Mines Branch Technical Bulletin TB 36

ILLUSTRATIVE APPLICATIONS OF THE JONES WET MAGNETIC MINERAL SEPARATOR

by

R. A. Wyman, *
W. J. D. Stone** and F. H Hartman***

SYNOPSIS

This bulletin reports the first substantial body of test work performed with the Jones Wet Magnetic Mineral Separator, a new device capable of isolating weakly, as well as strongly, magnetic minerals in the particle size range of -20 mesh to a few microns.

The 173 tests included were performed on 83 samples representing 34 different materials. Two photographs and 154 tables are included.

With some mineral combinations sharp separations were demonstrated, with others the separation was not complete, and with still others it was poor. The demand for test work with the equipment during the period covered was so great that individual problems could not be completely worked out. The tests reported should, therefore, be considered as illustrative of the problems to which the Jones separator may be applied, rather than as conclusive.

*Head, Industrial Minerals Milling Section, **former Scientific Officer, and ***Scientific Officer, Mineral Processing Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

Direction des mines

Bulletin technique TB 36

EXEMPLES D'APPLICATIONS DU SEPARATEUR MAGNETIQUE DE MINERAUX JONES, PAR VOIE HUMIDE

par

R.A. Wyman*
W.J.D. Stone** et F.H. Hartman***

RÉSUMÉ

Le présent bulletin passe en revue le premier groupe important de travaux expérimentaux exécutés à l'aide du séparateur magnétique Jones de minéraux par voie humide, nouvel appareil capable d'isoler aussi bien les minéraux faiblement que les minéraux fortement magnétiques une fois réduits en particules qui traversent le tamis de 20 mailles jusqu'à quelques microns.

Les 173 essais exécutés l'ont été à partir de 83 échantillons qui représentaient 34 matériaux différents. Le bulletin contient deux photographies et 154 tableaux.

Pour certaines combinaisons minérales, on a obtenu des séparations intégrales, dans certains autres cas, la séparation n'était pas complète, tandis que dans d'autres cas encore la séparation était médiocre. La demande de travaux expérimentaux à l'aide de l'appareil durant la période à l'étude était si forte que les problèmes particuliers n'ont pu être résolus parfaitement. En conséquence, les essais mentionnés ne devraient pas être comptés comme concluants, mais il faut plutôt y voir des exemples des problèmes à la solution desquels le séparateur Jones pourrait servir.

*Chef, Section du broyage des minéraux industriels, **ci-devant chargé de recherches et ***chargé de recherches, Division du traitement des minéraux, Direction des mines, ministère des Mines et des Relevés techniques, Ottawa, Canada.

CONTENTS

CONTENTS (Cont'd)

Note: There are 154 tables interspersed in the "Record of Tests" portion of the report.

INTRODUCTION

Magnetic separation has played an important role in mineral dressing for many years. Until recently, however, equipment has not been available which would perform effective separations on material from about 100 mesh down to a few microns, particularly weakly magnetic material.

In the spring of 1959 the Mines Branch purchased a Jones Wet Magnetic Mineral Separator -- at that time the only machine of its kind in existence. It differs considerably from other magnetic equipment and is particularly designed to process weakly magnetic materials of fine size. In addition, minerals of comparatively high magnetic susceptibility, such as garnet, can be easily recovered and small amounts of magnetite removed. Magnetite, or metallic iron, cannot be readily cleared from the plates unless these materials are fed slowly and the plates are scoured with water at 40 to 50 psi.

A demand for test work on the Jones separator quickly developed, and it became necessary to limit the number of tests on each sample. Because of such factors as the several operating variables pertaining to the equipment, and the particle size at which minerals in a sample are liberated, one or two tests can usually provide only an indication of what might be accomplished. The results of the tests recorded herein cannot, therefore, be considered as conclusive. For the majority of tests, an analysis was provided by the submitter.

It is believed that a new dimension has been added to mineral dressing with the Jones equipment, and that the results of exploratory testing carried out at the Mines Branch should be available to the general public. With the exception of 11 tests for which no analyses or other criteria are available, all trials performed between April 1959, when the equipment was put into operation, and March 1961, when other machines became available in Ottawa, have been included in this Bulletin, regardless of the success achieved. The equipment has also been used successfully to magnetize ferrite blocks.

DESCRIPTION OF EQUIPMENT

A diagrammatic view of the working parts is shown in Figure 1, and a photograph of the machine in Figure 2.

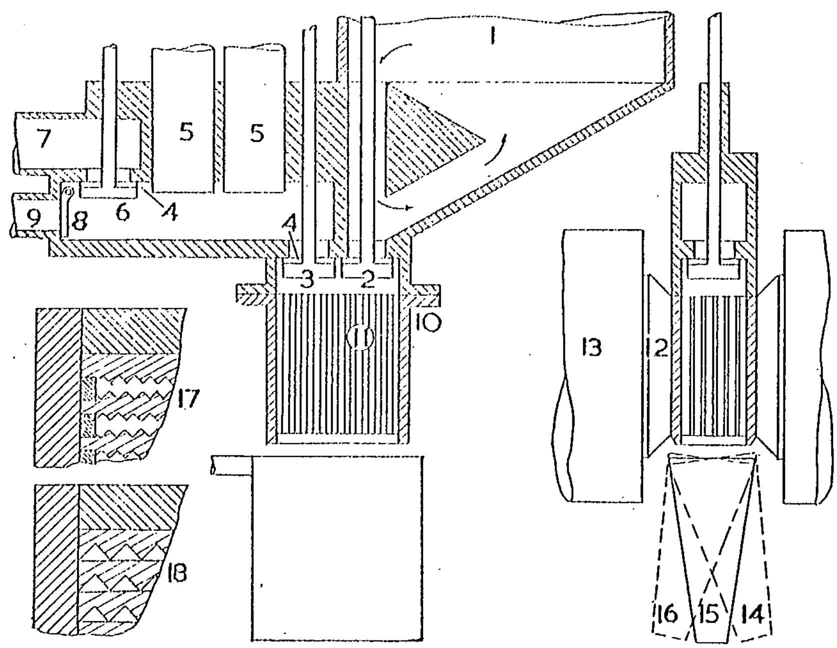

Fig 1. Arrangement of Separator*

As indicated in Figure 1, a high-intensity magnetic field is applied by the magnet (13) through the poles (12) to the plates (11) in the plate box (10). The plates are grooved (17 and 18) so that the magnetic forces are at their maximum along the peaks of the grooves. The action of the machine is cyclic, although some 16 cycles per minute make it, in effect, a continuously-operating device. Feed is kept in constant motion in the feed hopper (1) by a stirrer to ensure that equal amounts are removed at each opening of the feed valve (2) and that feed does not settle on this valve when the latter is closed.

---

*Fig 1 and Fig 2 are from "Wet Magnetic Separator For Feebly Magnetic Minerals", by G.H. Jones and W.J.D. Stone. International Mineral Processing Congress, London, England, April 6-9, 1960. Preprint No. 34.

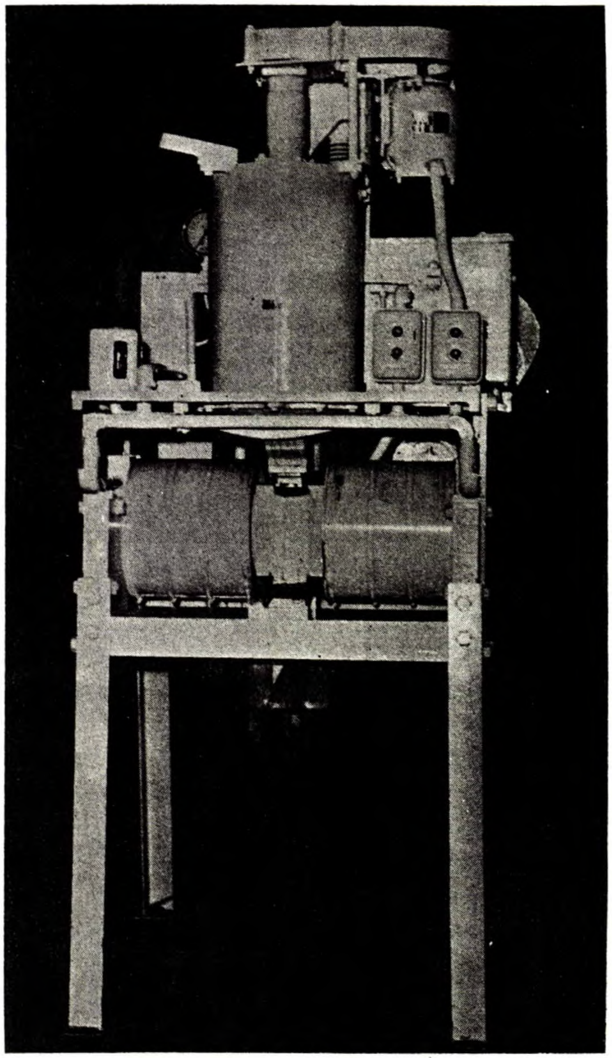

Fig 2. The Jones Wet Magnetic Mineral Separator

In the first phase of each cycle, the feed is allowed to pass along the grooved plates (11) by opening the feed valve (2) for 2 seconds. Magnetic particles tend to move to the peaks and be retained, while non-magnetic particles pass along the groove valleys into a suitable collecting trough.

In the second phase of the cycle, the retained magnetics are washed by a low-velocity flow of water entering via (9) and (3). During this wash period, two rams (5) are activated one after the other. This causes two short, quick pulses of water at high pressure to spread the retained magnetics and move them a little along the plates, thus helping to release any trapped non-magnetic particles or mixed grains not securely held. Such material is collected separately as a "middling". The wash period of the cycle is approximately 1-1/2 seconds.

At the end of the washing phase, power to the magnetizing coils is shut off and a brief surge of high-pressure water (40 or more psi) is allowed to enter via valves (6) and (3). The released magnetics are discharged to a third collecting point. The plates are now clean and ready for the power to come back on, and the first phase to begin again.

The magnetic system may be operated either at 24 or at 36 volts, dc, although all test work so far has been at the lower voltage. Current input may be varied between 0 and 25 amp, and provides a measure of magnetic field intensity, with highest strength at 25 amp and lowest at 0 amp. Usually a slight residual magnetism remains in the system at 0 amp. Decay of the magnetic field to minimum in the shortest possible time at the start of the third, or "scouring", phase is secured by the opening of two mercury switches which are in series with the magnetic coils.

With the salient plates, (17) in Figure 1, there is a gap of 0.05 in. With the high-extraction plates, (18) in Figure 1, this gap is smaller. In order to avoid plugging of the plate box, care must be taken not to allow particles coarser than this limiting size into the feed. On the other hand, particles as small as 1 to 5 microns may be treated.

GENERAL PLAN

With 173 tests involving some 34 different types of material, it is essential to report the simplest possible plan of presentation. In this bulletin the significant mineral or metal has been chosen as the key, and each is dealt with alphabetically, beginning with Alumina and ending with Zinc.

To distinguish samples of similar material from different points of origin, capital letters are used (e.g., Talc A, Talc B, etc.). Where more than one test has been done on a sample, or where some other form of processing has been employed prior to the Jones separator, the additional sub-division is indicated by lower-case letters. For example a test on a sample as received might be designated "Material A (a)", and a second test on this sample, or on flotation concentrate prepared from this sample, would be "Material A (b)". The very few deviations from this general plan are indicated in the text.

Individual tests are recorded under four headings: Object, Test Data, Results, and Remarks.

Object: The purpose of the test is stated. When available, the feed grade, particle size, and other minerals present are given. If not specified, particle size of feed is finer than 28 mesh.

Test Data: Preparation of feed, if any, is stated (e.g., grinding), and the procedure followed for the test is detailed. With only one or two exceptions, the tests were performed on 500 g or 1000 g batches at approximately 15 per cent solids by weight, with wash water at a pressure of 3 ft static head, and scour water at approximately 40 psi. Since this information applies to most of the tests, it is not stated in the individual test records.

Results: Where possible, a tabulation is presented. The machine always produces three fractions -- magnetic, middling, and non-magnetic -- from each passage of feed. The middling is usually of small quantity, and frequently of only slight difference in grade from the non-magnetic. Unless it appeared advisable to keep the non-magnetic and middling separate, therefore, they were combined and shown simply as non-magnetic.

Remarks: Information that may not be at once apparent from the results obtained is pointed out, when necessary, in this section.

TERMS EMPLOYED IN THIS REPORT

Separation at: A single passage of feed through the machine at a specific amperage.

Fractionation: Successive removal of magnetic fractions each at a higher amperage than the preceding one. With this procedure the middling and non-magnetic fractions from the first pass are combined to form feed for the next, and so on.

Mag: A magnetic fraction.

Midd: A middling fraction.

Non-mag: A non-magnetic fraction, or a combination of non-magnetics and middlings.

Cleaning: When a product is again passed through the machine in order to secure additional upgrading.

Recleaning:	When a cleaned product is again passed through the machine in order to secure still further upgrading.
Scavenging:	When a product is again passed through the machine in order to recover additional material of value.
Rescavenging:	When a scavenged product is again passed through the machine in order to recover still further material of value.
Primary:	A direct series of steps, such as an initial separation followed by cleaning, leading to a final product.
Secondary:	An indirect series of steps, such as scavenging followed by cleaning, leading to a secondary product, which is usually of lower value than the primary product.

RECORD OF TESTS

In order that specific tests, or tests on a particular material, may be quickly located, the record for each test begins at the top of a new page under its appropriate designation.

ALUMINA A

Object:	Removal of certain dark-coloured grains from several hundred pounds of alumina.
Test Data:	Continuous operation. Separation at 25 amp.
Results:	Most of the dark grains were successfully removed. No chemical analysis was done.

APATITE A

Object: Concentration of apatite to a minimum of 31 per cent P_2O_5 in a -200 mesh discard from another method of treatment. Feed contained about 5 per cent P_2O_5, with magnetite, ilmenite, and minor constituents.

Test Data: Fractionation at 1, 5 and 25 amp. Midd at 25 amp cleaned once.

Results:

TABLE 1

Product	Wt %	Fe %	Dist %	P_2O_5 %	Dist %
Mag - 1 amp	28.8	39.6	68.2	0.36	2.0
" - 5 amp	42.5	9.9	25.1	0.31	2.5
" - 25 amp	14.1	6.84	5.7	1.06	2.9
Cleaner mag	0.8	5.95	0.3	2.88	0.4
Non-mag	13.8	0.87	0.7	35.5	92.2
Feed (calc)	100.0	16.7	100.0	5.27	100.0

APATITE B

Object: Concentration of apatite from a sample composed of apatite and pyroxene in approximately equal proportions.

Test Data: Separation at 25 amp.

Results: Microscopic examination indicated that a good separation had been obtained. Chemical analysis was not done.

APLITE A (a)

Object: Reduction of the iron content of a sample of aplite.

Test Data: Separation at 25 amp. Non-mag and midd scavenged at 25 amp. Mag fractions combined for analysis. Non-mag and midd fractions combined for analysis.

Results:

TABLE 2

Product	Wt %	Fe_2O_3 %	Dist %
Mag	5.9	12.00	88.5
Non-mag	94.1	0.099	11.5
Feed (calc)	100.0	0.802	100.0

Remarks: Although the iron content was reduced to 0.099 per cent Fe_2O_3, the submitter indicated that as low as 0.075 per cent Fe_2O_3 was possible by dry methods.

APLITE A (b)

Object: Reduction of the iron content of the same material as A (a).

Test Data: Separation at 25 amp. Non-mag and midd scavenged at 25 amp. Scavenger non-mag and midd again scavenged at 25 amp. All mag fractions combined for analysis.

Results:

TABLE 3

Product	Wt %	Fe_2O_3 %	Dist %
Mag	8.3	9.01	88.5
Non-mag	91.7	0.107	11.5
Feed (calc)	100.0	0.850	100.0

Remarks: Compare with A (a). The extra scavenging failed to improve the result.

ASBESTOS A

Object: Recovery of iron, nickel and chromium from an asbestos plant tailing, ground to -100 mesh.

Test Data: Fractionation at 0, 5 and 25 amp.

