Ottawa, Ont.
April 5, 1923

REPORT
of the
ORE DRESSING AND METALLURGICAL LABORATORIES.

Test No.165

The wet separation of Asbestos from its gangue.

In 1921 the Division of Ore Dressing and Metallurgy conducted dry milling tests on shipments of asbestos rock from two mines in the Quebec asbestos field. On the completion of these tests it was decided to investigate the wet milling of asbestos. This investigation was carried out as far as the means at the disposal of the Division would allow. The asbestos rock with which the tests were made was the unused portion of a shipment received for dry milling from the Black Lake Asbestos & Chrome Company.

In all thirteen tests were made on this shipment, three large and one small scale dry milling tests, and nine small scale wet milling tests. To give an idea of the results obtained by wet milling, the last test will be given in detail.

Test No. 13

Run No. 1 (1st. wet ball milling) This test was made on 25 pounds of a head sample taken from the five tons of asbestos rock which was used in the first large scale dry milling test. The 25 pounds were crushed to pass $\frac{3}{4}$" and fed to a small wet ball mill, the mill discharge was screened on $\frac{1}{2}$", and the $-\frac{1}{2}$" went to a small Richards pulsating jig. The jig separated the fibre from the rock. The fibre from the jig was run to a 4 mesh screen and the -4 mesh fell onto a 20 mesh screen. This gave a +4

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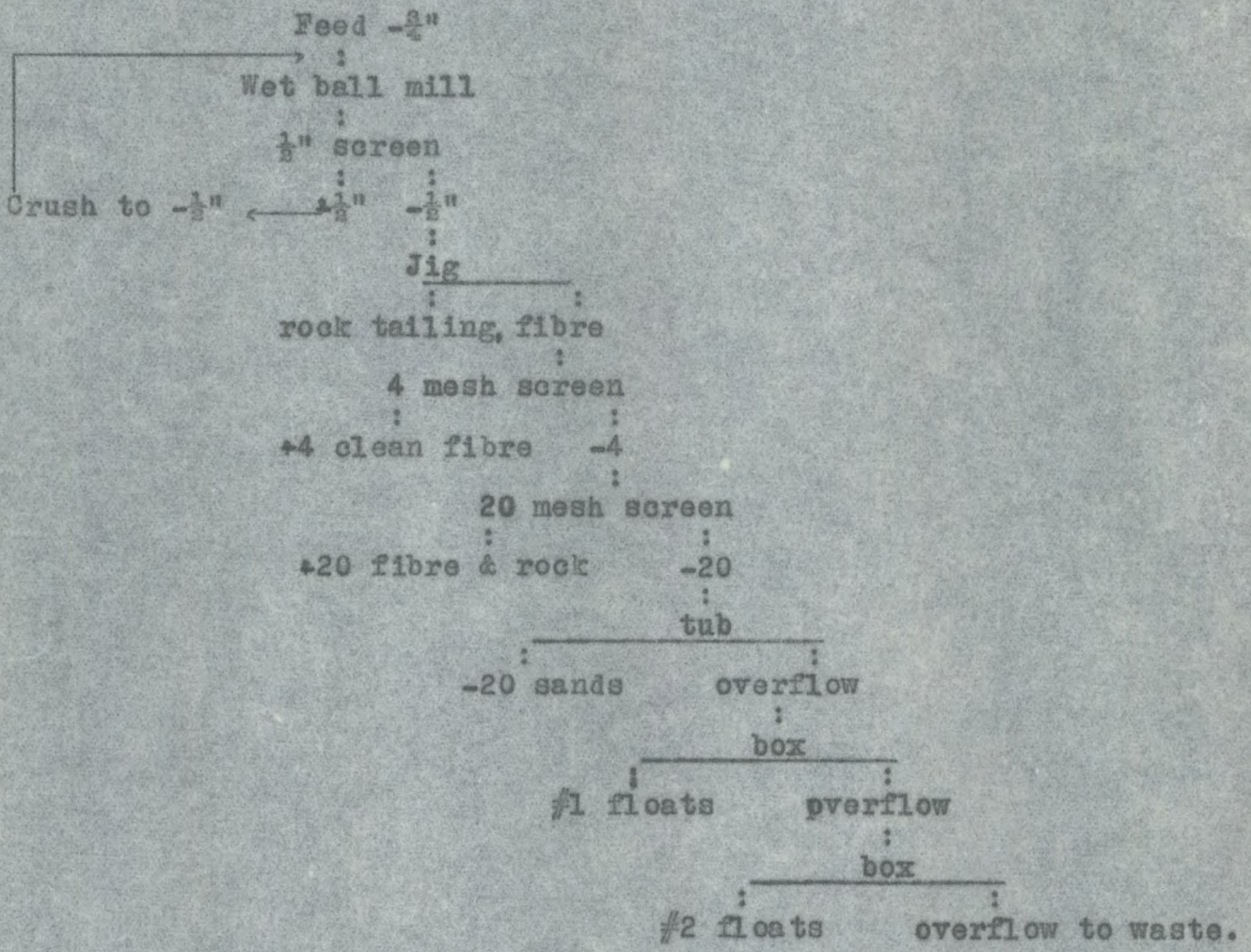
mesh clean fibre and a +20 mesh fibre which contained some rock. The -20 fell into a tub, the overflow from the tub running to a series of two settling boxes. This gave a -20 sand product which contained some fibre and two float products from the settling boxes which are composed of very fine fibre. After the 25 pounds had been fed the +½" was dried and crushed to -½" and fed back to the mill.

