia had heard was most promising, and knew no more about it. An insistent owner of antimony bearing lands in Newfoundland importuned the authorities to examine the ground and to settle the matter some one had to make the trip. Many costly trips of this sort are made at the behest of people with more authority than wisdom.

So it came to pass that I was on my way to Moreton Harbor, Notre Dame Bay, on the east coast of Newfoundland in May, 1916. The Canadian Department of Mines could provide one with no maps, reports or other information, for it was outside its territory. A few stories of hunting trips, and a recent write up in the Journal of Commerce with a map on a small scale were all I could get before leaving. Arrived at St. John, I betook myself to the museum and geological office, but found no one there except one lady, who gave me some bulletins concerning the mineral occurrences, as scanty as used to be the Annual Reports of the Minister of Mines for Quebec. Also, to my joy, a geological map of the country made by Dr. Howley. Dr. Howley himself, after fifty years of traversing this wilderness was now unable to come to his office, so I went to see him at his home.

Here I found him, at this time, more interested in the recent publication of his life work upon the Beothuks or Red men; aborigines of the island, a race which became extinct within his own experience. I bought the book and read it later, after I had seen something of the country. The narrative is, like its setting, one which conveys a feeling of the aboriginal and prehistoric, of a distinct race which, friendly at first to the coasting fishermen, withdrew to the interior and died out like some shy and untameable animal, forever driven from the coast by relentless cruelties.

Fortified with the geological map, some local advice, and a letter of introduction to a resident of Moreton Harbor I took the Reid-Newfoundland train for Lewisport, on Notre Dame Bay. One does not go far from the coast before entering primitive Newfoundland. It is a matter of wonder that a railway should be built through such unpromising natural resources—at this time a leafless land just free of the winter snow. Coming down the Lewisport junction line through such a landscape we chased a very thin horse which had survived the winter. He tried to beat the train into Lewisport; but at a low trestle got his legs embarrassed in its timbers. We got him out and left him, not much the worse for it, regarding us from the willow brush flat which adjoins the village of Lewisport.

From this place there was a boat service to Moreton Harbor, forty miles away on an island. Thence we went to Twillingate, the "Northern Capital." As we proceeded out into Notre Dame Bay, with its many islands the wind grew chilly and there was talk of drift ice coming in.. Two of the passengers who, at first, I took to be American evangelists, turned out to be photograph enlargers. They said business was good at fifteen dollars a photo in these secluded fishing villages around the coast. They were bound for Moreton Harbor. As evening approached we sighted a few lordly icebergs, and cut through a little drift ice. The captain said he might not be able to call in at the Harbor on his return, if the ice came in. He was due to return in two days, but his boat got fast near Twillingate and I never saw it again.

Moreton Harbor is, I suppose, one of dozens of little fishing village tucked in the bottom of a good sized cove, with rocks and wilderness as a backyard. The two apparent evangelists and myself excited a temporary interest as we landed at the wharf, but the inhabitants soon drifted off to their home fires and supper. We lugged our baggage up to a Mrs. Turner's house, where strangers were sometimes taken in; but Mrs. Turner could do nothing for us. So we sat on our provisions by the wayside and held a council. The evangelists would scour the village for beds, and I would present my introduction to a local storekeeper. The storekeeper had a good sized house; but madame was at her spring cleaning, and though I protested my readiness to sleep anywhere could not allow her household goods to be seen in disarray. Thence I was taken round the bay to an ancient mariners abode. He had no room. We drifted back to Mrs. Turner's and found that after all my persuasive friends had got a lodging there, and another one for me further round the harbor. Thither I went in the darkness and found the family not yet retired.

After toasting myself at a hot stove I was escorted to an upper bedroom as cold and cheerless as an Arctic case. The Newfoundlanders are a hardy people. They seemed to be quite warm in their house clothes, at any time, whereas I had on the usual attire plus a suit of pyjamas inside and a sweater and overcoat outside.

Next morning the harbor was filling with drift ice from the Labrador coast, driven in by a cruel northeast wind. The ancient mariner of the night before was my guide over the antimony property. It was a low upland covered with bog, rock and scrubby conifers. The hand of man had not yet despoiled this ground of much antimony ore, but a well defined and once worked vein on an adjoining claim would, if produced far enough, not miss the tract under examination—for it was extensive.

The ancient mariner took great interest in the ice pack coming in. He said that last year it did not go

out of the harbor until June 21st. It was now about May 20th, and I began to look for some other way back to the mainland, for a month in Moncton Harbor seemed excessive for the opportunities offered. There was a trail or road of several miles to a narrow strait, thence to the mainland and Lewisport. While I was contemplating this, I found a good road to a more sheltered harbor in the lee of the island. Here I asked a fisherman if he could go to Lewisport next day. He thought so, but it would cost me a lot. It would cost me five dollars. "I'll give you ten," I said with much relief.