Results:

TABLE 3

Product	Sol Fe %	Ni %	Cr %
Mag - 0 amp	26.4	0.71	1.38
" - 5 amp	4.40	0.35	0.38
" -25 amp	4.09	0.22	0.56
Non-mag	3.04	0.13	0.16
Feed (calc)	5.00	0.24	0.21

Remarks: It is of interest to note that the bulk constituent of the feed was fibrous. A tendency for iron, nickel and chromium to collect in the mag fractions is demonstrated.

BARITE A

Object: Removal of stained particles and other coloured contaminants from a sample of barite ground to -28 mesh.

Test Date: Separation at 25 amp.

Results: Although 2.3 per cent of the material was recovered as a magnetic fraction that was obviously undesirable in the barite, this was only a part of the undesirable content.

COLUMBITE A

Object: To determine the susceptibility of columbite to magnetic separation in the Jones equipment. Several size fractions of a sample of columbite concentrate were tested.

Test Data: Each feed size fraction was magnetically fractionated at 3, 5 and 7 amp.

Results:

TABLE 4

Product	-48+65 M Wt %	-65+100 M Wt %	-100+325 M Wt %	-325 M Wt %
Mag - 3 amp	28.8	36.6	42.2	53.7
" - 5 amp	62.6	58.8	56.4	45.2
" - 7 amp	8.4	4.4	1.1	0.7
Non-mag	0.2	0.2	0.3	0.4
	100.0	100.0	100.0	100.0

Remarks: Columbite is shown to be highly susceptible to magnetic separation in the Jones equipment at 5 amp. The fact that there is a more complete recovery in the finer sizes may be explained, at least in part, by the fact that inclusions of zircon and other minerals may be observed in the coarser particles.

COLUMBITE B

Object: Recovery of the small columbite-tantalite content of a 70-lb sample, the valuable constituent of which was beryl.

Test Data: Continuous operation. Separation at 25 amp. Mag reground and cleaned at 25 amp. Cleaner mag recleaned at 0 amp to remove iron particles picked up during regrind.

Results:

TABLE 5

Product	Wt	Col-tan %
Cleaner mag	.111 lb	10.4
" non-mag	67.9 lb	--
Feed (calc)	68.0 lb	0.0173

Remarks: A high concentration ratio was obtained, about 600 to 1.

COPPER A (a)

Object: To examine the distribution of copper in magnetic fractions of a sample containing pyrrhotite and possibly some magnetite, in addition to the copper mineral, as an aid to determining liberation particle size. The nominal feed size was -65 mesh.

Test Data: The feed was first screened into +240 and -240 mesh sizes. Each size was magnetically fractionated at 0, 3, 5, 10 and 25 amp.

Results: The results for +240 mesh material are given in Table 6 and for -240 mesh material in Table 7.

TABLE 6

Product	Wt %	Cu %	Dist %
Mag - 0 amp	44.5	1.30	51.1
" - 3 amp	20.8	1.03	18.9
" - 5 amp	15.7	0.88	12.4
" - 10 amp	8.1	1.10	7.9
" - 25 amp	5.7	1.35	6.8
Non-mag	5.2	0.61	2.9
Feed (calc)	100.0	1.13	100.0

TABLE 7

Product	Wt %	Cu %	Dist %
Mag - 0 amp	29.0	1.25	12.6
" - 3 amp	15.7	1.62	8.8
" - 5 amp	12.1	1.59	6.6
" - 10 amp	7.3	3.45	8.9
" - 25 amp	2.7	5.10	4.8
Non-mag	33.2	4.85	58.3
Feed (calc)	100.0	2.88	100.0

Remarks: In Table 6, most of the copper appears in association with the more highly magnetic minerals; in Table 7, 58 per cent remains in the non-mag. Since over 40 per cent is still with the mag fractions, a liberation size of approximately 325 mesh is suggested.

COPPER A (b)

<u>Object:</u> To examine the distribution of copper in magnetic fractions of flotation concentrates prepared from the same material as A (a). Feed size, -240 mesh.

<u>Test Data:</u> Fractionation at 0, 3, 5, 10 and 25 amp.

<u>Results:</u>

TABLE 8

Product	Wt %	Cu %	Dist %
Mag - 0 amp	5.7	15.84	4.4
" - 3 amp	15.0	14.53	10.7
" - 5 amp	14.9	15.73	11.5
" - 10 amp	13.2	23.49	15.2
" - 25 amp	12.3	27.02	16.4
Non-mag	38.9	21.88	41.8
Feed (calc)	100.0	20.33	100.0

<u>Remarks:</u> Table 8 demonstrates much the same trend as did Table 7, confirming that a still finer grind would be necessary for more complete liberation.

CORDIERITE A

Object: Concentration of cordierite from a -65 + 100 mesh sample containing approximately 10 per cent cordierite.

Test Data: Fractionation at 3, 5, 10, 17 and 25 amp.

Results: Microscopic examination indicated a strong concentration of cordierite in the 10-, 17- and 25-amp fractions.

GARNET A

<u>Object:</u> Concentration of garnet from a -28+65 mesh sample composed of garnet and quartz in approximately equal amounts.

<u>Test Data:</u> Separation at 10 amp.

<u>Results:</u>

TABLE 9

Product	Wt %	Garnet %	Dist %
Mag	51.1	96.7	97.0
Non-mag	48.9	3.2	3.0
Feed (calc)	100.0	51.1	100.0

<u>Remarks:</u> The iron content of the non-mag was 0.47%.

GERMANIUM A

Object: Concentration of germanium from a sample composed chiefly of talc, but containing lead, zinc and germanium constituents.

Test Data: Separation at 25 amp.

Results:

TABLE 10

Product	Wt %	Ge %	Pb %	Zn %
Mag	3.2	0.003	1.1	10.5
Midd	33.8)			
	)	0.005	0.7	1.8
Non-mag	63.0)			
Feed (calc)	100.0			

GERMANIUM B (a)

Object: Concentration of germanium from a sample of copper flotation concentrate from a high lime circuit. The germanium content was about 0.05%.

Test Data: Fractionation at 5, 10 and 25 amp.

Results:

TABLE 11

Product	Wt. %	Ge %	Dist %
Mag - 5 amp	5.2	0.320	37.3
" - 10 amp	11.5	0.064	16.5
" - 25 amp	7.4	0.046	7.1
Non-mag	75.9	0.023	39.1
Feed (calc)	100.0	0.045	100.0

Results: The three magnetic fractions together contain 60.9 per cent of the Ge in 24.1 per cent of the bulk, at 0.114 per cent Ge.

GERMANIUM B (b)

Object: Concentration of germanium from a sample of copper flotation concentrate from the same source as B (a) but from a different circuit.

Test Data: Fractionation at 5, 10 and 25 amp.

Results:

TABLE 12

Product	Wt %	Ge %	Dist %
Mag - 5 amp	11.2	0.097	26.2
" - 10 amp	11.3	0.043	11.5
" - 25 amp	6.8	0.040	6.5
Non-mag	70.7	0.033	55.8
Feed (calc)	100.0	0.041	100.0

Remarks: This separation was not as good as B (a), although some concentration was made at 5 amp. The submitter believes that of two germanium-bearing minerals present one is comparatively magnetic, the other not. The former tends to follow the "lime" circuit from which B (a) was taken, and the latter the circuit from which B (b) was taken.

GERMANIUM B (c)

Object: Concentration of germanium from the same material as B (b), but calcined.

Test Data: Fractionation at 5, 10 and 25 amp.

Results:

TABLE 13

Product	Wt %	Ge %	Dist %
Mag - 5 amp	19.6	0.067	27.9
" - 10 amp	15.0	0.039	16.8
" - 25 amp	11.0	0.034	7.9
Non-mag	54.4	0.041	47.4
Feed (calc)	100.0	0.047	100.0

Remarks: Calcination did not improve the magnetic properties of the germanium mineral involved. See also "Remarks" for B (b).

GOLD A

Object: To observe the distribution of gold through the various magnetic fractions obtained from a sample of flotation concentrate containing pyrite, arsenopyrite, pyrrhotite, stibnite, and minor sulphides, in addition to the gold.

Test Data: Fractionation at 0, 5, 10 and 25 amp.

Results:

TABLE 14

Product	Wt %	Gold oz/ton	Dist %
Mag - 0 amp	7.0	4.14	3.0
" - 5 amp	18.7	7.59	14.8
" - 10 amp	8.2	6.58	5.6
" - 25 amp	6.7	8.03	5.6
Non-mag	59.4	11.44	71.0
Feed (calc)	100.0	9.58	100.0

Remarks: It is possible that finer grinding would allow magnetic material to be removed without gold.

GRANITE A

Object: To lower the iron content of a granite sample ground to -28 mesh. The chief iron-bearing mineral was light-coloured mica. Small inclusions of micaceous alteration products had been observed in the feldspar.

Test Data: Separation at 25 amp. Non-mag and midd cleaned at 25 amp.

Results:

TABLE 15

Product	Wt %	Fe_2O_3 %	Dist %
Mag - 25 amp	1.6	3.72	14.2
Cleaner mag	1.2	2.32	6.7
" midd	29.2	0.43	30.1
" non-mag	68.0	0.30	49.0
Feed (calc)	100.0	0.42	100.0

Remarks: This is a problem for which magnetic separation would not usually be considered, because of the low susceptibilities of the minerals involved. The magnetic fractions were chiefly mica, indicating that even light-coloured micas may sometimes be recovered by this method.

GRAPHITE A

Object: To increase the carbon content of a -65+100 mesh fraction of graphite concentrate containing iron oxide stained grains together with small amounts of quartz, diopside, goethite, sphene and apatite.

Test Data: Separation at 25 amp. Non-mag and midd cleaned at 25 amp.

Results:

TABLE 16

Product	Wt %	C %	Dist %
Mag - 25 amp	6.5	43.6	3.4
Cleaner mag	6.6	58.8	4.5
" midd	26.2	88.3	27.1
" non-mag	60.7	90.9	65.0
Feed (calc)	100.0	85.0	100.0

Remarks: Stained graphite grains were observed in the mag fractions, along with other deleterious material.

ILMENITE A (a)

Object: Removal of non-titanium minerals from a sample of ilmenite concentrate (feed to a leaching plant).

Test Data: Fractionation at 0, 1, 2, 3, 7 and 25 amp.

Results:

TABLE 17

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag - 0 amp	1.4	55.23	11.00	1.5	1.1
" - 1 amp	87.7	54.93	14.28	90.5	87.0
" - 2 amp	4.0	44.70	26.02	3.4	7.2
" - 3 amp	3.1	46.37	17.80	2.7	3.8
" - 7 amp	2.9	27.93	3.98	1.6	0.8
" - 25 amp	0.3	26.65	1.86)		
			)	0.3	0.1
Non-mag	0.6	14.15	2.00)*		
Feed (calc)	100.0	52.11	14.42	100.0	100.0

* Estimated. Too little sample for analysis.

Remarks: By separating at 3 amp it would be possible to discard 3.8 per cent of the bulk with a loss of less than 1 per cent of the TiO_2. Removal of this amount of undesirable material from the leach was considered significant by the submitter.

ILMENITE A (b)

Object: To remove untreated ilmenite and iron salts from a sample of anatase (TiO_2) obtained by pressure leaching the ilmenite concentrates of A (a).

Test Data: Separation at 25 amp with high-extraction plates.

Results:

TABLE 18

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag	41.3	14.19	72.65	63.6	38.4
Non-mag	58.7	5.71	81.95	36.4	61.6
Feed (calc)	100.0	9.22	78.10	100.0	100.0

Remarks: X-ray diffraction patterns indicated the presence of ilmenite in the magnetic but not the non-magnetic, fraction. Many partially-reacted particles were observed to be present in the magnetic fraction into which they were drawn because of their ilmenite content.

ILMENITE B

<u>Object:</u> Concentration of ilmenite from a -100 mesh sample of Jeffery Magnetic Separator tailing.

<u>Test Data:</u> Fractionation at 0 and 5 amp.

<u>Results:</u>

TABLE 19

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag - 0 amp	10.7	42.98	30.49	19.7	17.3
" - 5 amp	41.5	36.74	32.28	65.1	71.0
Non-mag	47.8	7.44	4.63	15.2	11.7
Feed (calc)	100.0	23.39	18.85	100.0	100.0

ILMENITE C (a)

<u>Object:</u> Recovery of ilmenite from the Crockett Magnetic Separator sand tailing of a -65 mesh titaniferous magnetite sample.

<u>Test Data:</u> Fractionation at 0 and 5 amp.

<u>Results:</u>

TABLE 20

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag - 0 amp	5.6	7.50	28.03	8.9	8.2
" - 5 amp	9.3	9.84	30.12	19.4	33.1
Non-mag	85.1	3.96	0.48	71.7	58.7
Feed (calc)	100.0	4.70	4.75	100.0	100.0

<u>Remarks:</u> The weight figures indicate that the magnetic material has been substantially removed by the Crockett machine.

ILMENITE C (b)

Object: Recovery of ilmenite from a Crockett Magnetic Separator slime tailing of the same material as C (a).

Test Data: Fractionation at 0 and 5 amp.

Results:

TABLE 21

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag - 0 amp	5.9	23.50	14.60	12.6	26.0
" - 5 amp	46.3	11.04	19.85	47.7	6.3
Non-mag	47.8	9.20	7.37	39.7	67.7
Feed (calc)	100.0	11.06	13.56	100.0	100.0

Remarks: TiO_2 in feed was much higher than in C (a), and the concentrate at 5 amp was lower. This material was considerably finer in particle size than C (a).

ILMENITE C (c)

Object: Recovery of ilmenite from the Crockett sand tailing of another test on the same material as C (a).

Test Data: Fractionation at 0 and 5 amp.

Results:

TABLE 22

Product	Wt %	Fe %	TiO_2	Dist TiO_2 %
Mag - 0 amp	6.6	14.04	27.94	7.2
" - 5 amp	84.6	12.82	27.80	92.1
Non-mag	8.8	--	2.09	0.7
Feed (calc)	100.0		25.52	100.0

Remarks: Feed grade suggests a concentrate rather than a tailing.

IRON A (a)

Object: To concentrate the iron from a sample of classifier overflow containing chiefly hematite and quartz, and averaging 89 per cent - 325 mesh in particle size.

Test Data: Fractionation at 5, 17 and 25 amp. The fractions were deslimed to improve filtering. Magnetics at 17 and 25 amp and slime were combined and roasted elsewhere, and a Davis Tube separation was made on the product.

Results:

TABLE 23

Product	Wt %	Analysis %		Dist %	
		Sol Fe **	SiO_2	Fe	SiO_2
Mag - 5 amp	18.2	62.38	4.28	26.2	2.0
" - 17 amp*	14.6	58.36	7.26	21.5	2.7
" - 25 amp*	5.9	54.32	13.4	7.9	2.1
Slime *	24.8	38.20	51.3	24.1	33.0
Non-mag	36.5	24.18	63.3	20.3	60.2
*Davis mag	29.9	67.8		47.0	
" non-mag	15.4	18.2		6.5	
Feed (calc)	100.0	43.2	38.4	100.0	100.0

** Generally indicates HCl soluble, i.e. all iron minerals except silicates.

Remarks: A potential recovery of 73.2 per cent of the iron at a grade of 65.6 per cent Fe is indicated by this test. This and the following four samples make up a group of similar material from the same source. A summary of the tests is given, under "Remarks", for IRON A (e).

IRON A (b)

Object: Concentration of the iron from a sample of the same material as A (a) but averaging 86 per cent -325 mesh in particle size.

Test Data: Fractionation at 3, 5, 7 and 25 amp. The fractions were deslimed to improve filtering. Magnetics at 7 and 25 amp together with slime were roasted elsewhere, and a Davis Tube separation was made on the product.