Flow sheet for run #1 :-

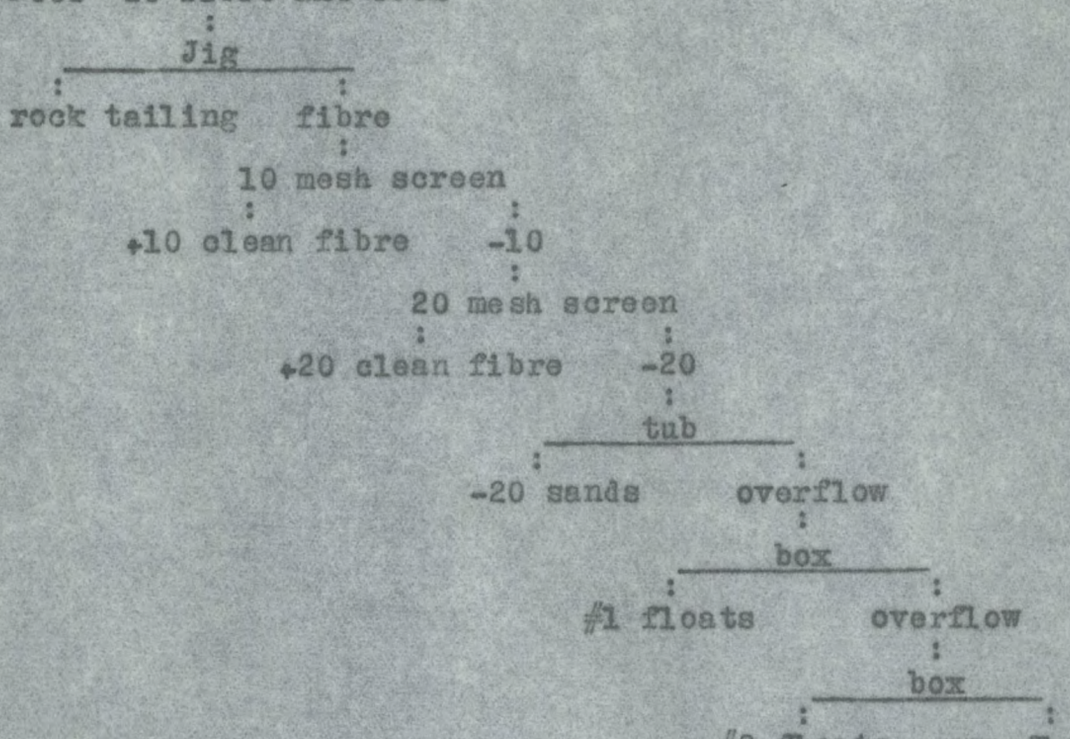


Run No. 2 (cleaning up +20 fibre and rock from run #1)

The +20 fibre and rock from run no. 1 was fed to the jig making a rock tailing and a fibre product. The fibre was run to 10 and 20 mesh screens, giving a +10 clean fibre and a +20 clean fibre. The -20 was treated in the same way as the -20 of run no. 1.