Next morning we were off in a good sized gasoline fishing boat, such as is used in "The Labrador." We dodged ice cakes and seals and arrived at Lewisport before noon. This was not much of a place to stay, though cheap enough, and I went on a local train up to Grand Falls to await the express which passed next day for Port au Basque. The station at Grand Falls is a modest affair and a shack or two near-by was all I could see. So when a man came up to me on the blind side of the train and said: "Cab, sir?" I replied in astonishment, "Where is the town." "About two miles," he said.

Between the station and the town the aspect of the country changes. One descends a little towards the river through a sprightly growth of trees. There is soil, real red earth, and some small ploughed fields. A softer, more benign landscape than elsewhere, is due to a geological factor, for there is here a basin of red sandstone, which, breaking down has left a mantle of soil rich in iron. I viewed the falls, a pretty picture in the evening sunlight, with sea-gulls flitting over them, also the great pulp and paper mills of Lord Northcliffe and the orderly little town built on a raised flat, with promise of gardens later on.

Next day the Reid-Newfoundland express took us onwards and upwards through the small scrub, bog and rock to a barren desolation which looked like the roof of the world. A weird landscape of granite boulders, with here and there a mass of glaciated rock like some leviathan watching for sunrise. Here the reinder and paleolithic man might well feel at home, or the extinct Beethuk find a refuge. It is 1,200 feet above sea. We left this drear spot by a little coulee which soon became a ravine and a valley. Toward evening we sped downwards to an arm of the sea.

On the train were some companies of the voyage from Halifax to St. John, and the Premier of Newfoundland, now Lord Morris. We whiled away the evening listening to stories of the supernatural, of which he said he now had about a hundred dealing with the wild coast and its fishermen. It is to be expected that these lonely hamlets would harbor ghosts as long as any place on the earth. I trust his life will give him leisure to make a book of curious stories. We reached Port au Basque in early foggy morning and left the treeless shore of Newfoundland for North Sydney and the green hills of Nova Scotia.

Diamond Drilling Property at Boston Creek.

Diamond drilling apparatus is being set up on the Cullen-Renaud property in Boston Creek district preparatory to the exploration of the big vein at depth. The first hole will be driven at an angle which should cut the main vein at a depth of about 400-feet. The Cullen-Renaud is a portion of the holdings of the Allied Gold Mines, Limited.

Market Conditions

In the market for mineral raw materials, a general dullness continues. Many important producing districts in the United States have curtailed operations by as much as 50 per cent. The explanation of the situation is found in the fact that large stocks were accumulated before the signing of the armistice, and have not yet been absorbed. The consumers are largely keeping out of the market until it becomes apparent that some stable level of prices has been reached, and until the extent of the post-war demand becomes evident. This situation is further aggravated by the present shortage in ships and the resulting uncertainty as to when foreign imports may be resumed on a large scale.

After investigations by the U. S. Bureau of Mines the following information was recently given out:

Iron Outlook Promising.

The outlook, although the market is still dull, is promising; the demand for iron and steel should soon begin to be felt to supply the needs of construction neglected during the war. A good example of this condition is India. Before the war India was importing almost twice as much iron and steel products as at the close of the war, and the source of a large part of the supply shifted from England to the United States. India, therefore, is short in iron and steel supplies, as compared to the normal consumption, by several hundred thousand tons.

Some demands for iron and steel products come from China and also South America during February. The activity in China is of special interest as indicating development in that country.

The chief item of interest during February was the formation of the London Iron and Steel Exchange, which is an organization to promote the interests of the British iron and steel manufacturers and producers. It is apparently the outcome of the recommenations of the departmental committee appointed by the London Board of Trade, and will be similar to the organizations in Italy, Russia, and other countries.

Copper Prices Down Before Other Prices.

Business in major electrolytic copper markets for February is reported as ranging between 18½ cents at the beginning, and 16 cents towards the end of the month. Sales from minor interests have probably been somewhat under these figures. Figures for total sales are not available at this time, but it is apparent that sales have been made at the expense of prices.

From 1904 to 1913 the average price of copper was 15 cents. At no time since 1898 has the average annual price of the metal fallen below 12 cents.

Were the prices of food stuffs, necessities of life, steel products, manufactured articles, and other inflated commodities to approach as near normal as current quotations of copper, industrial activity and expansion would probably prevail. The establishment of a Government price-adjustment board is expected to accelerate the return of industry to a normal basis.

Lead is Cheap.

The domestic market for lead has been very dull during January and February. During the week of February 13 to 19, the St. Louis price varied from 4.60 to 4.75 cents per pound, as compared with an average price in 1918 of 7.222 cents, and in January, 1919, of 5.316 cents.

It is to be noted that following the abandonment of a fixed Government price for lead the London quotation rose from 29 pounds to 40 pounds as the average for December. During January there was a recession owing to accumulating stocks, and on February 19 the price was apparently stable at 25 pounds.

Galvanizers Still Using But Little Zinc.

The domestic market for zinc has been very dull during January and February. During the week of February 13 to 19 the St. Louis price varied from 6.20 to 6.35 cents, as compared with an average price of 7.890 cents in 1918 and 6.922 cents in January, 1919.