Results:

TABLE 24

Product	Wt %	Analysis %		Dist %	
		Sol Fe	SiO_2	Fe	SiO_2
Mag - 3 amp	10.1	63.5	3.90	14.2	0.9
" - 5 amp	8.8	57.5	6.91	11.1	1.6
" - 7 amp*	3.8	46.3	23.4	4.9	2.1
" - 25 amp*	5.9	44.2	28.6	6.9	4.0
Slime *	52.0	37.4	50.5	51.4	62.4
Non-mag	19.4	26.7	62.1	11.5	29.0
*Davis mag	40.0	61.0		54.3	
" non-mag	21.7	18.2		8.9	
Feed (calc)	100.0	45.0	42.0	100.0	100.0

Remarks: A potential recovery of 68.5 per cent of the iron at a grade of 60.8 per cent Fe is indicated.

IRON A (c)

Object: Concentration of iron from a sample of the same material as A (a) but averaging 68 per cent -325 mesh in particle size.

Test Data: Fractionation at 5, 17 and 25 amp. The fractions were deslimed to improve filtering. Magnetics at 17 and 25 amp together with slime were roasted elsewhere, and a Davis Tube separation was made on the product.

Results:

TABLE 25

Product	Wt %	Analysis %		Dist %	
		Sol Fe	Si O_2	Fe	SiO_2
Mag - 5 amp	40.8	64.1	4.88	57.0	5.9
" - 17 amp*	12.9	51.4	20.94	18.2	8.0
" - 25 amp*	3.8	38.0	36.7	3.7	4.1
Slime *	17.5	36.2	39.8	17.2	20.6
Non-mag	25.0	7.36	83.0	3.9	61.4
*Davis mag	26.5	64.4		37.4	
" non-mag	7.7	10.4		1.7	
Feed (calc)	100.0	45.8	33.8	100.0	100.0

Remarks: A potential recovery of 94.4 per cent of the iron, at a grade of 64.2 per cent Fe, is indicated.

IRON A (d)

Object: Concentration of iron from a sample of classifier overflow from the same source as A (a), composed chiefly of quartz and hematite but containing about 10 per cent magnetite, and averaging 53 per cent -325 mesh in particle size.

Test Data: Procedure exactly as for A (c).

Results:

TABLE 26

Product	Wt %	Analysis %		Dist %	
		Sol Fe	SiO_2	Fe	SiO_2
Mag - 5 amp	37.4	62.32	5.56	68.8	4.3
" - 17 amp*	8.1	43.00	25.12	13.0	4.2
" - 25 amp*	3.5	33.42	44.80	4.4	3.3
Slime *	7.6	35.10	49.80	9.7	7.9
Non-mag	43.4	3.22	88.80	4.1	80.3
*Davis mag	12.1	65.5		23.3	
" non-mag	7.1	17.8		3.8	
Feed (calc)	100.0	33.9	48.0	100.0	100.0

Remarks: A potential recovery of 92.1 per cent of the iron at a grade of 63.1 per cent Fe is indicated.

IRON A (e)

Object: To concentrate the iron from a sample of classifier overflow from the same source as A (a), composed chiefly of hematite and quartz, but containing about 2 per cent magnetite, and averaging 69 per cent -325 mesh in particle size.

Test Data: Procedure exactly as for A (c).

Results:

TABLE 27

Product	Wt %	Analysis %		Dist %	
		Sol Fe	SiO_2	Fe	SiO_2
Mag - 5 amp	32.0	61.2	4.56	63.1	2.9
" - 17 amp*	6.5	37.6	35.4	9.0	4.6
" - 25 amp*	2.4	15.2	70.1	1.6	1.7
Slime *	18.6	33.1	47.6	22.8	17.6
Non-mag	40.5	2.72	91.2	3.5	73.2
*Davis mag	14.5	65.1		30.2	
" non-mag	13.0	8.0		3.2	
Feed (calc)	100.0	31.1	50.4	100.0	100.0

Remarks: A potential recovery of 93.3 per cent of the iron at a grade of 62.4 per cent is indicated. A comparison of the overall results for the five preceding tests is given in Table 28. As only one test was made on each sample, the results may not be considered as conclusive.

TABLE 28

Sample No.	Potential Recovery %	Grade % Fe	Amount Roasted %	Feed Size % -325 M
(a)	73.2	65.6	45.3	89
(b)	68.5	60.8	61.7	86
(c)	94.4	64.2	34.2	68
(d)	92.1	63.1	19.2	53
(e)	93.3	62.4	27.5	69

The initial Jones separator pass in each case raised the grade to above 60 per cent Fe, from 31.1 to 45.8 per cent Fe in the feeds. The roasting of secondary Jones concentrations allowed recovery of additional iron. Particle size appeared to play an important role in the results obtained, the coarser sizes producing the best overall recoveries at fair grade and with comparatively small amounts roasted.

IRON B (a)

Object: To concentrate iron from a sample of rougher spiral tailings containing 12.7 per cent iron minerals, -20 mesh in particle size with 17 per cent -325 mesh.

Test Data: Fractionation at 0, 3 and 7 amp.

Results:

TABLE 29

Product	Wt %	Analysis %		Dist %	
		Sol Fe	SiO_2	Fe	SiO_2
Mag - 0 amp	16.1	52.3	21.2	39.5	6.9
" - 3 amp	14.9	32.6	24.3	22.8	7.3
" - 7 amp	10.1	11.8	24.2	5.6	5.0
Slime	17.8	34.8	70.3	29.1	25.4
Non-mag	41.1	1.54	66.4	3.0	55.4
Feed (calc)	100.0	21.3	49.3	100.0	100.0

IRON B (b)

Object: To concentrate the iron from the same material as B (a) ground to -100 mesh.

Test Data: Fractionation at 0 and 25 amp. The 25-amp mag was roasted and the product separated by Davis Tube.

Results:

TABLE 30

Product	Wt %	Sol Fe %	Dist %
Mag - 0 amp	19.0	59.2	48.5
" - 25 amp*	31.0	33.6	48.5
Non-mag	50.0	1.36	3.0
*Davis mag	15.4	66.4	44.2
" non-mag	15.6	6.7	4.3
Feed (calc)	100.0	23.1	100.0

Remarks: This treatment shows a potential recovery of 92.7 per cent of the iron at a grade of 62.2 per cent Fe. Grinding alone allowed concentration of 97.0 per cent of the iron in 50 per cent of the bulk by Jones separator. Compare with B (a).

IRON C (a)

<u>Object:</u> To concentrate the iron from a sample of rougher spiral tailings from the same source as B (a). This sample was -20 mesh with 9.8 per cent -325 mesh.

<u>Test Data:</u> Fractionation at 0, 3 and 7 amp. Products were deslimed to improve filtering.

<u>Results:</u>

TABLE 31

Product	Wt %	Analysis %		Dist %	
		Sol Fe	SiO_2	Fe	SiO_2
Mag - 0 amp	3.3	53.6	20.4	15.3	0.9
" - 3 amp	10.8	37.6	22.7	35.3	3.4
" - 7 amp	8.8	21.8	20.7	16.6	2.5
Slime	10.2	28.2	70.1	25.0	10.0
Non-mag	66.9	1.35	89.4	7.8	83.2
Feed (calc)	100.0	11.5	71.9	100.0	100.0

<u>Remarks:</u> No satisfactory product is indicated, although 69.9 per cent of the bulk may be discarded for a loss of only 7.8 per cent of the iron.

IRON C (b)

Object: Concentration of iron from the same material as C (a) but ground to -100 mesh.

Test Data: Fractionation at 0 and 25 amp. The mag at 25 amp was roasted and the product separated by Davis Tube.

Results:

TABLE 32

Product	Wt %	Sol Fe	Dist %
Mag - 0 amp	3.4	68.0	16.8
" - 25 amp*	26.8	36.0	73.6
Non-mag	69.8	1.88	9.6
*Davis mag	13.3	69.8	67.8
" non-mag	13.5	6.2	5.8
Feed (calc)	100.0	13.7	100.0

Remarks: A recovery of 84.6 per cent at a grade of 69.5 per cent Fe was obtained by this treatment despite a low feed grade. Grinding to -100 mesh allowed 90.4 per cent of the iron to be concentrated in 30.2 per cent of the bulk by Jones separator.

IRON D (a)

Object: Concentration of iron from a sample of oolitic material composed of fine concentric layers of silicate and hematite, -28 mesh in particle size.

Test Data: Fractionation at 0, 3, 10, 17 and 25 amp.

Results:

TABLE 33

Product	Wt %	Analysis %		Dist %	
		Fe	SiO_2	Fe	SiO_2
Mag - 0 amp	0.5	43.28	14.32	0.6	0.4
" - 3 amp	0.8	40.03	13.24	0.9	0.6
" - 10 amp	30.2	40.69	13.12	35.2	23.3
" - 17 amp	15.2	37.30	14.62	16.3	13.1
" - 25 amp	17.0	34.64	16.72	16.9	16.7
Non-mag	36.3	28.85	21.48	30.1	45.9
Feed (calc)	100.0	34.86	17.00	100.0	100.0

IRON D (b)

Object: Concentration of iron from the same material as D (a), but with the oolitic structure partially broken down by grinding.

Test Data: Fractionation at 10, 17 and 25 amp.

Results:

TABLE 34

Product	Wt %	Analysis %		Dist %	
		Fe	SiO_2	Fe	SiO_2
Mag - 10 amp	35.6	42.17	11.16	42.7	22.9
" - 17 amp	10.3	37.90	13.98	11.1	8.3
" - 25 amp	14.4	32.27	15.36	14.8	12.7
Non-mag	39.7	27.84	24.56	31.4	56.1
Feed (calc)	100.0	35.18	17.38	100.0	100.0

Remarks: The intimate mixture of hematite and silicate makes concentration by magnetic separator difficult.

IRON E (a)

Object: Concentration of iron from a sample of oolitic material from the same source as D and similar to it in general composition, -28 mesh in particle size with 13 per cent -325 mesh.

Test Data: Fractionation at 10, 17 and 25 amp.

Results:

TABLE 35

Product	Wt %	Analysis %		Dist %
		Fe	SiO_2	Fe
Mag - 10 amp	31.4	42.9	10.90	43.8
" - 17 amp	9.6	38.1	14.96	11.9
" - 25 amp	25.4	30.1	16.10	24.9
Non-mag	33.6	17.8		19.4
Feed (calc)	100.0	30.7		100.0

Remarks: Compare with D (a).

IRON E (b)

Object: Concentration of iron from the same material as E (a) but ground to give 18 per cent +100 and 31 per cent -325 mesh.

Test Data: Fractionation at 10, 17 and 25 amp.

Results:

TABLE 36

Product	Wt %	Analysis %		Dist %
		Fe	SiO_2	Fe
Mag - 10 amp	31.9	40.5	14.66	39.6
" - 17 amp	28.2	38.7	16.56	33.4
" - 25 amp	13.2	34.7		14.1
Non-mag	26.7	15.8		12.9
Feed (calc)	100.0	32.6		100.0

Remarks: No improvement over E (a). Compare with D (b).

IRON F (a)

Object: To concentrate the iron from a Buell Classifier product, all -200 mesh in particle size, and composed of hematite, magnetite, quartz, and iron silicates. This material was considered to be a waste product.

Test Data: Fractionation at 0, 3, 5 and 25 amp.

Results:

TABLE 37

Product	Wt %	Fe %	Dist %
Mag - 0 amp	15.2	54.38	42.9
" - 3 amp	14.6	48.54	36.7
" - 5 amp	9.8	25.92	13.2
" - 25 amp	12.0	6.81	4.2
Non-mag	48.4	1.20	3.0
Feed (calc)	100.0	19.29	100.0

Remarks: The 0 and 3 amp fractions together represent 79.6 per cent of the iron at a grade of 51.5 per cent Fe.

IRON F (b)

Object: Concentration of iron from the same material as F (a).

Test Data: Fractionation at 0, 3 and 7 amp with higher than normal wash water pressure to improve middling removal.

Results:

TABLE 38

Product	Wt %	Fe %	Dist %
Mag - 0 amp	10.6	67.70	37.3
" - 3 amp	16.9	46.13	40.5
" - 7 amp	15.2	20.53	16.2
Non-mag	57.3	2.00	6.0
Feed (calc)	100.0	19.24	100.0

Remarks: The increased wash water pressure had the desired effect in raising the grade at 0 amp. Combined 0 and 3 amp fractions for this test give a recovery of 77.8 per cent of the iron at a grade of 54.4 per cent Fe.

IRON F (c)

Object: To observe the concentration of iron in magnetic fractions below 3 amp from the same material as F (a).

Test Data: Fractionation at 0, 1, 2 and 3 amp.

Results:

TABLE 39

Product	Wt %	Fe %	Dist %
Mag - 0 amp	12.0	61.35	36.9
" - 1 amp	6.0	36.30	10.9
" - 2 amp	5.5	46.65	12.9
" - 3 amp	8.7	46.95	20.4
Non-mag	67.8	5.55	18.9
Feed (calc)	100.0	19.93	100.0

Remarks: The 1- and 2-amp fractions are lower in grade than the 3-amp fraction. Test (a) shows 5 amp, and Test (b) shows 7 amp, to both produce much lower grades than 3 amp.

IRON G

Object: To concentrate the iron from a No. 2 Buell Classifier product from the same source as F but coarser in particle size.

Test Data: Fractionation at 0, 1, 2 and 3 amp.

Results:

TABLE 40

Product	Wt %	Fe %	Dist %
Mag - 0 amp	16.8	60.45	38.6
" - 1 amp	16.8	45.45	29.0
" - 2 amp	8.0	52.20	15.9
" - 3 amp	8.0	44.85	13.6
Non-mag	50.4	1.50	2.9
Feed (calc)	100.0	26.31	100.0

Remarks: The feed grade of this sample was higher than in F, but much the same trends were developed. At 3 amp, 97.1 per cent of the iron was recovered with a reduction in the bulk of 50 per cent.

IRON H (a)

Object: To concentrate the iron from a sample composed of magnetite, hematite, siderite, quartz, and iron silicates, -200 mesh in particle size.

Test Data: Fractionation at 0, 3, 5, 10 and 25 amp.

Results:

TABLE 41

Product	Wt %	Fe %	Dist %
Mag - 0 amp	24.0	60.25	55.7
" - 3 amp	19.1	30.60	22.4
" - 5 amp	14.2	21.20	11.7
" - 10 amp	7.2	16.70	4.4
" - 25 amp	2.9	14.70	1.7
Non-mag	32.6	3.25	4.1
Feed (calc)	100.0	25.86	100.0

IRON H (b)

Object: Concentration of iron from the same material as H (a).

Test Data: Fractionation at 0, 1, 2, 3, 5 and 25 amp.

Results:

TABLE 42

Product	Wt %	Fe %	Dist %
Mag - 0 amp	22.1	63.25	54.5
" - 1 amp	3.0	36.65	4.3
" - 2 amp	2.2	36.65	3.1
" - 3 amp	5.5	34.40	7.4
" - 5 amp	17.8	23.70	16.4
" - 25 amp	9.6	18.70	7.0
Non-mag	39.8	4.90	7.3
Feed (calc)	100.0	25.71	100.0

Remarks: Compare with H (a).

IRON I

Object: To concentrate iron from a classifier overflow product from a regrind circuit.

Test Data: Fractionation at 0, 1, 3, 7 and 25 amp.

Results:

TABLE 43

Product	Wt %	Fe %	Dist %
Mag - 0 amp	39.0	58.78	68.5
" - 1 amp	19.8	25.65	15.2
" - 3 amp	9.1	32.85	8.9
" - 7 amp	7.0	21.22	4.4
" - 25 amp	3.9	10.26	1.2
Non-mag	21.2	2.84	1.8
Feed (calc)	100.0	33.45	100.0

Remarks: Mixed grains were observed in all the magnetic fractions. The grades obtained also suggest lack of full liberation.

IRON J (a)

Object: Concentration of the iron from a complex feed composed of magnetite, hematite, goethite, actinolite, quartz, and several lesser minerals, 33 per cent -200 mesh in particle size.

Test Data: Separation at 0 amp.

Results:

TABLE 44

Product	Wt %	Fe %	Dist %
Mag	25.4	54.7	46.0
Non-mag	74.6	20.8	54.0
Feed (calc)	100.0	29.4	100.0

Remarks: The magnetic fraction was examined and was found to contain numerous mixed grains.

IRON J (b)

Object: Concentration of iron from the same material as J (a) ground to 98 per cent -325 mesh.