Flow sheet of run #2:

Flow sheet of run no. 2 :-



Run no. 3 (2nd. wet ball mill run) The rock tailings from runs 1 and 2 were dried and crushed to pass 4 mesh and fed to the mill. The flow sheet for this run is the same as for run #1, except that no ½" screen was used, the mill discharge passing directly to the jig. Very little +4 mesh fibre was obtained in this run.

Run no. 4 (cleaning up +20 fibre and rock from run no. 3) The +20 fibre and rock from run no. 3 was fed to the jig. The flow sheet for this run is the same as that of run no. 2. The +10 fibre obtained in this run was equal to about ¼ of the +10 fibre obtained in run no. 2, and the +20 fibre was equal to about 2/3 of the +20 of run no. 2

Run no. 5 (3rd. wet ball mill run) The rock tailing from runs 3 and 4 were dried and crushed to pass 8 mesh and fed to the ball mill. The flow sheet for this run is the same as that for run #1, except that no ½" screen was used, the mill discharge passing directly to the jig. No +4 fibre was obtained from this run.

Run no. 6 (cleaning up +20 fibre and rock from run #5) The +20 fibre and rock from run 5 was fed to the jig. The flow sheet for this run is the same as that of run 2. Very little fibre was obtained from this run.

Run no. 7 (tabling -20 sands) The -20 sands from runs 1 to 6 inclusive were tabled on a small Wilfley table making a sand product, a middling, and a fibre product. The middling was re-run twice, and in the second re-run only two products were made. The overflow from the boxes used to collect the table products was led to the tub and two settling boxes that were used in the other runs.

Products obtained, runs 1 to 7 All the products were dried and weighed. The table fibre and #1 and #2 floats were screened on 65 mesh to remove sand. The following is a summary of all the products:

Product	Weight grams
Rock tailing run 5	5221
Tailing run 6, rock and fibre	113
+4 and +10 fibre	55
+20 fibre	17
Table fibre +65	116
Sand from table fibre -65	165
Table sands	4086
#1 floats, fibre +65	15
#1 floats, sand -65	366
#2 floats, fibre +65	85
#2 floats, sand -65	142
Loss	969
Feed	11350

Fibre obtained from runs 1 to 7: All the fibre obtained was rubbed between the hands to loosen it up as in drying it sticks together. Each lot of fibre was then tested on a standard testing machine with the following results :-

+4 and +10 fibre	+2	3	grams
	+4	27	"
	+10	14	"
	+10	10	"
+20 fibre	+2	0	"
	+4	2	"
	+10	5	"
	-10	10	"

Table fibre	+2	0 grams		
	+4	0 grams		
	+10	22 grams		
	-10	95 "		
#1 float fibre	+2	0 grams		
	+4	0 grams		
	+10	4 "		
	-10	11 "		
#2 float fibre	+2	0 "		
	+4	5 "		
	+10	33 "		
	-10	46 "		
Total fibre	+2	3 "	.026%	of heads
	+4	34 "	.300	"
	+10	78 "	.687	"
	-10	172 "	1.515	"
		287	2.528	"

CONCLUSIONS

1. As the test was on a small scale the results will only roughly approximate those that would be obtained in large scale work. In a large ball mill the fibre would be cut up more before being discharged and hence less coarse fibre would be obtained. In testing the fibre in the standard testing machine a pound of fibre should have been used, but as none of the fibre products weighed a pound, the tests had to be made on a much smaller amount. The result of this would be that the coarse fibre would have a better opportunity to work through the screens and the tests would indicate a lower grade of fibre than that really obtained. In the work on dry milling of asbestos rock it was found that large and small scale tests on similar feeds did not check. This is due to the great difficulty of getting a small representative sample.

2. The following table shows the total fibre obtained in test no. 13 compared with that obtained in the first large dry milling test. Both these tests were on similar rock, the feed to test no. 13 being part of a head sample cut out of the feed of the large dry milling test.

	Total fibre Test 13	% of heads Dry milling Test
+2	.026	.048
+4	.300	.265
+10	.687	.346
-10	1.515	.430
Total	2.528	1.089

The results of the wet milling test compare favourably with those of the dry milling test. As to which is the best milling method, it would be difficult to say with the preset data. This question could only be decided by comparative large scale tests which it is hoped the Division of Ore Dressing and Metallurgy will be able to carry out in the near future.