Small consumption by galvanizers has been a feature for more than two years, and accounts for the decreased domestic production of secondary spelter. Galvanizers are buying to some extent at low points in the market.

In London, the removal of the fixed government price was followed by a rise from £54 to £56.050. Notwithstanding increasing government stocks this price held during January, but had fallen by the 19th of February to £45.

Chromite.

Little interest is exhibited in either the production or purchase of chromite. Considerable speculation is indulged in regarding the ability of either American or Canadian purchasers to compete with such foreign fields as New Caledonia and Brazil. No market quotations on chrome ore nor ferrochrome are available.

While domestic production of chrome ore is practically at a standstill, and there is no market for the ores except for those shipping on old contracts, yet the imports are of fair size and are increasing.

Pyrite.

There was no marked activity in the pyrite and sulphur industries during February, owing primarily to some curtailment in acid manufacture, and to the slowing up of other industries utilizing these materials.

The termination of hostilities found the large consumers of pyrite and sulphur with considerable reserves of raw material and finished product on hand. Until these reserves are absorbed and markets and prices are adjusted to a peace-time basis, the demand for both pyrite and sulphur is likely to remain uncertain.

Some individuals in intimate touch with the industry think that sulphur will come into active competition with pyrite. Others, however, take the view that the sulphur producers will not cut the price of sulphur to any extent in order to compete with pyrite. They believe that the sulphur producers may compete to some extent in some of the more favored localities in the South, but will not bid for the business along the North Atlantic coast.

Advice from some of the larger consumers, such as the General Chemical Co., is to the effect that they are not at present in the market for either pyrite or sulphur owing to large stocks. One of the largest consumers of pyrite and sulphur operating its own mines has sufficient stocks on hand for a considerable period, at its midwestern works, and expects that its seaboard works can be supplied, as formerly, by Spanish ores.

The Canadian pyrite industry is not active. The present shipments into the United States are from the Eustis and Weedon mines in Quebec, and the General Chemical Company's mine at Sulphide, Ontario, at the rate of approximately 6,000 tons per month, or 75,000 tons per annum.

One of the General Chemical Company's mines in western Ontario, is not shipping, and is not likely to resume operations for at least a year.

Sulphuric Acid.

Information furnished by a representative of the Chemical Alliance indicates that there has been considerable curtailment of production since the first of the year, also some falling off in price. Acid of 66°B. is now being offered at about $20 per ton in the Eastern markets, and by-product acid, 50° B, from the zinc plants, is being offered as low as $10 per ton in the Chicago markets.

The acid manufacturers kept their plants running at nearly full capacity until the first of the year, in order to keep labor employed, although in the latter part of the year the demand for acid for war purposes had practically ceased. Thus the large reserve stocks already on hand were increased. Besides, at the termination of the war, there were in transit and in storage large stocks of acid at the various explosive works.

The outlook for a large demand for acid in the steel and oil industries is exceptionally good.

Magnesite.

The magnesite industry continues in much the same condition as in January and late in 1918. Some of the consuming companies are taking advantage of the quiet condition to make necessary repairs, or changes, at their plants.

One of the most important factors in the success of Austrian magnesite has been the careful standardization of the finished product, attained only by careful selection and preparation of the raw material, and skillful burning, whereby a product of uniform quality has been assured. Uniformity and close adherence to specifications undoubtedly have been important factors in the growth of both Austrian and Grecian business in the United States.

Gypsum.

Gypsum production is largely influenced by activity in the building industries. The large decline in use in 1918 was caused both by lack of demand on account of stagnation of building industries and by restriction of shipping due to high freight rates, scarcity of bottoms, and war regulations.

Increased activity in the gypsum industry for 1919 is presaged by the incorporation of several new mining companies, the building of new mills, and the reopening of old mines. The Gypsum Industries Association, of Chicago, Ill., has launched a campaign to popularize greater use of ground gypsum on the farm both as land plaster and as a deodorizer and a fixitive of ammonia in manure about stables.

Special Correspondence

NORTHERN ONTARIO.

Prospectors Review Licenses.

Renewal of mining licenses, which are the fundamental basis on which all mining claims are staked and held in the North Country, is in full swing. The time for renewal expires on or before April 1st. Officials at the various offices throughout the North state increased activity among the prospectors is apparent this year, presaging greater activity in the prospecting game during the coming spring and summer.

Sinking Central Shaft at Miller-Independence.

The enlargement of operations announced some weeks ago for the Miller-Independence Mines, Limited, of Boston Creek is now under way, and the central shaft has been commenced. This working is being prosecuted by the use of two plugger drills, and rapid headway is expected. The shaft will be sunk to a depth of 600-feet. It is expected the main vein of the property will cut across the working before this depth is reached. A station is to be cut at the 300-foot level and a crosscut driven to the vein at this point. No time will be lost, however, in sinking. Once the station has been made at the 300-foot level, extra machines will be put on for the purpose of crosscutting.