Test Data: Fractionation at 0, 3, 7, 10 and 25 amp.

Results:

TABLE 45

Product	Wt %	Fe %	Dist %
Mag - 0 amp	27.4	66.66	62.0
" - 3 amp	7.1	53.54	12.9
" - 7 amp	5.6	44.76	8.5
" - 10 amp	3.8	25.41	3.4
" - 25 amp	6.0	18.06	3.7
Non-mag	50.1	5.63	9.5
Feed (calc)	100.0	29.40	100.0

Remarks: The 0- and 3-amp products together give 74.9 per cent recovery of the iron at a grade of 64.0 per cent Fe. If the 7-amp product is added to this the recovery becomes 83.4 per cent and the grade 61.2 per cent Fe. This is on a total Fe basis; recoveries would be higher on a soluble Fe basis.

IRON J (c)

Object: Concentration of the iron from the same material as J (a), ground to 95 per cent -200 mesh.

Test Data: A complex form of fractionation was used to produce 0-, 3-, 7-, 10- and 15-amp fractions. After separation at 0 amp, the mag was cleaned at the same amperage. Non-mag and midd from the cleaner were added to the feed for 3-amp separation. The 3-amp mag was, in turn, cleaned at 3 amp, and the non-mag and midd from the cleaner were added to the feed for the 7-amp separation. This pattern was followed for each fraction in the series. All fractions were deslimed to improve filtering.

Results:

TABLE 46

Product	Wt %	Fe %	Dist %
Mag - 0 amp	24.5	67.88	56.5
" - 3 amp	6.7	59.06	13.3
" - 7 amp	6.4	53.98	11.8
" - 10 amp	2.1	17.04	1.3
" - 15 amp	1.8	12.70	0.8
Non-mag	17.3	0.66	0.4
Slime	41.2	11.40	15.9
Feed (calc)	100.0	29.40	100.0

Remarks: While the grind was not as fine as J (b), the complex treatment produced somewhat better results. The combined 0-, 3- and 7-amp fractions contain 81.6 per cent of the iron at 64.0 per cent Fe despite loss to slimes. The silicates which appear in the 10- and 15-amp fractions largely represent non-recoverable iron.

IRON K

Object: Concentration of iron from a spiral middling product composed of hematite, ankerite, and quartz. The sample contained approximately 25 per cent of mixed grains. The particle size was 33 per cent -200 mesh.

Test Data: Separation at 25 amp, with one cleaning step on the mag at the same setting.

Results:

TABLE 47

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 25 amp	53.7	3.9	64.5	95.7
Cleaner mag	3.6	62.8	16.8	1.6
" non-mag	42.7	93.8	2.2	2.7
Feed (calc)	100.0	44.4	36.2	100.0

Remarks: Examination revealed that the 3.9 per cent SiO_2 remaining in the concentrate was there entirely as mixed grains.

IRON L (a)

Object: Concentration of the iron from a sample composed almost entirely of hematite and quartz, and high in initial grade. Particle size, -100 mesh.

Test Data: Separation at 25 amp.

Results:

TABLE 48

Product	Wt %	SiO_2 %	Fe %	Dist. Fe %
Mag	64.0	1.69	67.67	70.7
Non-mag	36.0		49.78	29.3
Feed (calc)	100.0		61.23	100.0

Remarks: Some of the hematite in this sample is earthy. Even at -100 mesh the quartz is coated with the earthy material. Flotation, and roasting followed by magnetic separation, both failed to reduce the SiO_2 to any extent.

IRON L (b)

Object: Concentration of iron from the same material as L (a).

Test Data: Fractionation at 10 and 25 amp.

Results:

TABLE 49

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 10 amp	62.7	1.92	66.20	71.1
" - 25 amp	6.5		64.21	7.2
Non-mag	30.8		41.25	21.7
Feed (calc)	100.0		58.39	100.0

Remarks: Although the bulk of the iron was concentrated at 10 amp, a good product was also returned at 25 amp. The magnetic fractions produced a combined recovery of 78.3 per cent with a grade of 66.0 per cent Fe.

IRON L (c)

Object: Concentration of iron from the same material as L (a).

Test Data: Fractionation at 0, 10 and 25 amp.

Results:

TABLE 50

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 0 amp	1.0	) (	65.6	1.0
" - 10 amp	79.2	) 1.88 (	67.5	85.3
" - 25 amp	4.8	) (	61.5	4.7
Non-mag	15.0		37.6	9.0
Feed (calc)	100.0		62.6	100.0

Remarks: The combined magnetic fractions represent a recovery of 91 per cent at a grade of 2 per cent SiO_2.

IRON M

Object: To concentrate the iron from a sample composed of soft, earthy hematite and quartz, ground to -100 mesh.

Test Data: Fractionation at 10 and 25 amp. Products deslimed for filtering.

Results:

TABLE 51

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 10 amp	19.6	14.0	54.3	53.0
" - 25 amp	2.1	46.8	28.6	2.9
Non-mag	64.9	89.3	4.0	12.9
Slime	13.4		46.7	31.2
Feed (calc)	100.0		20.0	100.0

Remarks: A situation similar to that with sample L, coating of the quartz with hematite, existed here. In addition mixed grains were found in the concentrate. Slime loss was unusually high with this material.

IRON N (a)

Object: To concentrate the iron from a sample of very fine-grained, hard, cherty hematite, ground to -100 mesh.

Test Data: Fractionation at 3 and 25 amp.

Results:

TABLE 52

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 3 amp	10.8	21.4	50.9	12.5
" - 25 amp	38.6		42.3	37.3
Non-mag	50.6		43.4	
Feed (calc)	100.0		43.8	100.0

IRON N (b)

Object: Concentration of the iron from the same material as N (a), but ground to -200 mesh.

Test Data: Fractionation at 3 and 25 amp.

Results:

TABLE 53

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 3 amp	11.9	23.0	49.4	13.2
" - 25 amp	27.6		44.3	27.4
Non-mag	60.5		43.7	59.4
Feed (calc)	100.0		44.6	100.0

Remarks: The finer grind did not produce an improvement over N (a).

IRON O (a)

Object: To separate magnetite from ilmenite in a fine-grained sample containing 20.4 per cent Fe and 8.83 per cent TiO_2, ground to -20 mesh.

Test Data: Fractionation at 0, 1, 2, 3 and 5 amp.

Results: Only the 0- and 1-amp fractions were analysed.

TABLE 54

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag - 0 amp	30.3	30.6	6.47	45.4	22.2
" - 1 amp	22.2	16.4	14.93	17.9	37.6
" - 2 amp	9.2				
" - 3 amp	9.0				
" - 5 amp	8.2				
Non-mag	21.1				
Feed (analysis)	100.0	20.4	8.83		

IRON O (b)

Object: To separate magnetite from ilmenite in the same material as O (a), ground to -48 mesh.

Test Data: Fractionation at 0, 1, 2, 3 and 5 amp.

Results: Only 0- and 1-amp fractions were analysed.

TABLE 55

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag - 0 amp	24.2	39.4	4.65	46.7	12.7
" - 1 amp	16.8	20.0	18.10	16.5	34.4
" - 2 amp	10.5				
" - 3 amp	5.8				
" - 5 amp	11.9				
Non-mag	30.8				
Feed (analysis)	100.0	20.4	8.83		

IRON O (c)

Object: Separation of magnetite from ilmenite in the same material as O (a), ground to -100 mesh.

Test Data: A rather elaborate procedure was followed in this test. The sample was first fractionated at 0, 1, 2, 3, 5 and 25 amp. Half of the mag at 0, 1, 2, and 3 amp were then separately cleaned, each at the corresponding amperage. The second half portions of the 0- and 1-amp mag were screened on 200 mesh, and the cleaner 0- and 1-amp mag were each screened on 150, 200 and 325 mesh.

Results: Analyses were obtained on the 0- and 1-amp products from the original fractionation, the corresponding cleaners, and the screen fractions of these same products, as shown in Table 56.

TABLE 56

Product	Wt %	Analysis %			Distribution %		
		Fe	Sol Fe	TiO_2	Fe	Sol Fe	TiO_2
Mag - 0 amp	8.4	51.4	49.4	3.63	21.1	23.8	3.5
+200 M	2.8	47.2	44.4	3.93			
-200 M	5.6	53.6	52.0	3.47			
Mag - 1 amp	4.8	30.4	27.2	27.8	7.2	7.5	15.0
+200 M	1.8	29.0	26.2	26.7			
-200 M	3.0	31.2	27.8	28.4			
Cleaner mag - 0 amp	7.9	57.2	54.4	1.92	22.1	24.6	1.7
-100 +150 M	1.3	50.0	47.4	3.04			
-150 +200 M	1.8	52.0	49.8	2.38			
-200 +325 M	2.0	56.4	52.8	1.88			
-325 M	2.8	64.0	61.6	1.10			
Cleaner mag - 1 amp	4.9	30.0	26.9	26.4	7.2	7.6	17.7
-100 +150 M	0.7	24.2	22.2	22.3			
-150 +200 M	1.3	28.8	25.8	26.3			
-200 +325 M	1.6	31.0	28.2	29.1			
-325 M	1.3	33.2	29.2	25.3			
Feed (analysis)		20.4	17.4	8.83			

Remarks: The -325 mesh portion of the cleaner mag at 0 amp contained 61.6 per cent Sol Fe (64 per cent total Fe) and only 1.1 per cent TiO_2. The coarser size fractions of this product graded lower in Fe and higher in TiO_2. To a lesser degree the same trend is shown by the +200 and -200 mesh of the 0-amp mag. Grade improvement by cleaning is illustrated by the mag 0-amp and cleaner mag 0-amp products. The indications are, therefore, that the magnetite content of the sample could be well concentrated at 0 amp at a sufficiently fine particle size.

IRON O (d)

Object: To separate magnetite from ilmenite in a conventional wet magnetic separator tails containing 15.8 per cent Fe and 9.96 per cent TiO_2, produced from the same material as O (a).

Test Data: Fractionation at 0, 1, 2, 3 and 5 amp.

Results: Only the 0- and 1-amp products were analysed.

TABLE 57

Product	Wt %	Analysis %		Dist %	
		Fe	TiO_2	Fe	TiO_2
Mag - 0 amp	5.6	24.4	6.3	8.7	3.5
" - 1 amp	12.4	27.8	29.5	21.8	36.7
" - 2 amp	19.5				
" - 3 amp	4.1				
" - 5 amp	14.6				
Non-mag	43.8				
Feed (analysis)	100.0	15.8	9.96		

IRON P (a)

Object: Concentration of iron from a sample composed chiefly of quartz and fine hematite.

Test Data: 1000 g of feed ground for 75 min in a ball mill at 50 per cent solids, and then screened on 100 mesh. The +100 mesh was observed to be chiefly quartz. The -100 mesh was separated at 3 amp. Non-mag and midd were scavenged at 3 amp.

Results:

TABLE 58

Product	Wt %	Fe %	Dist %
+100 M	1.0		
Combined mag	17.2	63.95	30.0
Non-mag	81.8	31.42	70.0
Feed (calc)	100.0	36.70	100.0

IRON P (b)

Object: Concentration of iron from the same material as P (a).

Test Data: 1000 g of feed was ground in a ball mill for 30 min at 50 per cent solids. The +200 mesh was screened out and reground for 15 minutes under the same conditions. The remaining +100 mesh was then screened out. The combined -100 mesh was separated at 3 amp. Non-mag and midd were scavenged at 3 amp.

Results:

TABLE 59

Product	Wt %	Fe %	Dist %
+100 M	0.4		
Combined mag	20.3	64.93	35.6
Non-mag	79.3	28.90	64.4
Feed (calc)	100.0	37.08	100.0

IRON P (c)

Object: To obtain more information on the fineness to which the material used in P (a) must be ground to liberate the values.

Test Data: Step fractionation at 0, 3, 5 and 25 amp. That is, separation at 0 amp with mag cleaned at 0 amp, and non-mag and midd from both steps joined as feed for 3-amp separation; the same pattern was repeated at 3 amp and at 5 amp, but the cleaning step was not used at 25 amp. The 0-, 3- and 5-amp products were screened on 325 mesh.

Results:

TABLE 60

Product	Wt %	Insol %	Dist %
Cleaner mag - 0 amp +325 M	3.1	15.8	1.0
-325 M	0.8	11.8	0.2
Cleaner mag - 3 amp +325 M	22.0	7.8	3.4
-325 M	3.6	5.8	0.4
Cleaner mag - 5 amp +325 M	9.2	15.0	2.7
-325 M	2.5	9.8	0.5
Mag - 25 amp	8.6	26.0	4.4
Non-mag	50.2	89.0	87.4
Feed (calc)	100.0	50.1	100.0

IRON Q

Object: Concentration of the iron from a sample of -100 mesh washer plant tailings containing goethite as the chief ore mineral.

Test Data: Fractionation at 3, 5 and 10 amp.

Results:

TABLE 61

Product	Wt %	SiO_2 %	Total Fe %	Sol Fe %	Dist Sol Fe %
Mag - 3 amp	14.2	7.32	61.22	51.80	22.5
" - 5 amp	20.7	7.68	58.74	55.08	34.8
" - 10 amp	10.9	15.96	52.38	45.92	15.3
Non-mag	54.2	70.12	17.95	16.54	27.4
Feed (calc)	100.0			32.74	100.0

IRON R (a)

Object: Concentration of the iron from a sample of -100 mesh Jeffrey Magnetic Separator tails containing hematite and quartz.

Test Data: Fractionation at 0 and 5 amp.

Results:

TABLE 62

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 0 amp	19.0	42.44	34.5	24.8
" - 5 amp	35.2	27.10	43.0	57.3
Non-mag	45.8		10.4	17.9
Feed (calc)	100.0		26.4	100.0

IRON R (b)

Object: Concentration of iron from the same material as R (a) but -200 mesh in particle size.

Test Data: Fractionation at 0 and 5 amp.

Results:

TABLE 63

Product	Wt %	SiO_2 %	Fe %	Dist Fe %
Mag - 0 amp	16.9	42.24	35.1	22.8
" - 5 amp	35.5	28.90	43.4	59.4
Non-mag	47.6		9.7	17.8
Feed (calc)	100.0		26.0	100.0

Remarks: Results are similar to those for R (a), the finer size having little effect.

IRON S (a)

Object: Recovery of hematite from a sample of Crockett Magnetic Separator tailings reground to -100 mesh. The original feed contained magnetite, hematite, goethite, pyrrhotite, and pyrite.

Test Data: Fractionation at 0 and 3 amp.

Results:

TABLE 64

Product	Wt %	Fe %	Dist %
Mag - 0 amp	9.5	29.82	21.9
" - 3 amp	10.6	19.44	15.9
Non-mag	79.9	10.08	62.2
Feed (calc)	100.0	12.95	100.0

IRON S (b)

Object: Recovery of hematite from a sample of Jeffrey Magnetic Separator tailings reground to -100 mesh. Ore from the same source as S (a).

Test Data: Fractionation at 0, 3 and 10 amp.

Results:

TABLE 65

Product	Wt %	Fe %	Dist %
Mag - 0 amp	11.7	21.10	19.7
" - 3 amp	10.6	19.32	16.5
" - 10 amp	21.5	17.70	30.5
Non-mag	56.2	7.38	33.3
Feed (calc)	100.0	12.48	100.0

Remarks: Compare with S (a).

IRON S (c)

Object: Recovery of hematite from the same material as S (b) but ground to -200 mesh.

Test Data: Fractionation at 0, 3 and 10 amp.

Results:

TABLE 66

Product	Wt %	Fe %	Dist %
Mag - 0 amp	9.6	33.28	23.0
" - 3 amp	9.2	18.74	12.4
" - 10 amp	19.2	18.00	25.0
Non-mag	62.0	8.88	39.6
Feed (calc)	100.0	13.87	100.0

Remarks: Results still poor, although the finer grind produced some improvement in grade.

IRON T (a)

Object: Recovery of the iron from a sample of secondary cyclone overflow (slime), 85 per cent -20 microns in particle size, and containing a reported 16.8 per cent Fe, 34 per cent of which was thought to be in magnetite and the rest in hematite.

