FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 9 OF 1963.

A REPORT ON THE WASHABILITY CHARACTERISTICS OF THREE SAMPLES FROM BROCKWELL ANTHRACITE COLLIERY.

BY:
S. F. STREICHER.

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INTRODUCTION:

The Fuel Research Institute was requested by Messrs. Brockwell Anthracite Colliery Pty., Limited, to determine the washability characteristics of three samples of anthracite being small nuts, peas and pearls, respectively.

The samples, weighing about 400 lb. each, were taken by colliery officials and were railed to the Fuel Research Institute in grain bags.

ANALYSIS OF SAMPLES.

Representative sub-samples of each of the three products were subjected to detailed float and sink analyses on a fractional basis at 0.04 intervals in the specific gravity range 1.38 - 1.70.

Ash determinations were then carried out on all specific gravity fractions, and cumulative ash contents were calculated for the different specific gravities. These results are reported in Table 1. Washability curves were drawn for each product. (Figure 1 - 3).

DISCUSSION .../

DISCUSSION OF RESULTS:

It was understood that the Proprietors of Brockwell Anthracite Colliery were contemplating the purchase of a second-hand jig washer for the cleaning of their products.

The washability curves of the products show that treating this coal in a washer constitutes a formidable washing proposition under any circumstances.

The difficulty or otherwise of washing a coal is determined by the amount of ±0.1 specific gravity material present i.e. the percentage of material which is included in a specific gravity interval which extends to 0.1 specific gravity units on both sides of a proposed cut point.

A coal is considered difficult to wash in a jig washer when the amount of near gravity material exceeds about 20%. The washability curves of e.g. the small nuts show that, in an extreme case the amount of near gravity material can be as high as 89% when washing at specific gravity 1.48.

From the above it is evident that only a very efficient dense medium washer would be capable of treating this coal profitably, and that a jig washer would be totally unsuitable if an ash reduction of anything more than 3% is required.

As regards the suggestion that a bulk sample, be sent to the F.R.I. pilot plant for testing in the jig washer, it is felt that this would be a waste of time and money because:

(a) a large consignment of coal would be necessary for preliminary adjustments to the unit before any test work could be done;

(b) a fairly accurate prediction can be made of the probable performance of a washer on a coal of which the washability characteristics are known.

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The Tromp distribution curve is typical of the size of coal being treated and the type of separating machine used, but it is, for practical purposes, independent of the washability characteristics of the coal treated. Distribution curves for jigs on all sizes of coal are well known.

By applying a normal distribution curve for a jig, when treating a specific size fraction, to the washability characteristics of the type of coal to be treated, a fairly accurate prediction can be made of the efficiency that is to be expected.

Considering the washability characteristics of the small nuts, the following deductions can be made:

(i) When washing at say specific gravity 1.55 the theoretical yield and ash content of the washed product are 84.5% and 10.8%, respectively.

(ii) The amount of ±0.1 sp.gr. near gravity material at this cut point is ca. 65%.

(iii) By applying a distribution curve representing a probable error of 0.05, which is optimistic for a jig treating that size of coal, a yield of 75.8% and a product having an ash content of 11.1% can be expected. This means that for every 100 tons of raw coal treated, rather more than 8 tons of usable coal will be lost in the discard, and the product will be poorer to the extent of 0.3% ash.

If it is desired to bring the ash down to the required limit, washing will have to be done at a lower specific gravity with additional loss in yield of washed coal.

Efficiency figures on the smaller sizes will certainly be much poorer than the above, resulting in losses of at least double the said figure.

This problem would be seriously aggravated should marketing requirements demand an ash content of 10% or less.

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A dense medium washer treating the same coal at the same specific gravity can be expected to produce an efficiency in terms of probable error of better than 0.02.

When the above calculations are repeated applying a normal dense medium distribution curve representing a probable error of 0.02, it may be shown that a yield of 85.3% at an ash content of 10.9% can be expected.

The initial saving in capital expenditure, by buying the proposed second-hand jig, will certainly be eclipsed in a very short time by the extra recovery of saleable coal in a dense medium washer.

(SIGNED) S. F. STREICHER.
SENIOR TECHNICAL OFFICER.

PRETORIA.
28/3/63.

TABLE 1.

FLOAT AND SINK ANALYSIS OF PRODUCTS.