In the meantime drifting operations will be continued on the orebody in the 200-ft. incline shaft, where calaverite was first discovered on the Independence, and the importance of the rich orebody made known. The work now in progress in this portion of the mine will permit of blocking out a large tonnage of high grade ore for early treatment in the mill, and it is anticipated stoping operations will soon be under way. Thus, by the time the central shaft has reached the proposed depth of 600-feet the mine will be on a producing basis down to the 200-foot level.

The connecting of the subsequent levels of the mine will probably be accomplished by raising on the orebody from the 600-foot level, thus facilitating the work, and gaining time in the development of the property.

A second large vein discovered has a dip which should cause it to cut the new central shaft at a depth of about 280-feet. Very little surface work has been done on this vein, but it has been proven to contain gold tellurides. The development of this vein at the point where expected in the new shaft will give added interest to the progress of the work at the Miller-Independence. The management are making plans for the installation of electric power to replace the present steam plant, and this will facilitate the development of the mine to a very great degree.

Right of Way Mines.

The annual general meeting of the shareholders of the Right of Way Mines, Limited, of Cobalt, will be held at the head office, Ottawa, on March 24th, for the purpose of receiving the annual report for the past year, the election of officers for the ensuing year, and for the consideration and if deemed advisable, ratifying and confirming by-law No. 49, passed by the directors authorizing the sale of the company's unissued shares at a discount of 97 per cent. below par and for the transaction of such other business as may properly be brought before the meeting.

Nipissing Dividends.

The dividend of 5 per cent., declared by the Nipissing Mining company, payable April 21st, to shareholders of record March 31st, will call for a disbursement of $300,000. This will make a total of 15 per cent., or $900,000 already distributed this year. The total disbursements of the company since 1906 have now reached the huge figure of $18,840,000, while the total production of silver from the big mine is in the neighborhood of 52,000,000 ounces.

Kerr Lake.

During the month of February the Kerr Lake Mining company produced an average of approximately $3,400 every twenty-four hours. Therefore, although production shows a decline during the past few months, the mines' output is still maintained at upwards of a million ounces of silver annually. The production at this property at present is on a basis similar to that of the Coniagas and O'Brien properties. The financial position of the company is exceptionally strong.

Mining Corporation.

During the year 1918 the Mining Corporation of Canada shipped 1,994,061 ounces of silver. This significant fact is no doubt responsible for the latest dividend announced by the company being unaccompanied by the usual bonus, which had become almost as regular as the dividend disbursement itself. For the year 1917 the company was the heaviest silver producer in the Cobalt camp. During 1918, however, both the Nipissing and Kerr Lake production exceeded that of the Mining Corporation.

Operating the Old Foster Mine.

The continued operation of the old Foster property at Cobalt, under lease is said to be attended with very gratifying results, some very good ore is being bagged. A considerable tonnage of Cobalt ore is being mined from the second level. The water is being pumped from the lower workings of the mine preparatory to carrying on further exploration work, while a substantial tonnage of mill rock is being developed at the first level.

Ore Shipments.

Ore shipments over the T. & N. O. railway during the month of February amounted to 1,186.93 tons of silver ore from Cobalt and 88.50 tons of nickel ore from the Alexo Mines at Porquis Junction. Silver ore shipments from the respective mines were as follows:

Mine.	Tons.
Buffalo	220.00
Coniagas	218.52
Dominion Reduction	95.25
Hudson Bay	30.77
Kerr Lake	73.90
Larose	73.66
McKinley-Darragh	239.26
O'Brien	96.00
Penn-Canadian	52.20
Trethewey	40.55
South Lorrain:	
Pittsburg-Lorrain	46.82
Total	1,186.93

Murray-Mowgridge.

Satisfactory arrangements are said to have been completed for the financing of the Murray-Mowgridge property at Wolfe Lake, near Bourkes' Siding on the T. & N. O. Ry. Supplies are being taken in to the property and active operations are expected to be under way early in April. A small mining plant has been installed on the property and the vein on the surface has been stripped for a considerable distance, while the shaft has been sung to about one hundred feet with a small amount of lateral work accompanying. The results of the limited amount of work so far done on the property have been decidedly encouraging.

Matachewan Gold Mines.

Due to friction between the principals involved in the leading mining property of the Fort Matachewan Mining Field (the Matachewan Gold Mine) the district is losing the benefits which might be derived from the active exploration and development of the property. It was expected the winter roads would be used for the transportation of supplies to this property and that active operations would be resumed early this spring, but such has not been the case. While it is generally admitted that the district has a good deal of merit, the failure of the Fort Matachewan Gold Mines to proceed with development work naturally has a restraining influence on would-be purchasers of mining properties in the district. It is nevertheless the opinion of not a few mining men that Fort Matachewan will ultimately receive due attention with excellent possibilities of developing satisfactorily.

Adanac.

Continued favorable results are being met with in the development of the Adanac Mine at the 310-ft. level. Last week ore was broken into when a winze was started which was of exceedingly high grade, the vein having a width of from ten to twelve inches. Considerable high grade ore is being bagged and the outlook is very favorable.

Will Build Railway to Kirkland Lake.