Test Data: Fractionation at 0, 5 and 25 amp.

Results:

TABLE 67

Product	Wt %	Sol Fe %	Dist %
Mag - 0 amp	14.8	44.8	44.4
" - 5 amp	16.1	20.8	22.4
" - 25 amp	12.2	14.0	11.5
Non-mag	56.9	5.7	21.7
Feed (calc)	100.0	14.9	100.0

IRON T (b)

Object: Recovery of iron from the same material as T (a).

Test Data: Separation at 0 amp. Mag cleaned at 0 amp. Combined non-mag and midd separated at 3 amp. Mag cleaned at 3 amp.

Results:

TABLE 68

Product	Wt %	Sol Fe %	Dist %
Mag - 0 amp	10.8	51.6	39.2
" - 3 amp	6.8	22.0	10.5
Non-mag	82.4	8.7	50.3
Feed (calc)	100.0	14.2	100.0

Remarks: Cleaning improved the grade a little but recovery remained low. Compare with T (a).

IRON T (c)

Object: Recovery of iron from the same material as T (a).

Test Data: Procedure as in T (b), but sodium silicate used as a dispersant for the fine, slimy pulp.

Results:

TABLE 69

Product	Wt %	Sol Fe %	Dist %
Mag - 0 amp	10.6	53.1	37.4
" - 3 amp	7.1	25.1	11.8
Non-mag	82.3	9.3	50.8
Feed (calc)	100.0	15.1	100.0

Remarks: Very little improvement through the use of sodium silicate.

IRON T (d)

Object: Recovery of iron from the same material as T (a).

Test Data: Procedure as in T (b), but hydrofluosilic acid used as dispersant.

Results:

TABLE 70

Product	Wt %	Sol Fe %	Dist %
Mag - 0 amp	10.8	53.7	39.3
" - 3 amp	6.6	22.8	10.1
Non-mag	82.6	9.1	50.6
Feed (calc)	100.0	14.8	100.0

Remarks: Hydrofluosilicic acid as dispersant did not improve the separation to any extent.

IRON U (a)

Object: To concentrate the iron from a sample of dry classifier fines, mostly -200 mesh, and containing approximately 12 per cent magnetite and 30 per cent hematite, with quartz, grunerite and a little talc.

Test Data: Separation at 3 amp.

Results:

TABLE 71

Product	Wt %	Sol Fe %	Dist %
Mag	18.4	52.02	48.4
Non-mag	81.6	12.01	51.6
Feed (calc)	100.0	19.79	100.0

IRON U (b)

Object: Concentration of iron from the same material as U (a).

Test Data: Fractionation at 0, 3, 7 and 25 amp.

Results:

TABLE 72

Product	Wt %	Sol Fe %	Dist %
Mag - 0 amp	17.2	60.22	41.7
" - 3 amp	18.5	52.48	39.0
" - 7 amp	15.1	23.67	14.3
" - 25 amp	5.8	7.99	1.8
Non-mag	43.4	1.84	3.2
Feed (calc)	100.0	24.90	100.0

Remarks: The combined 0- and 3-amp fractions contain 80.7 per cent of the iron at a grade of 56.0 per cent Fe.

IRON U (c)

Object: Concentration of iron from the same material as U (a).

Test Data: Separation at 3 amp; mag cleaned at the same setting. Combined 3-amp non-mag scavenged at 5 amp; mag cleaned at the same setting.

Results:

TABLE 73

Product	Wt %	Sol Fe %	Dist %
Cleaner mag - 3 amp	21.0	64.58	62.0
" " - 5 amp	13.3	40.91	24.9
" non-mag - 5 amp	4.2	8.41	1.6
Non-mag - 5 amp	61.5	4.09	11.5
Feed (calc)	100.0	21.84	100.0

Remarks: Cleaning at 3 amp gave a much improved separation. The cleaner mag at 5 amp might be roasted and recovered.

IRON U (d)

Object: Concentration of iron from the same material as U (a).

Test Data: Separation at 0 amp; mag cleaned at 0 amp and the cleaner mag recleaned at the same amperage. Combined non-mag scavenged at 3 amp, with the mag cleaned at 3 amp and the cleaner mag recleaned at the same setting.

Results:

TABLE 74

Product	Wt %	Sol Fe %	Dist %
Recleaner mag - 0 amp	13.0	65.6	35.8
" " - 3 amp	13.0	60.9	35.3
" non-mag -3 amp	2.8	45.1	5.6
Cleaner non-mag -3 amp	9.2	25.7	10.6
Non-mag - 3 amp	62.0	4.6	12.7
Feed (calc)	100.0	22.4	100.0

Remarks: This procedure should be compared with that of U (c): 0 and 3 amp have been used in place of 3 and 5 amp, and each product has been given an additional "recleaning" step. As a result the combined 0- and 3-amp products yield a 71 per cent recovery at 63.4 per cent Fe, compared to the 3-amp product of 62 per cent recovery at 64.6 per cent Fe in U (c).

IRON U (e)

Object: To concentrate the iron from the same material as U (a), and to observe the effect of "reverse fractionation".

Test Data: Separation at 0 amp. Non-mag scavenged at 0 amp. Combined mag cleaned at 0 amp. Combined non-mag scavenged at 5 amp; non-mag rescavenged at 5 amp. The combined 5-amp mag subjected to "reverse fractionation", as follows: separation at 25 amp, mag cleaned at 25 amp; the 25-amp cleaner mag separated at 10 amp; the 10-amp mag separated at 7 amp, mag cleaned at 7 amp; the 7-amp cleaner mag separated at 5 amp, and mag cleaned at 5 amp.

Results:

TABLE 75

Product		Wt %	Sol Fe %	Dist %
Cleaner mag -	0 amp	10.0	66.2	30.7
" " -	5 amp	20.8	50.3	48.7
" non-mag -	5 amp	2.1	28.2	2.8
Non-mag -	5 amp	2.6	22.4	2.7
Cleaner non-mag -	7 amp	2.0	21.8	2.0
Non-mag -	7 amp	2.4	19.7	2.2
" " -	10 amp	1.4	22.4	1.4
Cleaner non-mag -	25 amp	1.2	22.9	1.3
Non-mag -	25 amp	3.9	10.9	2.0
Scavenger non-mag -		53.6	2.5	6.2
Feed (calc)		100.0	21.5	100.0

Remarks: The unusually complex arrangement of this test was largely to collect information on the performance of the equipment. It was also hoped that the grade of secondary material, e.g., the 5-amp cleaner mags of U (c), might be improved. The 5-amp cleaner mags (Table 75) show that this was done, but at the expense of the primary product rather than a direct improvement.

IRON V (a)

Object: Concentration of iron to a minimum of 60 per cent Fe from a sample of plant tailings composed of goethite, hematite, magnetite, quartz, carbonates, and iron silicates. The material assayed at 36.8 per cent Fe and 36.7 per cent SiO_2, and was 60 per cent -325 in particle size, although about 3 per cent was above 20 mesh.

Test Data: The +20 mesh was removed by screening; -20 mesh was fractionated at 0, 3, 7 and 25 amp.

Results:

TABLE 76

Product	Wt %	Acid Insol %	Sol Fe %	Dist Fe %
+20 M	1.6	44.54	31.44	1.4
Mag - 0 amp	2.5	26.37	44.44	3.2
" - 3 amp	7.7	14.14	53.86	11.8
" - 7 amp	21.4	10.01	55.65	33.9
" - 25 amp	9.7	23.28	45.41	12.5
Non-mag	57.1	54.82	22.95	37.2
Feed (calc)	100.0	38.16	35.16	100.0

IRON V (b)

Object: Concentration of iron from the same material as V (a).

Test Data: The +20 mesh was screened out. The -20 mesh was separated at 7 amp and the non-mag scavenged at 7 amp. The combined mag was cleaned at 7 amp and the mag recleaned at 7 amp.

Results:

TABLE 77

Product	Wt %	Sol Fe %	Dist %
+20 M	2.0	(32.4)*	1.8
Recleaner mag	16.8	59.7	27.2
" non-mag	4.2	54.9	14.1
Cleaner non-mag	11.3	46.1	6.2
Scavenger non-mag	65.7	28.4	50.7
Feed (calc)	100.0	36.9	100.0

* Average of +20 from V (a) and V (d).

IRON V (c)

Object: Concentration of iron from the same material as V (a).

Test Data: The +20 mesh was removed by screening. The -20 mesh was separated at 10 amp and the non-mag was scavenged at 10 amp. The combined mag was cleaned at 10 amp and the mag recleaned at 10 amp.

Results:

TABLE 78

Product	Wt %	Sol Fe %	Dist %
+20 M	2.3	(32.4)*	2.0
Recleaner mag	25.2	59.0	40.0
" non-mag	3.0	51.7	4.2
Cleaner non-mag	10.8	41.9	12.2
Scavenger non-mag	58.7	26.4	41.6
Feed (calc)	100.0	37.2	100.0

* Average of +20 from V (a) and V (d).

IRON V (d)

Object: Concentration of iron from the same material as V (a).

Test Data: The +20 mesh was removed by screening. The -20 mesh was separated at 10 amp and the non-mag was scavenged at 10 amp. The combined mag was separated at 25 amp, the mag cleaned at 25 amp, and the cleaner mag recleaned at 25 amp.

Results:

TABLE 79

Product	Wt %	Acid Insol %	Sol Fe %	Dist Fe %
+20 M	3.7	42.8	33.4	3.5
Recleaner mag	25.1	5.8	60.0	42.4
" non-mag	1.4	12.7	53.6	2.1
Cleaner non-mag	2.8	17.5	50.3	4.0
Non-mag - 25 amp	9.6	35.1	37.9	10.2
" " - 10 amp	57.4	54.6	23.4	37.8
Feed (calc)	100.0	38.4	35.5	100.0

KYANITE A (a)

Object: To remove biotite and garnet from a sample containing, beside these two minerals, kyanite, quartz and feldspar, and ground to -28 mesh.

Test Data: Fractionation at 10 and 25 amp.

Results:

TABLE 80

Product	Wt %	Fe %	Dist %
Mag - 10 amp	40.6	12.0	92.8
" - 25 amp	2.0	9.14	3.4
Midd	16.7	0.47	1.5
Non-mag	40.7	0.30	2.3
Feed (calc)	100.0	5.30	100.0

Remarks: The particle size of this material was substantially -28 +325 mesh; very little -325 was developed during the grind. The combined magnetics contained 96 per cent of the iron, representing virtually all the garnet and biotite.

KYANITE A (b)

Object: To remove the biotite remaining in a dry, high-intensity magnetic separator reject from a kyanite flotation concentrate made from the same material as A (a).

Test Data: Separation at 10 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at 25 amp. All mag and midd combined.

Results:

TABLE 81

Product	Wt %	Biotite %
Mag and midd	52.4	95.5
Non-mag	47.6	0.0
Feed (calc)	100.0	50.0

Remarks: The non-mag fraction contained 95 per cent of the kyanite in the feed, and this was 68 per cent -325 mesh in particle size. The fact that this was done on material which had already been subjected to magnetic separation is of particular interest.

MAGNESITE A

Object: To remove chlorite from a sample composed chiefly of magnesite and chlorite, ground to -100 mesh.

Test Data: Separation at 25 amp.

Results:

TABLE 82

Product	Wt %	LOI %
Mag	8.5	40.7
Non-mag	91.5	32.4
Feed (calc)	100.0	33.1

Remarks: LOI (loss on ignition) was used as an approximation of the magnesite content. The magnetic fraction shows a higher magnesite content than the non-magnetic. Examination revealed that iron-stained magnesite grains, rather than chlorite, had been concentrated in the magnetic fraction.

MAGNESITE B (a)

Object: To lower the iron content of a sample composed of magnesite and silica. The sample was -28 mesh in particle size.

Test Data: Separation at 25 amp.

Results:

TABLE 83

Product	Wt %	Fe_2O_3 %	Dist %
Mag	3.4	9.4	9.0
Midd	34.0	3.3	31.4
Non-mag	62.6	3.4	59.6
Feed (calc)	100.0	3.6	100.0

MAGNESITE B (b)

Object: To lower the iron content in the same material as B (a).

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp.

Results:

TABLE 84

Product	Wt %	Fe_2O_3 %	Dist %
Mag - 25 amp	4.5	7.8	10.7
Cleaner mag	0.7	5.2	1.2
" midd	30.7	3.1	29.0
" non-mag	64.1	3.0	59.1
Feed (calc)	100.0	3.3	100.0

MANGANOSIDERITE A

Object: To concentrate manganese from a slurry sample reported to contain 25 per cent manganosiderite, the chief gangue mineral being pyrite.

Test Data: Fractionation at 5 and 25 amp. The 25-amp non-mag was scavenged at the same setting; 25-amp and scavenger mag combined.

Results:

TABLE 85

Product	Wt %	Mn %	Dist %
Mag - 5 amp	29.8	10.7	91.3
" - 25 amp	8.2		
Non-mag - 25 amp	62.0		
Feed	100.0		

Remarks: Analysis was supplied by the submitter, and only the 5 amp results were reported. Submitter stated that this result was "very interesting".

MANGANOSIDERITE B (a)

Object: Concentration of manganese from a sample containing lead, zinc, feldspar, quartz, etc., as well as the manganosiderite, ground to -28 mesh.

Test Data: Fractionation at 5, 10 and 25 amp.

Results:

TABLE 86

Product	Wt %	Mn %	Dist %
Mag - 5 amp	63.6	10.3	71.0
" - 10 amp	9.7	14.5	15.3
" - 25 amp	4.0	8.7	3.7
Non-mag	22.7	4.1	10.0
Feed (calc)	100.0	9.2	100.0

MANGANOSIDERITE B (b)

Object: Concentration of manganese from a sample of manganosiderite tailing from the same material as B (a).

Test Data: Fractionation at 5, 10 and 25 amp.

Results:

TABLE 87

Product	Wt %	Mn %	Dist %
Mag - 5 amp	28.0	19.8	53.5
" - 10 amp	16.6	13.5	21.8
" - 25 amp	6.8	10.7	6.9
Non-mag	48.6	3.8	17.8
Feed (calc)	100.0	10.4	100.0

MARMATITE A

Object: Concentration of zinc from a sample containing marmatite, pyrite and some manganosiderite, -28 mesh in particle size.

Test Data: Fractionation at 10 and 25 amp. The 25-amp non-mag was scavenged at the same setting, the scavenger mag being added to the 25-amp mag.

Results:

TABLE 88

Product	Wt %	Zn %	Dist %
Mag - 10 amp	41.2	47.2	13.8
" - 25 amp	25.8	47.6	52.8
Non-mag	33.0	15.4	33.4
Feed (calc)	100.0	36.9	100.0

Remarks: The marmatite was found to contain 54.4 per cent Zn. The 10-amp mag contained some manganosiderite, and the 25-amp mag some pyrite.

MONAZITE A

Object: To determine the susceptibility of monazite to magnetic separation by fractionating a sample of high-grade concentrate.

Test Data: Fractionation at 3, 5, 7, 10 and 25 amp.

Results:

TABLE 89

Product	Wt %	ThO_2 %
Mag - 3 amp	1.4	5.93
" - 5 amp	25.0	6.19
" - 7 amp	41.8	6.26
" - 10 amp	27.4	6.26
" - 25 amp	3.5	5.70
Non-mag	0.9	----
Feed (calc)	100.0	6.19

Remarks: The significant column is Wt %. As this is a concentrate little difference in grade would be expected, the amperage at which the material is removed indicating the susceptibility range -- in this case 5 to 10 amp. Grade, however, does show some concentration in this range.

MUD A

Object: To determine whether iron-bearing minerals could be removed from an extremely fine-grained river mud containing 3.2 per cent Fe_2O_3.

Test Data: Fractionation at 5 and 25 amp.

Results: Analyses were not obtained, but an examination of the magnetic products by microscope revealed a high concentration of iron-bearing minerals. The mag at 5 amp represented 0.9 per cent of the feed weight, and at 25 amp, 3.9 per cent.

NICKEL A

Object: Concentration of nickel in a -28 mesh sample of the concentrate from a producing mine.

