CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

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INVESTIGATION OF COMMINUTION OF BURNED LIME

SUBMITTED BY

THE ALUMINIUM COMPANY OF CANADA

by

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The sample received consisted of several hundred pounds of coarse burned limestone, 4"-8" pieces, packed in air-tight containers. Information desired was the best method of producing a -65+325 mesh product by crushing and screening. This product is to be used for the precoating of filter-cloth. An important factor in the selection of equipment will depend upon whether or not use can be made of the -325 mesh material.

Test Work

Trials were conducted using Victoria, Hammer and Impactor type mills. Screens used were the Rotex and Tyler-Hummer.

Victoria Mill

For the Victoria mill, a 25 lb sample was reduced to about 4 mesh in a jaw crusher and then run through. A screen analysis was made on a representative portion of the product.

Size	% Distribution
+ 4	2.2
- 4 + 14	25.5
- 14 + 35	22.5
- 35 + 65	11.6
- 65 +100	4.5
-100 +200	6.4
-200 +325	7.0
-325	20.3

20.3% of -325 mesh fraction actually represents 53.1% of the -65 mesh fraction.

Hammer Mill

The Hammer mill can take much coarser feed than the Victoria, saving on preliminary crushing. The 25 lb sample for the Hammer mill was reduced by hand to 2-4" pieces.

Speed of mill = 2800 R.P.M.

Gratings - None

The product was screened on the Rotex giving 87% of +60 mesh and 13% of -60 mesh material.

There was 87% oversize in the product which would give a very high circulating load. This oversize would be reduced by the use of gratings in the mill. Gratings of 3/8" spacings between the bars were installed and another 25 lb sample, of 2-4" pieces, run through.

Screen Analysis of Product

Size	% Distribution
+ 4	9.3
- 4+ 14	37.1
- 14+ 35	19.8
- 35+ 65	8.8
- 65+100	3.5
-100+200	6.0
-200	15.5

The product was then screened on the Hummer, giving 79.7% of +60 mesh and 20.3% of -60 mesh.

Screen Analysis of -60 mesh

Size	% Distribution
-60+325	54.6
-325	45.4

The above figures show that 20.3% of the product was -60 mesh of which 45.4% was -325. In actual operation the +65 mesh material would be re-circulated. To obtain such conditions with this batch process, the following procedure was adopted:

A 25 lb sample was prepared as before, run through and screened over the Rotex, giving 75% of +60 mesh and 25% of -60 mesh. More feed was added to the +60 mesh fraction to make up the weight to 25 lb passed through the Hammer mill and screened on the Rotex, which gave 80% of +60 mesh and 20% of -60 mesh.

Screen Analysis of -60 mesh fraction

Size	% Distribution
-60+325	66.3
-325	33.8

In this test there is a marked reduction in quantity of -325 mesh material produced.

In an attempt to produce more -60 mesh material under re-circulating conditions in the Hammer mill, the gratings of 3/8" spaces were replaced by a set of 3/16".

A 25 lb sample gave 61.2% of +60 mesh and 38.8% of -60 mesh on the Hummer screen. The +60 mesh fraction was made up to 25 lb and retreated, producing 68% of +60 mesh and 32% of -60 mesh. Again the +60 mesh was made up to 25 lb and retreated, giving 73.2% of +60 mesh and 26.8% of -60 mesh.

A screen analysis on the -60 mesh gave:-

Size	% Distribution
- 60+100	7.0
-100+200	15.7
-200+325	19.9
-325	57.4

These figures show that there is only a 42.6% recovery of the -60 mesh material.

Impactor Mill

In this test a 100 lb sample was used, product being screened on the Hummer screen. This gave 86.5% of +60 mesh and 13.6% of -60 mesh material. The +60 mesh fraction was made up to 100 lb and passed through again. This gave 83.5% of +60 mesh and 16.4% of -60 mesh. Again the +60 mesh was made up to 100 lb and retreated, resulting in 83.5% of +60 mesh and 16.5% of -60 mesh. Screening time for the material was 8½ minutes on the Hummer.

The +60 mesh was again made up to 100 lb giving a final product of 86.1% +60 mesh and 13.9% -60 mesh. On this fourth pass, a loss of material in the circuit

indicates that the -60 mesh should be about 16% as in the second and third passes.

Screen analysis of -60 mesh material

Size	% Distribution
- 60+100	10.1
-100+200	19.9
-200+325	26.2
-325	43.8

COMMENTS

The results of the various tests are tabulated so that a comparison can be easily made

Test No.	Type of Mill	Product (-65+325)	Fines (-325)	Circulating Load
1	Victoria	18.0	20.2	61.8
2	Hammer No grates 2800 RPM	13.0(-65)		87.0
3	Hammer 3/8" grates 1 pass	11.1	9.2	80.0
4	Hammer 3/8" grates 2 passes	13.2	6.8	80.0
5	Hammer 3/16 grates 3 passes	11.4	15.4	73.2
6	Impactor 4 passes	9.0	7.0	84

1. The highest percentage of product was given by the Victoria mill, which also had the lowest circulating load, but the highest percentage of fines, 20.2%. If these fines can be tolerated then this test gave the best results. In addition to the large quantity of fines produced, other disadvantages for using this mill are -

   (a) It is manufactured in Switzerland.

   (b) It is designed for use on material such as asbestos and very heavy wear is anticipated if used on this limestone.

2. The Impactor mill gave a high circulating load, a high proportion of fines and a low product.

3. The Hammer mill with 3/16" grates gave a low circulating load but a high production of fines and only 11.4% product.

4. The Hammer mill with 3/8" grates and two passes gives the highest product with the smallest amount of fines (excepting the Victoria mill) with 80% circulating load. This is definitely the best set of results for these trials. During this test steady conditions may not have been achieved and more passes should have been made. This may, or may not improve results.

5. No trouble was experienced in screening down to 60 mesh. Good results were indicated by the Tyler Hummer screen. Separation of -325 mesh material can be done either by screening or cyclone.

6. It was thought that if hydration took place it would present a screening problem. To investigate this possibility the product of Test 1 was placed in a steam chest for 1½ hours. On removal this was immediately screened on the Hummer and no blinding of the screen encountered.

7. An attempt was made to reserve the power supplied to the Impactor while on load, but due to erratic feeding of large lumps etc., it was not possible to produce steady running conditions.

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