The recent announcement that the Ontario Government will build a branch line of the T. & N. O. railway into Kirkland lake from Swastika, is one of the most important announcements ever made in connection with the development of the Kirkland Lake Gold area. The decision has been reached after careful investigation of the conditions existing at the various properties in the camp, and puts a stamp of approval on the merits of the camp and presages a great future for the district. The steady grow and development of this camp has gone on in spite of the rigors of war. The past two years has been marked by very rapid development of the camp from the initial stages to that of a thriving modern mining town. With the completion of the transmission line of the Northern Ontario Light and Power Company's line from Cobalt, bringing abundance of electrical energy for the operation of the many mining plants and lighting of the mines, the need for better transportation facilities led to the construction of a truck road from the railway to the camp, coupled with telephone connection with the outside world. All this time construction was proceeding on mining and milling plants, until to-day five mills have been completed and a sixth is under way. Now, it has been officially announced the camp is to have a railway. Much speculation is rife as to which route will be chosen for the railway. Some favor the route around the south end of the lake, thus passing in close proximity to the leading mines, while others are in favor of the railway crossing Kirkland Lake at the narrows to the north. It is officially stated the latter route has a lighter grade than the former. The cost of operation at the various mines should show a substantial reduction with the completion of the railway and the abolition of the present necessary expenses of hauling supplies.

Hunton-Kirkland.

Recent developments in the Hunton-Kirkland deal are understood to have been disappointing. Difficulties appear to have arisen which, while possibly not insurmountable, have altered the trend of the company's affairs and tend to surround the deal with much uncertainty.

Work Resumed at Minaker-Kirkland.

Work has been resumed at the Minaker-Kirkland property at Kirkland Lake. The Minaker lies adjacent to the Lake Shore Mines on the south. A number of well mineralized veins have been opened up on the surface of the property and a shaft has been started on the most promising of these veins, where it passes onto the Minaker from the Lake Shore. The necessary mining equipment for the preliminary development of the property has already been installed, and thus another active operation is added to the long list of Kirkland Lake Mines. Mr. John W. Morrison, formerly manager of the Lake Shore Mines is in charge of operations at the Minaker.

Tough-Oakes Resumes.

The Tough-Oakes Gold Mines at Kirkland Lake this week resumed operations. This pioneer gold mine of the Kirkland Lake camp is now apparently free from the retarding influence of serious litigation, and appears destined to soon resume its place among the leading gold producing mines of the Dominion. Although mining operations were resumed this week, it is not expected the mill will be placed in operations for some time yet, possibly not until early in June. During the most prosperous period of its career the Tough-Oakes mine produced gold at the rate of about $60,000 per month, and ranked among the first five gold mines of the Dominion. Its operation is now under control of the new interests with Harry Oakes as President and C. A. Richardson manager. Col. H. H. Johnson, representing the Kirkland Lake Proprietary is here from England, and while official announcement is lacking it is learned that plans are going ahead aiming at the connecting of the underground workings of the Burnside with the Tough-Oakes. This fact appears to indicate the probably successful culmination of the rumored consolidation of the Tough-Oakes, Burnside and Sylvanite properties. Such an amalgamation would provide a large acreage of highly mineralized territory and should mean that the 140-ton mill should be in operation at full capacity by the middle of the coming summer.

The Flin-Flon Property, Manitoba.

The great sulphide ore deposit at Flin-Flon, around which there is considerable interest at this time, was located and staked in August, 1915. It was found by Tom Creighton and Jack Mosher, who had as associates Isadore and Leon Dion, Dan Milligan and Dan Mosher. These men were sent out to prospect by Messrs. Alec Fasken, John Hammell and Frank Curry, of Toronto.

Mr. Hammell interested American capital, and, through Messrs. Hayden & Stone (acting for the Tennessee Company and others), the property was optioned at $4,000,000. Two diamond drills were operated in 1916, for a period of four months, when Messrs. Hayden & Stone withdrew. Mr. Alec Fasken, acting for others, took over the work and continued the drilling. Some forty holes were put down, at an average of 1,600 feet. The orebody averages 125 feet in width on the surface, and 2,500 feet in length. It is carefully estimated to contain 25,000,000 tons of ore, at a value of $10 a ton. Outside of drilling surface stripping has been done, and some twenty camp buildings erected. It is estimated that $300,000 has been already spent upon development work.

The owners of the porperty are Messrs. Hammell, Fasken and Currie, who control three-quarter interest, and Messrs. Creighton, Jack Mosher, Leon Dion and Dan Mosher, who control the balance. Messrs. Isadore Dion and Dan Milligan, of the original owners, sold out to Mr. David Fasken for $25,000 apiece. Messrs. Creighton, Jack Mosher, Leon Dion and Dan Mosher received a first payment of $5,000 cash from Mr. Fasken.—The Pas Herald.

THE WESTERN COMMERCIAL COAL CO.