Test Data: Fractionation at 0, 3, 5, 10 and 25 amp.

Results:

TABLE 90

Product	Wt %	Ni %	Dist %
Mag - 0 amp	12.2	5.93	6.2
" - 3 amp	14.5	19.53	24.2
" - 5 amp	13.5	23.79	27.4
" - 10 amp	12.6	19.25	20.7
" - 25 amp	7.9	12.22	8.2
Non-mag	39.3	4.02	13.3
Feed (calc)	100.0	11.75	100.0

Remarks: The combined 3- to 25-amp mag fractions represent a recovery of 80.5 per cent of the nickel in 48.5 per cent of the bulk at a grade of 19.5 per cent Ni. In view of high concentrate shipping costs, this was of considerable interest to the submitter.

PHLOGOPITE A

Object: Concentration of phlogopite from a sample also containing quartz and carbonaceous material.

Test Data: The +20 mesh content was screened out. The -20 mesh was separated at 25 amp; mag cleaned at 25 amp.

Results:

TABLE 91

Product	Wt %	Phlogopite %
+20 M	20.4	
Mag - 25 amp	15.2	75
Cleaner mag	3.4	75
" non-mag	61.0	
Feed	100.0	

Remarks: The submitter indicated that this was the best concentration obtained by several methods tried.

PYROCHLORE A

Object: Separation of pyrochlore from apatite in a pyrochlore flotation concentrate.

Test Data: The sample was blunged with Javex to remove amine coatings on the particles. Separation was at 25 amp.

Results: Microscopic examination indicated poor selectivity.

PYROCHLORE B

Object: To determine the susceptibility of pyrochlore to magnetic separation, using a pyrochlore flotation concentrate as feed.

Test Data: Fractionation at 2, 4, 8, 10, 15 and 25 amp.

Results: The products were not weighed or analysed, but each was examined microscopically. The 2-amp mag was low in pyrochlore; all other products had roughly the same concentration.

Remarks: Pyrochlore appears to have a very wide range of magnetic susceptibility, possibly due to a variable composition. A tendency was noted for progressively darker pyrochlore to appear in fractions from successively lower amperages, i.e. from light amber in the non-mag to a dark, red-brown in the 4-amp product.

PYROCHLORE C

Object: To see whether any significant concentration of pyrochlore could be obtained by magnetic separation of a sample of flotation concentrates containing silicates and calcite as well as pyrochlore.

Test Data: Fractionation at 3, 5, 10 and 25 amp.

Results:

TABLE 92

Product	Wt %	Analysis %			Distribution %		
		Nb_2O_5	Fe	SiO_2	Nb_2O_5	Fe	SiO_2
Mag - 3 amp	8.4	2.55	23.8	21.9	1.1	22.6	8.5
" - 5 amp	13.6	4.13	15.6	26.6	2.9	24.1	16.8
" - 10 amp	38.4	20.20	7.7	22.3	40.3	33.5	39.8
" - 25 amp	18.4	29.80	4.4	17.3	28.5	9.2	14.8
Non-mag	21.2	24.70	4.4	20.4	27.2	10.6	20.1
Feed (calc)	100.0	17.25	7.9	19.3	100.0	100.0	100.0

Remarks: The combined 3- and 5-amp fractions would reject 22 per cent of the weight at 3.5 per cent Nb_2O_5, for a loss of 4 per cent of the niobium. The remaining 78 per cent of the sample contained 23.7 per cent Nb_2O_5, an increase in grade of 6.5 per cent. The total weight of sample available for testing was 130 grams. It is of interest to note that some 20 passes through the equipment were made in preliminary and final testing, with a loss of only 13 grams of the sample.

RUTILE A

Object: To remove ilmenite from a sample of rutile concentrate.

Test Data: Fractionation at 3 and 25 amp.

Results:

TABLE 93

Product	Wt %	Fe_2O_3 %	Dist %
Mag - 3 amp	2.6	10.02	29.5
" - 25 amp	4.2	3.56	16.9
Non-mag	93.2	0.51	53.6
Feed (calc)	100.0	0.88	100.0

Remarks: Some iron is usually present in rutile. The mag fractions contained 46.4 per cent of the iron in 6.8 per cent of the bulk. This separation was considered very promising by the submitter.

SAND A

<u>Object:</u> To remove iron-bearing minerals from a material thought to be suitable for foundry sand if the iron content could be sufficiently lowered.

<u>Test Data:</u> Separation at 25 amp.

<u>Results:</u> The mag represented 15 per cent of the bulk. The non-mag was examined and found acceptable as foundry sand.

SAND B

<u>Object:</u> Removal of iron-stained grains and a very small amount of pyrite from a sand sample -28 +150 mesh in particle size.

<u>Test Data:</u> Separation at 25 amp.

<u>Results:</u> On this material a comparison was made between the Jones separator and a dry high-intensity magnetic separator.

TABLE 94

Product	Jones Separator		Dry Separator	
	Wt %	Fe_2O_3 %	Wt %	Fe_2O_3 %
Mag	2.2		5.0	
Non-mag	97.8	0.075	95.0	0.10
Feed (calc)	100.0	0.11	100.0	0.11

<u>Remarks:</u> Better efficiency was obtained on the Jones separator than on the dry separator. The dry separator product was actually a cleaner mag as compared with the single operation on the Jones. Stained grains were easily distinguished, particularly in the Jones mag.

SAND C

Object: The removal of iron-bearing minerals and stained grains from a sample of beach sand -28 mesh in particle size.

Test Data: Separation at 25 amp.

Results:

TABLE 95

Product	Wt %	Fe %	Dist %
Mag	3.7	5.16	44.0
Midd	39.4	0.32	28.0
Non-mag	56.9	0.22	28.0
Feed (calc)	100.0	0.45	100.0

Remarks: The iron in the non-mag remained too high for glass sand.

SAND D

Object: To remove iron-bearing minerals and stained grains from a sample of beach sand which is also -28 mesh in particle size but taken from a different source than C.

Test Data: Separation at 25 amp.

Results:

TABLE 96

Product	Wt %	Fe %	Dist %
Mag	8.0	9.63	69.0
Midd	27.8	0.50	12.5
Non-mag	64.2	0.32	18.5
Feed (calc)	100.0	1.10	100.0

Remarks: Results similar to C sample.

SAND E

Object: To remove stained quartz, and grains with inclusions of a dark mineral, from a sample of silica sand.

Test Data: Separation at 25 amp.

Results: Although 2 per cent of the sample was removed as a magnetic fraction, a microscopic examination of the non-mag showed many grains with dark inclusions. Because of this, no analyses were obtained.

EXPLANATORY NOTE ON SCHEELITE A

A Mines Branch investigation into the concentration of WO_3 from an ore containing approximately 50 per cent pyrrhotite, iron silicates, calcite and scheelite, took place over an extended period. As part of this investigation, samples were submitted, from time to time, for test by the Jones separator. An unusual number of Jones tests for any one material, during this phase of the Jones work, thus accumulated. These have been roughly sub-divided as follows:

Test No.	Feed
(a) to (e)	Ore
(f) to (h)	Table concentrate, first set.
(i)	Table concentrate, pilot plant run.
(j)	Flotation concentrate, pilot plant run.
(k) to (m)	Table concentrate, second set.

SCHEELITE A (a)

Object: Concentration of the scheelite from a tungsten ore containing pyrrhotite, iron silicates, calcite and scheelite, -100 mesh in particle size.

Test Data: Fractionation at 1, 3, 5 and 10 amp.

Results:

TABLE 97

Product	Wt %	WO_3 %	Dist %
Mag - 1 amp	9.5	0.01	0.03
" - 3 amp	7.8	0.01	0.03
" - 5 amp	20.3	0.01	0.07
" - 10 amp	17.3	0.01	0.07
Non-mag	45.1	3.56	99.80
Feed (calc)	100.0	2.00	100.00

Remarks: Results show that approximately 55 per cent of the bulk would be removed as magnetics with one pass at 10 amp, with practically no loss of tungsten.

SCHEELITE A (b)

Object: Concentration of scheelite from the same material as A (a).

Test Data: Fractionation at 3 and 25 amp.

Results:

TABLE 98

Product	Wt %	WO_3 %	Dist %
Mag - 3 amp	26.2	0.18	1.2
" - 25 amp	50.7	0.61	7.9
Non-mag	23.1	15.40	90.9
Feed (calc)	100.0	3.91	100.0

Remarks: Compare with A (a). The non-mag contained a higher grade but with lower recovery.

SCHEELITE A (c)

Object: Concentration of scheelite from the same material as A (a).

Test Data: Fractionation at 10 and 25 amp.

Results:

TABLE 99

Product	Wt %	WO_3 %	Dist %
Mag - 10 amp	66.1	0.08	1.3
" - 25 amp	5.9	0.68	0.9
Non mag	28.0	14.60	97.8
Feed (calc)	100.0	4.15	100.0

SCHEELITE A (d)

Object: Concentration of scheelite from the same material as A (a).

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp.

Results:

TABLE 100

Product	Wt %	WO_3 %	Dist %
Mag - 25 amp	74.4	0.40	7.5
Cleaner mag	4.7	2.46	2.9
Non-mag	20.9	16.95	89.6
Feed (calc)	100.0	3.96	100.0

SCHEELITE A (e)

Object: To see whether mixed grains were reducing effectiveness of the separation on the same material as A (a).

Test Data: Feed screened into +200 and -200 mesh fractions, and each separated at 25 amp.

Results:

TABLE 101

Product	Wt %	WO_3 %	Dist %
Mag +200 M	32.2	0.96	7.8
" -200 M	43.1	0.24	2.6

Remarks: The +200 mesh fraction lost 7.8 per cent of the WO_3 in 32.2 per cent of the bulk. The -200 mesh lost 2.6 per cent of the WO_3 in 43.1 per cent of the bulk. This indicates mixed grains in the +200 mesh and the need for a finer grind.

SCHEELITE A (f)

Object: To further concentrate scheelite from a table concentrate produced from the same material as A (a), -65 mesh in particle size.

Test Data: Separation at 25 amp.

Results:

TABLE 102

Product	Wt %	WO_3 %	Dist %
Mag	51.0	11.43	14.0
Non-mag	49.0	73.20	86.0
Feed (calc)	100.0	40.70	100.0

Remarks: A good separation was obtained although the grade and recovery were lower than desired. The loss to mag suggests the need for finer grinding.

SCHEELITE A (g)

Object: To further concentrate scheelite in a table concentrate produced from the same material as A (a), -100 mesh in particle size.

Test Data: Separation at 25 amp.

Results:

TABLE 103

Product	Wt %	WO_3 %	Dist %
Mag	42.6	10.12	8.9
Non-mag	57.4	76.83	91.1
Feed (calc)	100.0	48.41	100.0

Remarks: Improved grade and recovery were obtained with the finer feed. Analysis of the concentrate also showed: Cu - trace, P - 0.019 per cent, S - 0.12 per cent, Fe - 0.07 per cent. The mag contained 0.03 per cent Cu.

SCHEELITE A (h)

Object: This test was a duplicate of Test A (g).

Test Data: Separation at 25 amp.

Results:

TABLE 104

Product	Wt %	WO_3 %	Dist %
Mag	38.0	10.71	8.1
Non-mag	62.0	75.20	91.9
Feed (calc)	100.0	50.69	100.0

Remarks: Feed grade was slightly higher than A (g); concentrate grade was slightly lower, but recovery slightly higher. On the whole this test was a very close duplication of A (g). Analysis of the concentrate also showed: Cu - 0.01 per cent, P - 0.006 per cent, S - 0.11 per cent, and Fe - 0.19 per cent. Copper in the mag was 0.02 per cent.

SCHEELITE A (i)

Object: Further concentration of tungsten from several hundred pounds of table concentrate made on a pilot plant scale from the same material as A (a).

Test Data: Continuous operation. Separation at 25 amp.

Results: A high grade of product was recovered: WO_3 - 75.6 per cent, CaO - 17.95 per cent, SiO_2 - 1.54 per cent, Al_2O_3 - 0.21 per cent.

Remarks: This run demonstrated that continuous operation is practical, and that a product similar to that from batch operation could be made. Compare with A (g) and A (h).

SCHEELITE A (j)

Object: Further concentration of tungsten from flotation concentrate as part of the same pilot plant run as A (i).

Test Data: Continuous operation. About 185 lb of flotation concentrate, assaying 15.6 per cent WO_3, was separated at 25 amp. The non-mag was tabled and the table concentrate was further concentrated by Jones separator at 25 amp.

Results:

TABLE 105

Product	Wt %	WO_3 %	Dist %
Flotation conc (feed)	100.0	15.58	100.0
1st stage mag	45.5	4.57	13.3
" " non-mag (table feed)	54.5	24.80	86.7
1st stage feed (calc)	100.0	15.66	100.0
Table tail	12.4	19.50	15.5
" midd	21.9	18.00	25.3
" conc (2nd stage feed)	20.2	35.33	45.9
Table feed (calc)	54.5	24.80	86.7
2nd stage mag	6.7	8.80	3.8
" " non-mag	13.5	48.50	42.1
2nd stage feed (calc)	20.2	35.40	45.9

Remarks: The magnetic separation was not as successful as on table concentrate, Tests A (g), A (h), and A (i). Feed grade was a great deal lower. Upgrading was good, and recovery high in both stages of magnetic separation, but final concentrate was comparatively low in grade.

SCHEELITE A (k)

Object: To further concentrate scheelite from a table concentrate from the same material as A (a), -80 mesh in particle size.

Test Data: Separation at 25 amp.

Results:

TABLE 106

Product	Wt %	WO_3 %	Dist %
Mag	34.4	9.07	6.6
Non-mag	65.6	67.28	93.4
Feed (calc)	100.0	47.20	100.0

Remarks: Feed grade was slightly lower for this lot than for Tests A (g) and A (h). Recovery was up a little over those tests, but concentrate grade was a good deal lower.

SCHEELITE A (1)

Object: Further concentration of scheelite from the coarse fraction (-80 +200 mesh) of a table concentrate from the same material as A (a).

Test Data: Separation at 25 amp.

Results:

TABLE 107

Product	Wt %	WO_3 %	Dist %
Mag	46.5	6.21	7.5
Non-mag	53.5	67.03	92.5
Feed (calc)	100.0	38.79	100.0

SCHEELITE A (m)

Object: Further concentration of scheelite from the finer fraction (-200 mesh) of a table concentrate from the same material as A (a).

Test Data: Separation at 25 amp.

Results:

TABLE 108

Product	Wt %	WO_3 %	Dist %
Mag	51.6	3.84	6.1
Non-mag	48.4	63.38	93.9
Feed (calc)	100.0	32.68	100.0

SCHEELITE B (a)

Object: Concentration of the scheelite from a sample of flotation concentrate.

Test Data: Fractionation at 5 and 10 amp.

Results:

TABLE 109

Product	Wt %	WO_3 %	Dist %
Mag - 5 amp	24.2	11.86	6.9
" - 10 amp	9.2	4.85	1.1
Non-mag	66.6	57.83	92.0
Feed (calc)	100.0	41.82	100.0

Remarks: The flotation reagent used was oleic acid, which tends to produce flocculation and interfere with magnetic separation.

SCHEELITE B (b)

Object: Concentration of scheelite from the same material as B (a).

Test Data: Separation at 25 amp.

Results:

TABLE 110

Product	Wt %	WO_3 %	Dist %
Mag	33.0	5.16	3.86
Non-mag	67.0	63.28	96.14
Feed (calc)	100.0	44.10	100.00

Remarks: An improvement in recovery and grade was realized over B (a). Later work conducted elsewhere produced a concentrate of 72.4 per cent WO_3 with a recovery of 99.38 per cent by Jones separator.

TALC A (a)

Object: To obtain a product with the highest possible reflectivity from a sample of mine-run talc, composed of talc, chlorite and pyrrhotite, with a reflectivity of 65 per cent and ground to -48 mesh. (NOTE: The term "reflectivity", as used herein in all tests on talc, refers to a measure of the amount of light reflected from a packed surface of the sample in comparison with that reflected from a packed surface of magnesium carbonate powder. With the latter value arbitrarily set at 100, the "reflectivity" may be stated as a percent. There is a tendency for coarser particles to "scatter" light. Therefore, a reading made on very fine, packed particles is usually higher than one made on coarser particles. For many of the tests on talc a reflectivity determination was made on a little of the non-mag which had been reduced to -325 mesh, in addition to the determination on the product itself. The "fine-ground" value is given in the Remarks section of the test to which it applies).