Specific Gravity Interval.	SMALL NUTS				P E A S				P E A R L S			
	YIELD		ASH		YIELD		ASH		YIELD		ASH	
	Fract. %	Cum. %	Fract. %	Cum. %	Fract. %	Cum. %	Fract. %	Cum. %	Fract. %	Cum. %	Fract. %	Cum. %
F. 1.38	0.14	0.14	5.8	5.8	0.12	0.12	5.1	5.1	1.22	1.22	4.7	4.7
1.38 - 1.42	12.69	12.83	7.2	7.18	5.99	6.11	6.1	6.08	8.10	9.32	7.1	6.79
1.42 - 1.46	36.08	48.91	9.1	8.60	22.77	28.88	7.8	7.44	20.50	29.82	8.1	7.69
1.46 - 1.50	24.63	73.54	12.2	9.80	34.66	63.54	9.9	8.78	27.56	57.38	9.1	8.37
1.50 - 1.54	9.33	82.87	16.9	10.60	14.88	78.42	13.2	9.62	19.26	76.67	12.9	9.51
1.54 - 1.58	6.16	89.03	21.4	11.35	6.39	84.81	18.5	10.29	7.58	84.25	17.9	10.26
1.58 - 1.62	3.48	92.51	24.8	11.86	3.40	88.21	22.4	10,76	3.96	88.21	22.8	10.82
1.62 - 1.66	1.87	94.38	29.2	12.20	3.20	91.41	26.4	11.31	3.05	91.26	26.3	11.34
1.66 - 1.70	1.39	95.77	34.3	12.52	1.99	93.40	31.9	11.75	2.03	93.29	30.0	11.75
S. 1.70	4.23		51.2		6.60		51.4		6.71		52.0	
Raw Coal	100.00	100.00	-	14.16	100.00	100.00	-	14.37	100.00	100.00		14.45