Recent years have seen a wonderful development in the coal industry in the province of Alberta, especially in the Drumheller district, which has become famous throughout Western Canada, and is destined to be a large factor in the coal supply of the West. The Western Commercial Co., Ltd., mine operators, among the latest, have shown considerable activity in their mine situated at Wayne, nine miles east of Drumheller, and on the Goose Lake Branch of the Canadian Northern, where extensive deposits of subbituminous coal has been located in the valley of the Rosebud for a distance of 400 feet in depth. The seam has been traced to the crest of the valley. Development work was started in June, 1916. The following year 80,000 tons was mined, and in 1918 100,000 tons was produced. The output for 1919 is expected to reach 150,000 tons. Saskatchewan has absorbed the largest portion of this, with Alberta and Manitoba next in order.

Several thousand dollars were expended in equipping with mining machinery, so that every facility is on hand for the rapid working of the mine. Being alongside of the railway quick shipment can be made to all points. The head office of the company is situated at Calgary, with branches at Moose Jaw and Saskatoon.

The Canadian Northern Railway, since it came under the control of the Government, has just completed the double track of the road from Drumheller to Saskatoon, which will facilitate the rapid movement of both coal and grain, so that it is expected henceforth no delay will be encountered in supplying Saskatchewan and Manitoba, such as occurred a yaer ago. R. Wheeler.

The Mandy Mine, Manitoba.

The lens of high-grade copper ore at the Mandy has been excavated to the 200 ft. level, thus clearing out all the lens so far as explored. It was worked from the surface from open cut methods for 60 ft. A shaft was then sunk to the 100 ft. level, near the south end of the lens, and the lens stoped from that level.

From the indications from the 100 ft. level it appears that the lens would finger out towards the south-east about 30 feet below that level. On sinking to the 200 ft. level, however, the northern boundary of the lens, which, at the 100 ft. level, was dipping towards the south, was found to go down vertically, and a much larger body of ore than had been expected was stoped from the 200 ft. level. The percentage of copper was also higher at this depth, and continued higher to the bottom of the lens which was found by under stoping at about 25 feet below the 200 ft. level. Below this the ore passes into the zinc-copper mixture, too low grade for present transportation methods.

There is probably 1,000 tons of high grade ore still available in the stopes and 1,000 tons still left in the dump at the shaft. There are 7,000 tons at the foot of Schist lake, and the camp has been moved from the mine to the new camps at Schist creek, near their dump. This ore will be transferred by wagon to Sturgeon Landing, where there is already 7,800 tons on the dump. The teams will swing from Schist creek straight to Camp 2 on Athapapuskow lake. Other teams swing from Camp 2 to the half-way on the Goose Creek. returning at night to Camp 2. Still other teams swinging from camp at Sturgeon Landing to half-way on Goose creek, return at night with the ore. Each team now carries approximately 6½ tons, and there is being delivered at Sturgeon Landing, on an average, 220 tons per day.

At this rate all the ore (15,000 tons) will be delivered at Sturgeon Landing by March 21st, almost a week before the average date of break-up of the roads. At the same time, 3,000 tons will be delivered to the big bend on the Saskatchewan river, double teams swinging from Sturgeon Landing to the half-way just north of Rocky lake, and other double teams from the camp at the big bend to the half-way and back with the ore; 200 tons have already been delivered at the big bend. The total distance of haulage from the mine to Sturgeon Landing is about 40 miles, and to the big bend from the mine about 65 miles.

Having taken out all the high grade copper ore in sight, the Mandy Mine is closing down further active mining. There remains considerable tonnage of low grade ore, but present conditions will not warrant work upon it. The diamond drills will continue exploration from the 200-ft. level.—The Pas Herald.

GREAT INTEREST IS BEING SHOWN IN NORTHERN B. C., AND THE YUKON DISTRICTS.

Many inquiries are coming in from old time prospectors regarding the condition of the ice on the Yukon and the break up of the Yukon River is eagerly looked for. There is talk of great mine development in the North this coming year, and mben who have known that country for many years prophesy great prosperity in the old stamping grounds of the prospector and this is borne out by the inquiries that are being made at the present time.

Kirkland-Porphyry.

The litigation between the minority interests of the Orr Gold Mines represented by David Elliott, of Haileybury, and the Kirkland-Porphyry Gold Mines is still unsettled, the case having been heard this week in Toronto, the decision having been reserved.

A Copper Discovery in Manitoba.

According to "The Pas Herald," one of the most important discoveries of ore is said to have been made within a half mile of the Hudson Bay Railway, at Mile 191. Samples of the ore were shown to Commissioner Wallace, and some sent to Paris. It is a copper sulphide ore, with nickle, gold, silver and galena.

John Forbes is the finder, and he staked 104 claims in all. He got these claims in the late summer, and worked quietly away sinking a shaft to 75 feet. He says the mineral body is 7,000 feet long and 72 feet wide, extending over nine claims. He says there is 40 feet of iron capping before reaching the sulphide ore.

Mr. Forbes located the ore four years ago, but was unable to stake because of the regulations reserving all land within a half-mile on both sides of the railway. This regulation was withdrawn in 1918. He remained near the ore discovery for four years, hugging his secret for the time when the restrictions upon staking would be removed. The report of his discovery has caused quite a flutter among prospectors, and considerable staking is being done between Miles 191 and 195.