Test Data: Fractionation at 10 and 25 amp.

Results:

TABLE 111

Product	Wt %	Reflectivity %
Mag - 10 amp	10.3	40.5
" - 25 amp	10.6	44.0
Midd - 25 amp	16.6	66.0
Non-mag	62.5	70.5
Feed	100.0	65.0

Remarks: Fine-ground reflectivity of non-mag was 78 per cent.

TALC A (b)

Object: To obtain the highest possible reflectivity from the same material as A (a) ground to -65 mesh.

Test Data: Separation at 25 amp; non-mags cleaned at 25 amp.

Results:

TABLE 112

Product	Wt %	Reflectivity %
Mag - 25 amp	11.6	44.5
Cleaner mag	5.2	44.5
" midd	35.2	65.0
" non-mag	48.0	70.8
Feed	100.0	65.0

Remarks: The reflectivity of non-mag at -65 mesh was about the same as A (a). Fine-ground reflectivity was 78 per cent.

TALC A (c)

Object: To obtain the highest possible reflectivity from the same material as A (a), but ground to -200 mesh.

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at the same setting.

Results:

TABLE 113

Product	Wt %	Reflectivity %
Mag - 25 amp	7.0	47.0
Cleaner mag	4.4	50.0
Recleaner mag	2.8	51.5
" midd	33.8	70.0
" non-mag	52.0	70.5
Feed	100.0	65.0

Remarks: From A (a) and A (b) it had been inferred that finer initial grinding might allow better removal of dark-coloured material. In this case, finer particle size plus more cleaning failed to produce a non-mag of higher reflectivity. Fine-ground reflectivity was again 78 per cent.

TALC A (d)

Object: To obtain the highest possible reflectivity from the same material as A (a), ground to -65 mesh.

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at the same setting.

Results:

TABLE 114

Product	Wt %	Reflectivity %
Mag - 25 amp	11.7	56.5
Cleaner mag	6.2	54.0
Recleaner mag	4.5	54.5
" midd	33.0	74.6
" non-mag	44.6	77.5
Feed	100.0	65.0

Remarks: Compared with Test A (b), the extra cleaning here appears to have resulted in increased reflectivity of non-mag. Fine-ground reflectivity was 79.5 per cent.

TALC A (e)

Object: To obtain the highest possible reflectivity from the same material as A (a), ground to -65 mesh.

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp; cleaner non-mag recleaned at 25 amp, and recleaner non-mag again recleaned at the same setting.

Results:

TABLE 115

Product	Wt %	Reflectivity % *
Mag - 25 amp	17.3	60.0
Cleaner mag	5.3	67.2
1st recleaner mag	6.0	76.0
2nd recleaner mag	3.7	77.0
" " midd	2.7	77.0
Non-mag	65.0	83.5
Feed	100.0	65.0

* On portions of each product ground to -325 M.

Remarks: In comparison with the earlier tests, all the reflectivities above are at a higher level because fine-ground values are given for all products. The additional recleaning resulted in a fair increase in reflectivity of non-mag over that for A (d).

TALC A (f)

Object: To obtain the highest possible reflectivity from the same material as A (a), but on a -28+65 mesh fraction screened from the ground feed.

Test Data: Procedure exactly the same as for Test A (e).

Results:

TABLE 116

Product	Wt %	Reflectivity % *
Mag - 25 amp	31.6	60.7
Cleaner mag	23.1	71.0
1st recleaner mag	14.5	72.0
2nd recleaner mag	7.4	71.0
" " midd	4.5	74.0
Non-mag	18.9	82.0
Feed	100.0	65.0

* On portions ground to -325 M

Remarks: The coarse feed resulted in high losses to mag fractions.

TALC B (a)

Object: To improve the reflectivity of a talc product, 99.9 per cent -325 mesh in particle size, with a reflectivity of 74 per cent, and developed from the mine-run material of Sample A.

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp. Feed at 5 per cent solids.

Results:

TABLE 117

Product	Wt %	Reflectivity %
Mag - 25 amp	9.5	51.0
Cleaner mag	5.0	57.0
" midd	28.5	77.5
" non-mag	57.0	78.0
Feed	100.0	74.0

TALC B (b)

Object: To increase reflectivity of the same material as B (a).

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at 25 amp.

Results:

TABLE 118

Product	Wt %	Reflectivity %
Mag - 25 amp	8.4	53.2
Cleaner mag	7.3	56.5
Recleaner mag	4.2	62.0
" midd	28.4	79.0
" non-mag	51.7	79.0
Feed	100.0	74.0

Remarks: Recleaning resulted in little improvement over B (a).

TALC B (c)

Object: To improve reflectivity of the same material as B (a).

Test Data: Separation at 25 amp; non-mag cleaned, etc., through three recleaning stages, all at 25 amp.

Results:

TABLE 119

Product	Wt %	Reflectivity %
Mag - 25 amp	11.1	48.5
Cleaner mag	9.0	62.0
1st recleaner mag	3.2	58.0
2nd " "	1.0	59.0
3rd " "	1.2	61.5
3rd " non-mag	74.5	77.0
Feed	100.0	74.0

Remarks: Multiple cleaning does not improve the reflectivity of this very fine material.

TALC B (d)

Object: To observe more closely the effect of cleaning on the same material as B (a).

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at 25 amp. Reflectivity readings were obtained on all products from each stage.

Results:

TABLE 120

Product	Wt %	Reflectivity %
Mag - 25 amp	12.0	55.0
Midd - 25 amp	7.6	75.0
Non-mag - 25 amp	80.4	78.0
Cleaner mag	6.6	59.0
" midd	50.2	78.0
" non-mag	31.2	78.0
Recleaner mag	4.6	63.0
" midd	30.2	77.0
" non-mag	46.6	78.0
Feed	100.0	74.0

Remarks: Although a little of the dark material was removed with each magnetic fraction the results clearly show that cleaning has virtually no effect on the reflectivity of the product.

TALC C (a)

Object: To improve the reflectivity of a second talc product, 95 per cent -325 mesh, with a reflectivity of 80 per cent, developed from the mine-run material of Sample A.

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp. Feed at 5 per cent solids.

Results:

TABLE 121

Product	Wt %	Reflectivity %
Mag - 25 amp	12.4	60.3
Cleaner mag	4.2	65.0
" midd	28.9	82.0
" non-mag	54.5	83.5
Feed	100.0	80.0

Remarks: Compare with B.

TALC C (b)

Object: To improve the reflectivity on the same material as C (a).

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at 25 amp. Feed at 10 per cent solids.

Results:

TABLE 122

Product	Wt %	Reflectivity %
Mag - 25 amp	11.6	68.6
Cleaner mag	2.5	65.0
Recleaner mag	1.2	62.0
" midd	30.4	82.5
" non-mag	54.3	84.5
Feed	100.0	80.0

Remarks: The recleaning and increased pulp density produced a very slight improvement in comparison with C (a).

TALC C (c)

Object: To improve the reflectivity of the same material as C (a).

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at 25 amp. Feed at 20 per cent solids.

Results:

TABLE 123

Product	Wt %	Reflectivity %
Mag - 25 amp	10.6	65.0
Cleaner mag	4.2	66.4
Recleaner mag	2.7	63.2
" midd	29.5	82.0
" non-mag	53.0	83.5
Feed	100.0	80.0

Remarks: The additional change in density gave no improvement over C (a).

TALC D (a)

Object: To examine the distribution of minerals in Jones separator fractions obtained from a sample of "hard" talc, from the same source as Sample A, having a reflectivity of 65 per cent, and -325 mesh in particle size. Hard talc contains magnesite in addition to the pyrrhotite and chlorite.

Test Data: Fractionation at 10 and 25 amp.

Results: An X-ray diffraction study was made of each product, in addition to the reflectivity determinations.

TABLE 124

Product	Wt %	Reflectivity %	X-ray Analysis (in order of abundance)
Mag - 10 amp	10.3	40.5	Pyrrhotite...magnesite
" - 25 amp	10.6	44.0	Chlorite...talc
Midd	16.6	66.0	Chlorite...talc
Non-mag	62.5	70.5	Talc....chlorite
Feed	100.0	65.0	Talc...chlorite... magnesite...pyrrhotite

Remarks: These results are of interest because they show that chlorite, as well as pyrrhotite, is removed magnetically. Location of the magnesite in the earliest mag was curious, until microscopic examination revealed that the magnesite was iron-stained. Since magnesite constitutes "grit" in talc, its removal is a fortunate circumstance.

TALC D (b)

Object: To further examine the reflectivity of products from the same material as D (a), 21 per cent -325 mesh in particle size.

Test Data: Fractionation at 0, 10 and 25 amp; non-mag at 25 amp cleaned at the same setting.

Results:

TABLE 125

Product	Wt %	Reflectivity %
Mag - 0 amp	1.7	37.0
" - 10 amp	25.6	43.6
" - 25 amp	11.6	44.0
Cleaner mag	7.4	45.6
" midd	25.9	67.8
" non-mag	27.8	70.6
Feed	100.0	65.0

Remarks: Results are similar to those for D (a). The coarser feed produced a greater loss to mag fractions than in D (a). Fine-ground reflectivity of non-mag was 78 per cent.

TALC D (c)

Object: To improve reflectivity of the same material as D (b).

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp.

Results:

TABLE 126

Product	Wt %	Reflectivity %
Mag - 25 amp	30.1	42.0
Cleaner mag	4.4	50.0
" midd	26.8	72.1
" non-mag	38.7	74.2
Feed	100.0	65.0

Remarks: Non-mag reflectivity was slightly higher than D (a) or D (b). Fine-ground reflectivity was 76.5 per cent.

TALC D (d)

Object: To improve reflectivity of the same material as D (a), 59 per cent -325 mesh in particle size.

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp, and cleaner non-mag recleaned at the same setting.

Results:

TABLE 127

Product	Wt %	Reflectivity %
Mag - 25 amp	21.7	53.4
Cleaner mag	4.6	51.0
Recleaner mag	3.3	43.8
" midd	27.1	73.8
" non-mag	43.3	76.4
Feed	100.0	65.0

Remarks: Fine-ground reflectivity of non-mag was 79 per cent.

TALC D (e)

Object: To improve reflectivity of the same material as D (a), 50 per cent -325 mesh in particle size.

Test Data: Procedure was exactly the same as for D (d).

Results:

TABLE 128

Product	Wt %	Reflectivity %
Mag - 25 amp	29.4	48.8
Cleaner mag	4.7	46.8
Recleaner mag	3.3	45.0
" midd	26.2	68.2
" non-mag	36.4	70.0
Feed	100.0	65.0

Remarks: Fine-ground reflectivity of non-mag was 76.5 per cent.

TALC D (f)

Object: To improve reflectivity of the same material as D (a), 26 per cent -325 mesh in particle size.

Test Data: Procedure exactly as for D (d).

Results:

TABLE 129

Product	Wt %	Reflectivity %
Mag - 25 amp	27.1	45.0
Cleaner mag	6.5	45.4
Recleaner mag	2.0	51.0
" midd	25.4	69.0
" non-mag	39.0	73.0
Feed	100.0	65.0

Remarks: Fine-ground reflectivity of non-mag was 77 per cent. Reflectivity of product does not appear to be closely linked with feed particle size in the finer range.

TALC D (g)

Object: To improve reflectivity of the same material as D (a) but -28+65 mesh in particle size.

Test Data: Procedure exactly as for D (d).

Results:

TABLE 130

Product	Wt %	Reflectivity %
Mag - 25 amp	53.2	38.0
Cleaner mag	7.2	40.4
Recleaner mag	5.2	43.0
" midd	16.0	48.0
" non-mag	18.4	49.0
Feed	100.0	41.5

Remarks: The result of using very coarse feed was low weight recovery and low non-mag reflectivity as compared to D (d), D (e) and D (f). Fine-ground reflectivity was, however, 82 per cent, the highest of the four comparative tests.

TITANIUM A

Object: To concentrate titanium and iron from a sample of electric furnace sludge from a producing plant.

Test Data: Fractionation at 0, 3, 5, 7, 10 and 25 amp.

Results:

TABLE 131

Product	Wt %	Analysis %		Dist %	
		TiO_2	Fe	TiO_2	Fe
Mag - 0 amp	42.1	30.2	24.6	42.2	51.5
" - 3 amp	36.6	31.8	19.4	38.6	35.2
" - 5 amp	3.4	28.8	15.9	3.3	2.7
" - 7 amp	2.1	27.1	15.0	1.9	1.5
" - 10 amp	2.0	27.0	13.0	1.8	1.3
" - 25 amp	1.8	25.9	12.0	1.6	1.1
Non-mag	12.0	26.7	11.2	10.6	6.7
Feed (calc)	100.0	30.1	20.1	100.0	100.0

URANIUM A (a)

Object: Concentration of uranium from a sample of quartz conglomerate containing brannerite, uraninite and monazite, ground to 60 per cent -200 mesh.

Test Data: Separation at 25 amp; mag cleaned at 25 amp, and cleaner mag fractionated at 0, 3, 5, 10, 17 and 25 amp.

Results:

TABLE 132

Product	Wt %	U_3O_8 %	Dist %
Non-mag - 25 amp	91.08	0.044	32.9
Cleaner non-mag	3.16	0.13	3.4
Mag - 0 amp	0.54	0.47	2.0
" - 3 amp	1.80	0.53	7.9
" - 5 amp	1.28	1.27	13.2
" - 10 amp	1.21	2.57	25.7
" - 17 amp	0.52	2.30	9.8
" - 25 amp	0.41	1.50	5.1
Feed (calc)	100.00	0.122	100.0

Remarks: Individual grains of brannerite, uraninite and monazite were identified under the microscope in each mag. These minerals appear to be sufficiently susceptible to magnetism to allow concentration by this means.

URANIUM A (b)

Object: Concentration of uranium from the same material as A (a).

Test Data: Separation at 25 amp.

Results: The concentrate contained 54 per cent of the U_3O_8 in 2.9 per cent of the bulk, at a grade of 2.8 per cent U_3O_8.

URANIUM A (c)

Object: Concentration of uranium from the same material as A (a).

Test Data: Separation at 25 amp; non-mag scavenged at 25 amp.

Results: The combined mag contained 67.1 per cent of the U_3O_8 in 8.9 per cent of the bulk, at a grade of 0.92 per cent U_3O_8.

Remarks: The scavenging step increased recovery at the expense of grade.

URANIUM A (d)

Object: Concentration of uranium from the same material as A (a).

Test Data: Separation at 25 amp; non-mag screened on 200 mesh, and +200 reground to all -200. The combined -200 mesh was scavenged at 25 amp. Scavenger non-mag rescavenged at 25 amp.

Results: The combined mag contained 78 per cent of the U_3O_8 in 7 per cent of the bulk, at a grade of 1.51 per cent U_3O_8.

URANIUM A (e)

Object: Concentration of uranium from the same material as A (a).

Test Data: Separation at 25 amp; non-mag scavenged at 25 amp; scavenger non-mag rescavenged at 25 amp with "closed" plates (i. e., normal plate gap reduced to increase magnetic intensity at groove peaks).

Results: The combined mag contained 78.2 per cent of the U_3O_8 in 13.2 per cent of the bulk at a grade of 1.19 per cent U_3O_8.

Remarks: The procedure used in this test differed from that for A (d) by substituting "closed" plates for regrind. Double the bulk was removed with no increase in recovery.

URANIUM A (f)

Object: Concentration of uranium from the same material as A (a) but -28 mesh in particle size.

Test Data: Separation at 25 amp followed by four scavenging steps on successive non-mag, each preceded by a light regrind, and all at 25 amp.

Results: In this test the combined mag contained 92.6 per cent of the U_3O_8 in 19.9 per cent of the bulk, with a grade of 0.62 per cent U_3O_8.

Remarks: A good recovery was obtained by this complex treatment.