Fig. 3

Pearls

Cum. Ash %

18 16 14 12 10 8 6 4

Cum. Yield %

100 90 80 70 60 50 40 30 20 10 0

Cum. Ash %

130 140 150 160 170 180

SG

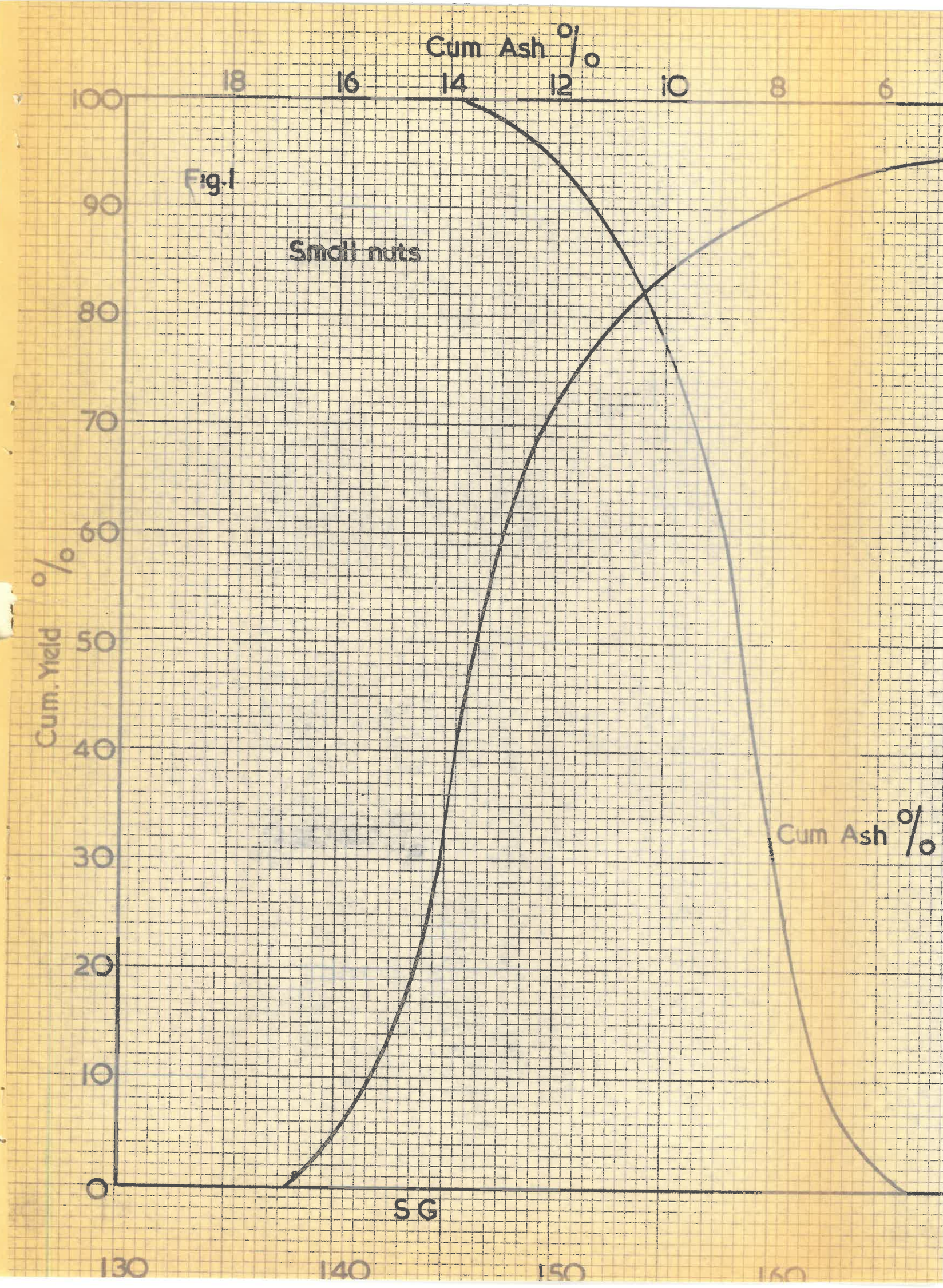
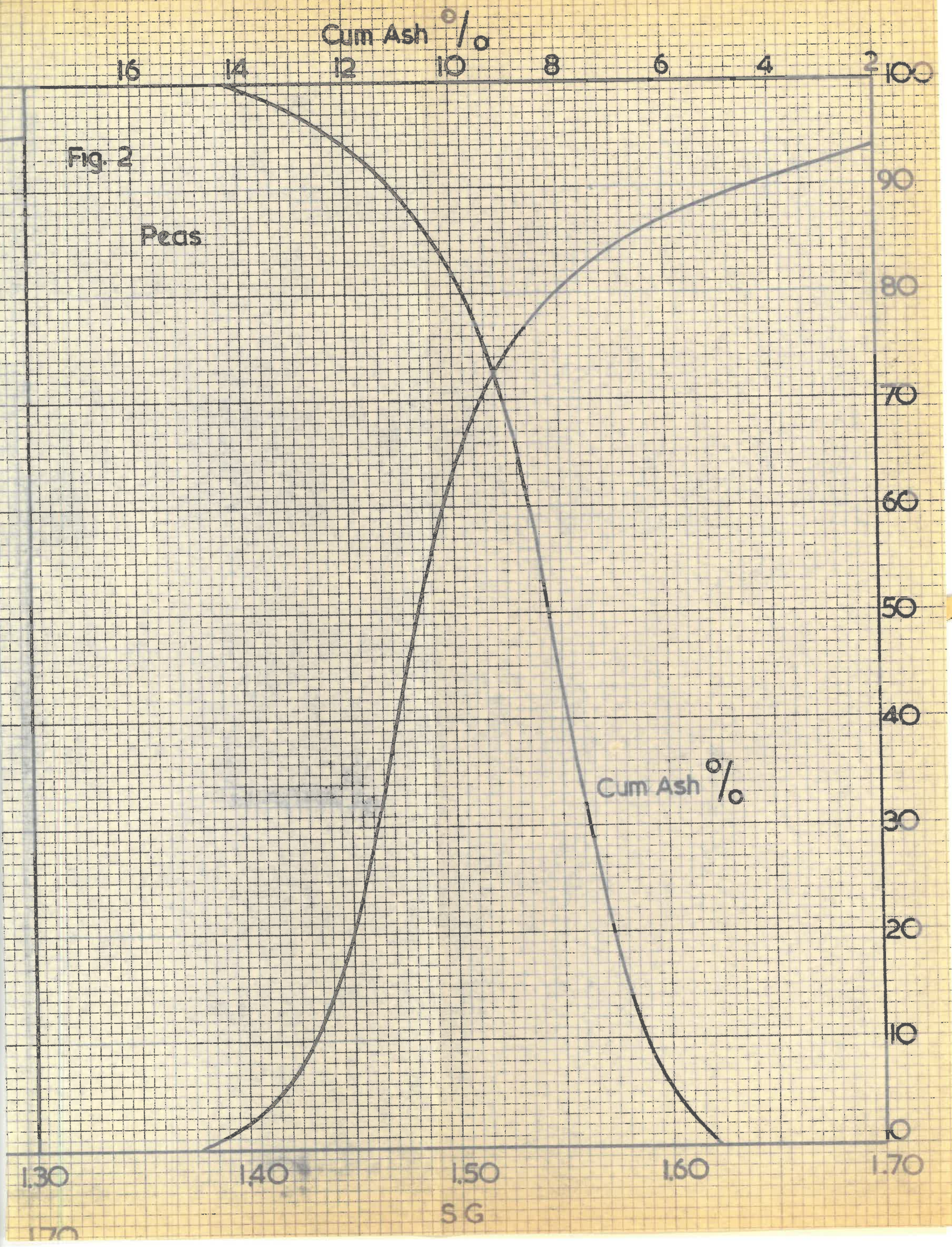

Cum Ash %
18
16
14
12
10
8
6
100
90
80
70
60
50
40
30
20
10
0
Cum. Yield %
Small nuts
Cum Ash %
S G
130
140
150
160

Fig.1


Cum Ash %
16
14
12
10
8
6
4
2
100
90
80
70
60
50
40
30
20
10
0
Fig. 2
Peas
Cum Ash %
1.30
1.40
1.50
1.60
1.70
S G