Mr. Forbes optimistically says that this ore body is larger than Flin-Flon, and the ore is much richer in copper. He thinks the tonnage is greater in volume and can be handled more economically. A sample assay from the four corners and middle of the shaft, at 60 feet, gave $170 in copper.

Professor Wallace states that the nickle showings were the best he has seen. He thought, in view of the fact that the surface showed weathered iron only, there must be good possibilities underneath, since high grade copper was encountered so heavily at 60 feet.

Mr. Forbes is backed by T. R. Edwards and Ward Hollands, of Winnipeg, who have prepared a program of exploration from Mile 86 to Mile 211, to cost $50,000.

WANTED.

WANTED—Ball Mill. Capacity about 50 tons per 24 hours. Preference given to Marcy Mill. Monarch Metal Company, Limited, Main St. W., Hamilton, Ont.

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Hadfields Ltd.
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Sullivan Machinery Co.
Canadian Rock Drill Co.

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Fuse:
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Northern Canada Supply Co.

Gears, Machine Cut:
The Hamilton Gear & Machine Co.
Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

Canadian Miners' Buying Directory.—(Continued from page 27.)

Gears:
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Northern Canada Supply Co.
The Hamilton Gear & Machine Co.
Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

Hammer Rock Drills:
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Mine and Smelter Supply Co.
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Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

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MacGovern & Co., Inc.
Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

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Canada Metal Co.
C. L. Constant Co.
Everitt & Co.

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Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

Monel Metal:
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Motors:
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Nickel:
International Nickel Co.

Ore Sacks:
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Ore Testing Works:
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Milton Hersey Co., Ltd.
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Hoyt Metal Co.

Ores and Metals—Buyers and Sellers of:
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Hoyt Metal Co.

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Consolidated M. & S. Co.
Northern Canada Supply Co.
Smart-Turner Machine Co.

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Piston Rock Drills:
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Plate Work:
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Jones & Glassco.

Prospecting Mills and Machinery:
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Mine & Smelter Supply Co.
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Pulverizers—Laboratory:
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Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

Pumps—Centrifugal:
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Mine & Smelter Supply Co.
Fraser & Chalmers Engineering Works.
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Pumps—Electric:

Pumps—Sand and Slime:
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Pumps—Pneumatic:
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Sullivan Machinery Co.

Pumps—Steam:
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Mussens, Limited.
Northern Canada Supply Co.
Smart-Turner Machine Co.
R. T. Gilman & Co.
Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

Pumps—Turbine:
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Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers Engineering Works.
Fraser & Chalmers of Canada, Ltd.

Pumps—Vacuum:
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Quarrying Machinery:
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Rails:
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Sheet Lead:
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Steel Drums:
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MacKinnon Steel Co.
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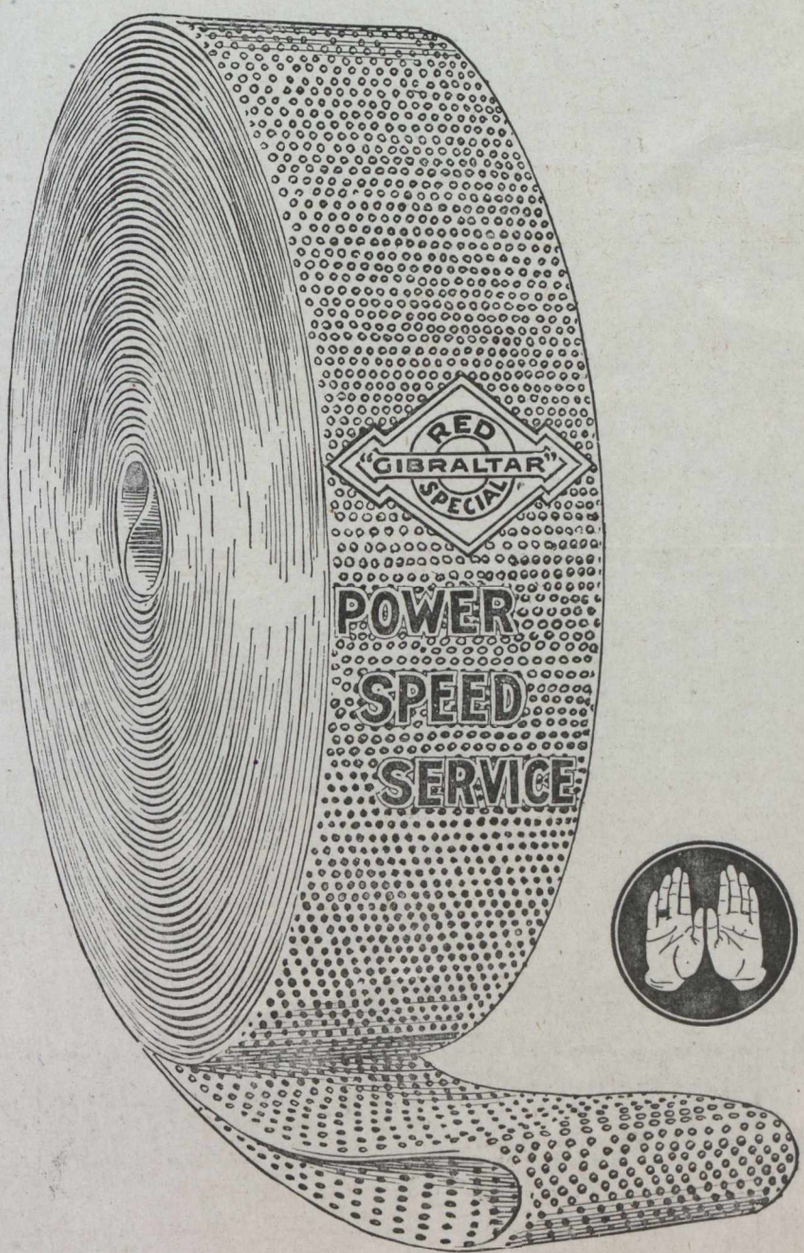