URANIUM A (g)

Object: Recovery of uranium from a flotation concentrate of acid-consuming minerals obtained from the same material as A (a).

Test Data: Fractionation at 0, 3, 7, 17 and 25 amp.

Results:

TABLE 133

Product	Wt %	U_3O_8 %	Dist %
Mag - 0 amp	2.0	0.22	2.01
" - 3 amp	2.2	0.94	9.54
" - 7 amp	2.4	0.95	10.50
" - 17 amp	2.0	0.90	8.25
" - 25 amp	2.8	0.72	9.25
Non-mag	88.6	0.15	60.45
Feed (calc)	100.0	0.22	100.00

URANIUM A (h)

Object: Recovery of uranium from the same material as A (g), but from another flotation test.

Test Data: Separation at 25 amp.

Results:

TABLE 134

Product	Wt %	U_3O_8 %	Dist %
Mag	11.2	0.79	31.3
Non-mag	88.8	0.22	68.7
Feed (calc)	100.0	0.28	100.0

URANIUM A (i)

Object: Recovery of uranium from the same material as A (g), but from a third flotation test.

Test Data: Separation at 25 amp.

Results:

TABLE 135

Product	Wt %	U_3O_8 %	Dist %
Mag	12.2	0.71	38.3
Non-mag	87.8	0.16	61.7
Feed (calc)	100.0	0.23	100.0

URANIUM B

Object: Concentration of uranium from a quartz conglomerate containing brannerite, uraninite and monazite but from a different source than A, ground to 63 per cent -200 mesh.

Test Data: Separation at 25 amp.

Results:

TABLE 136

Product	Wt %	U_3O_8 %	Dist %
Mag	6.6	1.28	59.7
Non-mag	93.4	0.06	40.3
Feed (calc)	100.0	0.14	100.0

Remarks: Results are similar to those for A (b), to which this test should compare. However, a higher weight was removed as mag in this test, with correspondingly low U_3O_8.

URANIUM C

Object: Concentration of uranium from a quartz conglomerate containing brannerite, uraninite and monazite but from still another source than A and B.

Test Data: Separation at 25 amp.

Results:

TABLE 137

Product	Wt %	U_3O_8 %	Dist %
Mag	8.3	0.89	57.3
Non-mag	91.7	0.06	42.7
Feed (calc)	100.0	0.13	100.0

Remarks: Results are again similar to A (b), and to B, to which this test should compare. Recovery for the three tests is in fairly close agreement. Bulk in mag here is still higher than for B, with grade correspondingly lower.

URANIUM D (a)

Object: Concentration of uranium from a weathered pegmatite containing uraninite and uranorthotite, ground to 50 per cent -200 mesh.

Test Data: Separation at 25 amp.

Results: In this test, 58.7 per cent of the U_3O_8 was concentrated in 24.4 per cent of the bulk, at a grade of 0.26 per cent U_3O_8.

URANIUM D (b)

Object: To see whether acid consumption would be less on magnetic concentrate than on ore, with the same material as D (a).

Test Data: Separation at 25 amp; mag cleaned at the same setting.

Results: The cleaner mag contained 29 per cent of the bulk for a recovery of 66.2 per cent of the U_3O_8 at a grade of 0.22 per cent U_3O_8. Consumption of acid on ore was 60 lb/ton and on the magnetic concentrate 46.7 lb/ton, a saving of 13.3 lb/ton.

URANIUM D (c)

Object: To see if uranium could be recovered from a flotation concentrate of acid consuming minerals from the same material as D (a).

Test Data: Separation at 25 amp.

Results:

TABLE 138

Product	Wt %	U_3O_8 %	Dist %
Mag	50.4	0.068	51.0
Non-mag	49.6	0.068	49.0
Feed (calc)	100.0	0.068	100.0

URANIUM E (a)

Object: Concentration of uranium from a sample of classifier overflow from a producing plant.

Test Data: Separation at 25 amp.

Results:

TABLE 139

Product	Wt %	U_3O_8 %	Dist %
Mag	20.6	0.434	45.7
Non-mag	79.4	0.134	54.3
Feed (calc)	100.0	0.196	100.0

URANIUM E (b)

Object: Concentration of uranium from the same material as E (a).

Test Data: Separation at 25 amp; non-mag scavenged at 25 amp; combined mag cleaned at 0 amp.

Results:

TABLE 140

Product	Wt %	U_3O_8 %	Dist %
Scavenger non-mag	73.6	0.12	44.6
Cleaner mag	0.7	0.38	1.4
" non-mag	25.7	0.42	54.0
Feed (calc)	100.0	0.20	100.0

URANIUM E (c)

Object: Concentration of uranium from the same material as E (a).

Test Data: Separation at 25 amp; non-mag scavenged at 25 amp; combined mag fractionated at 3, 5 and 10 amp.

Results:

TABLE 141

Product	Wt %	U_3O_8 %	Dist %
Scavenger non-mag	75.6	0.13	50.0
Mags - 3 amp	1.4	0.42	3.0
" - 5 amp	4.4	0.50	11.2
" - 10 amp	8.0	0.48	19.6
Non-mag	10.6	0.30	16.2
Feed (calc)	100.0	0.20	100.0

URANIUM F

Object: Concentration of uranium from a flotation concentrate of acid-consuming minerals made from the ore of a producing mine.

Test Data: Separation at 25 amp.

Results:

TABLE 142

Product	Wt %	U_3O_8 %	Dist %
Mag	11.0	0.85	55.2
Non-mag	89.0	0.13	44.8
Feed (calc)	100.0	0.21	100.0

URANIUM G

Object: Concentration of uranium and vanadium from a small sample ground to 55 per cent -200 mesh.

Test Data: Fractionation at 3 and 25 amp.

Results:

TABLE 143

Product	Wt %	Analysis %		Dist %	
		U_3O_8	V_2O_5	U_3O_8	V_2O_5
Mag - 3 amp	2.9	0.31	0.78	3.8	4.3
" - 25 amp	16.6	0.41	1.35	28.6	42.4
Non-mag	80.5	0.20	0.35	67.6	53.3
Feed (calc)	100.0	0.24	0.53	100.0	100.0

WOLFRAMITE A

Object: To concentrate wolframite from a mill tailing reported to contain 0.015 per cent WO_3.

Test Data: Separation at 25 amp; mag fractionated at 5, 10 and 17 amp.

Results:

TABLE 144

Product	Wt %	WO_3 %	Dist %
Mag - 5 amp	0.30	2.550	28.9
" - 10 amp	0.41	0.524	7.9
" - 17 amp	0.24	0.294	2.6
Non-mag - 17 amp	2.27	0.154	13.1
" " - 25 amp	96.78	0.013	47.5
Feed (calc)	100.00	0.027	100.0

Remarks: Calculated feed was considerably higher than the reported assay.

WOLFRAMITE B (a)

Object: Concentration of wolframite from a sample containing about 4 per cent WO_3, -20 mesh in particle size.

Test Data: Fractionation at 0, 5, 10 and 25 amp.

Results:

TABLE 145

Product	Wt %	WO_3 %	Dist %
Mag - 0 amp	2.0	7.0	3.1
" - 5 amp	5.0	40.8	44.6
" - 10 amp	3.1	19.2	13.1
" - 25 amp	2.1	14.3	6.6
Non-mag	87.8	1.7	32.6
Feed (calc)	100.0	4.6	100.0

Remarks: A concentration at 5 amp is demonstrated, although recovery is low.

WOLFRAMITE B (b)

Object: Concentration of wolframite from the same material as B (a).

Test Data: Separation at 5 amp; non-mag scavenged at 5 amp; combined mag cleaned at 5 amp. Non-mag combined for analysis.

Results:

TABLE 146

Product	Wt %	WO_3 %	Dist %
Mag	2.9	71.00	52.8
Non-mag	97.1	1.90	47.2
Feed (calc)	100.0	3.90	100.0

Remarks: A good grade resulted from this procedure, but at modest recovery.

WOLFRAMITE B (c)

Object: Concentration of wolframite from the same material as B (a).

Test Data: Separation at 5 amp; non-mag scavenged at 5 amp; combined mag cleaned at 5 amp.

Results:

TABLE 147

Product	Wt %	WO_3 %	Dist %
Cleaner mag	2.9	68.80	48.9
" non-mag	1.9	15.20	7.1
Scavenger non-mag	95.2	1.88	44.0
Feed (calc)	100.0	4.07	100.0

WOLFRAMITE C (a)

Object: Concentration of wolframite from a sample from the same source as B but a different vein, -20 mesh in particle size and containing approximately 3 per cent WO_3.

Test Data: Fractionation at 0, 5, 10 and 25 amp.

Results:

TABLE 148

Product	Wt %	WO_3 %	Dist %
Mag - 0 amp	2.1	3.68	2.2
" - 5 amp	3.0	28.40	23.2
" - 10 amp	2.9	18.00	14.2
" - 25 amp	2.2	8.00	4.8
Non-mag	89.8	2.26	55.6
Feed (calc)	100.0	3.66	100.0

WOLFRAMITE C (b)

Object: Concentration of wolframite from the same material as C (a).

Test Data: Separation at 25 amp; non-mag scavenged at 25 amp; combined mag ground to -65 mesh and cleaned at 5 amp.

Results:

TABLE 149

Product	Wt %	WO_3 %	Dist %
Cleaner mag	1.7	46.00	30.4
" non-mag	5.9	11.05	25.5
Scavenger non-mag	92.4	1.22	44.1
Feed (calc)	100.0	2.56	100.0

Remarks: Both grade and recovery up in comparison with C (a).

WOLFRAMITE C (c)

Object: Concentration of wolframite from the same material as C (a).

Test Data: Separation at 10 amp; non-mag scavenged at 10 amp; combined mag cleaned at 5 amp.

Results:

TABLE 150

Product	Wt %	WO_3 %	Dist %
Cleaner mag	2.1	57.4	41.5
" non-mag	3.6	11.92	14.8
Scavenger non-mag	94.3	1.35	43.7
Feed (calc)	100.0	2.90	100.0

Remarks: Both recovery and grade substantially increased over C (b).

WOLLASTONITE A

Object: To raise the grade of a wollastonite sample, -100 mesh in particle size, containing garnet and biotite, to 98 per cent or higher wollastonite.

Test Data: Separation at 25 amp.

Results: In this test, 33.7 per cent of the sample was removed in the mag fraction. The non-mag contained some coarse, dark flakes which were separated out on a 100 mesh screen. The -100 mesh product was reported by the submitter to be of acceptable grade.

Remarks: This material had been considered as waste, or non-treatable by dry magnetic separation, by the submitter.

WOLLASTONITE B

Object: To raise the grade of a second sample of wollastonite from the same source as A to 98 per cent or higher in grade.

Test Data: Separation at 25 amp.

Results: The mag fraction contained 14 per cent of this sample. The submitter reported that the non-mag was of acceptable grade.

Remarks: This material was apparently of higher initial grade than A.

WOLLASTONITE C

Object: To obtain a grade of 98 per cent or higher wollastonite from a third sample from the same source as A, but comparatively coarse, only 2.3 per cent passing 100 mesh and 7.5 per cent being + 16 mesh.

Test Data: Separation at 25 amp; non-mag cleaned at 25 amp.

Results: In this test, 44.4 per cent of the sample was removed in the mag fraction, and was reported to be practically free of wollastonite by the submitter. The -40 mesh portion of the non-mag was reported to be grade material, but the +40 mesh contained many mixed grains.

Remarks: There is an excellent possibility that regrinding the +40 mesh fraction and recycling, or further treating magnetically, would recover a good deal more of this material.

WOLLASTONITE D

Object: To obtain a grade of 98 per cent or higher wollastonite from a fourth sample from the same source as A, but all -16 mesh in particle size and about 40 per cent -100 mesh.

Test Data: Separation at 25 amp.

Results: In this test, 35.5 per cent of the sample was removed in the mag fraction and was reported by the submitter to be practically free of wollastonite. The -40 mesh non-mag was reported to be grade material, and the +40 mesh to be largely mixed grains.

Remarks: Very similar to C. The same remarks would apply.

WOLLASTONITE E

Object: To obtain a grade of 98 per cent or higher wollastonite from still another sample from the same source as A, but all -40 mesh in particle size with about 77 per cent -100 mesh.

Test Data: Separation at 25 amp.

Results: In this test, 14 per cent of the sample was removed as substantially wollastonite-free mag. The non-mag graded 99.2 per cent wollastonite, and the recovery was 98 per cent.

Remarks: A very sharp separation was made on this sample. Submitter indicated intention of conducting pilot plant tests on the -100 mesh (nominal) stockpile of material not treatable by dry magnetic separation.

ZEOLITES A

Object: Concentration of zeolites from a -48 mesh sample of schistose basalt containing approximately 17 per cent zeolites and some magnetite.

Test Data: Fractionation at 0, 10 and 25 amp.

Results:

TABLE 151

Product	Wt %	Zeolite %	Dist %
Mag - 0 amp	7.5	3.9	1.7
" - 10 amp	73.3	3.9	16.8
" - 25 amp	2.5	32.5	4.8
Midd	6.3	73.0	27.2
Non-mag	10.4	80.8	49.5
Feed (calc)	100.0	16.9	100.0

Remarks: The zeolites were observed to be liberated at -48 mesh. The grind to -48 mesh also produced 36 per cent -325 mesh. In this test, 76.7 per cent of the zeolite content was concentrated in the non-mag and midd at a grade of 77.9 per cent. About half of the zeolites was recovered at 80.8 per cent grade.

ZINC A (a)

Object: To remove undesirable pyrrhotite from sphalerite flotation concentrate, reported to contain 54.75 per cent Zn.

Test Data: Fractionation at 0, 1, 2, 3 and 25 amp.

Results:

TABLE 152

Product	Wt %	Zn %	Dist %
Mag - 0 amp	1.8	20.12	0.6
" - 1 amp	1.1	29.38	0.6
" - 2 amp	0.2	29.90	0.1
" - 3 amp	0.6	37.60	0.4
" - 25 amp	51.4	56.40	52.4
Non-mag	44.9	56.54	45.9
Feed (calc)	100.0	55.35	100.0

Remarks: Results suggest that 2-amp, or possibly 3-amp, separation would be helpful. Value of concentrate was reported to increase by $2.00 for every 1 per cent increase in zinc content. In this test a grade increase of above 1 per cent was shown over calculated feed grade, and 1.8 per cent over reported feed grade.

ZINC A (b)

Object: To remove undesirable pyrrhotite from the same material as A (a).

Test Data: Separation at 2 amp.

Results:

TABLE 153

Product	Wt %	Zn %	Dist %
Mag	3.9	26.40	1.9
Non-mag	96.1	55.95	98.1
Feed (calc)	100.0	54.79	100.0

ZINC A (c)

Object: To remove undesirable pyrrhotite from the same material as A (a).

Test Data: Separation at 3 amp; mag reground and scavenged at 3 amp.

Results:

TABLE 154

Product	Wt %	Zn %	Dist %
Non-mag - 3 amp	90.8	56.1	93.7
Scavenger non-mag	5.9	47.2	5.1
" mag	3.3	20.5	1.2
Feed (calc)	100.0	54.5	100.0

Remarks: Regrinding and rerunning reduced loss of zinc. The combined non-mag graded 55.6 per cent Zn with a recovery of 98.9 per cent.

CONCLUSIONS

1. The Jones Wet Magnetic Mineral Separator will readily isolate minerals of moderate magnetic susceptibility, such as hematite, ilmenite, garnet, or biotite.

2. Some minerals with very weak magnetic susceptibility are not completely isolated by the equipment.

3. With some mineral combinations a sharp separation is made; others display varying degrees of improvement.

4. A good separation depends on: a) full liberation of the minerals present; b) good dispersion of minerals in feed pulp; c) some magnetic susceptibility, over a fairly narrow range, for one or more constituents; d) a different susceptibility range for each magnetic mineral present; and e) the bulk constituent usually being non-magnetic.

5. If well liberated and well dispersed through the feed pulp, fineness of particle size is not an adverse factor -- micron particles may be separated.

6. Because a number of variables enter into the test procedures, an "investigation", rather than merely one or two tests, should normally be made.