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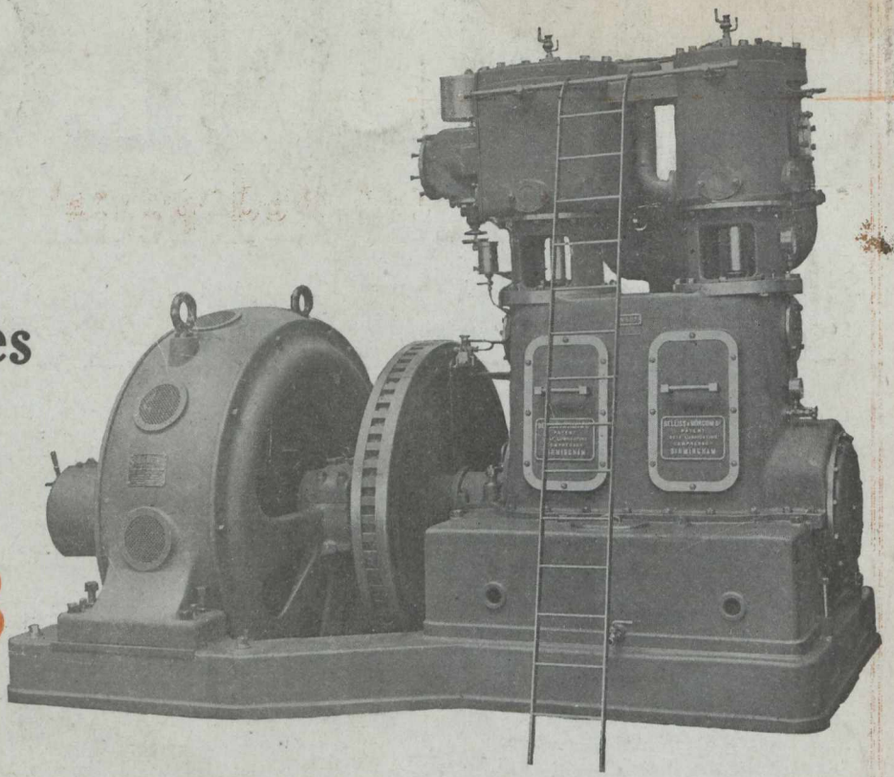

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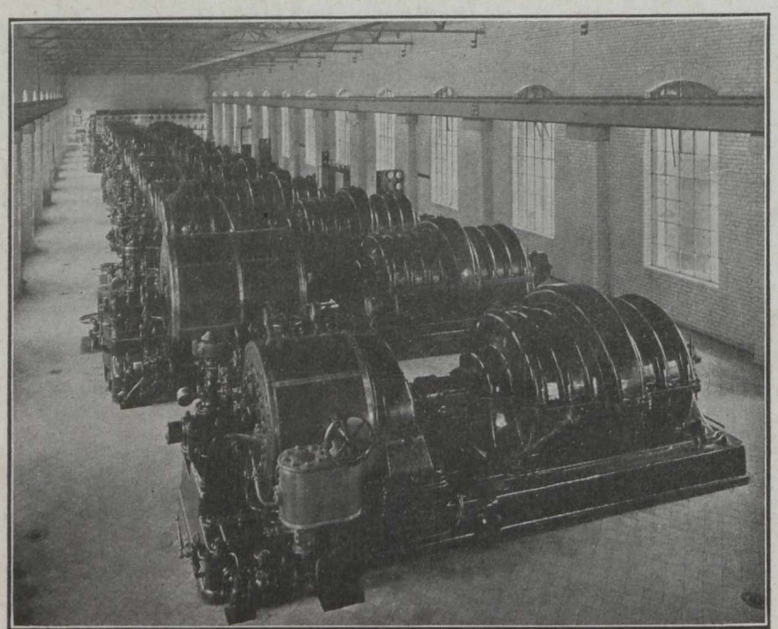

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