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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 33 OF 1965.



REPORT ON THE RESULTS OBTAINED FROM AN ACCEPTANCE
TEST CARRIED OUT ON THE COAL PREPARATION PLANT
AT PHOENIX COLLIERY, BEATH SECTION.

BY:

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INTRODUCTION:

The F.R.I. was requested by the Metallurgical Manager, Contracts Division, Fraser and Chalmers (S.A.) (Pty.) Ltd. to conduct an acceptance test on the newly commissioned Wemco Drum washer at Phoenix Colliery, Beath Section, on behalf of Johannesburg Consolidated Investment Co. Ltd.

OBJECT OF THE TEST:

The object of the test was to determine the efficiency of separation in the drum under full load conditions over a period of at least five hours. This entailed:

- (a) Sampling the products from the washer at pre-determined intervals over the test period.
- (b) Determining the total input to the plant at regular intervals.

THE TEST:

The test was carried out on Tuesday, June 15, 1965 and was started at 9 a.m. Because the total input to the plant under full load conditions exceeded the total underground output of the colliery, sampling had to be interrupted for 1 hour at 12 noon in order to allow the stock pile to build up sufficiently for the test to be continued. At 2.30 p.m., however, reserves were again so low that it was decided to stop the test rather than continue under reduced load conditions. The total test period was therefore reduced to 4½ hours.

The Wemco drum is designed to treat 6" x $\frac{5}{8}$ " coal, but in view of the excessive weights of samples that would have to be taken when the +4" material is included, it was decided by mutual consent of the parties concerned, that analysis would only be carried out on the -4" size

fractions/

fractions.

Washing efficiencies invariably decrease with diminishing size ranges treated, so that it follows that if the washer could meet the overall guarantee with the exclusion of the +4" size fraction, it must have done more than fulfill the overall guarantee.

LOAD TEST:

As no weightometer was available for weighing the raw coal feed to the plant, the load was determined by stopping the raw coal feed belt at 20 minute intervals and by clearing exactly 3 ft. of the conveyor and by weighing the increment obtained. The speed of the raw coal conveyor was determined under full load conditions and was found to be 324 ft. per minute. Results of these load determinations are reported in Table 1.

SAMPLING:

A. Raw Coal:

The increments obtained from the load determinations were screened at 4" and combined for use as a raw coal sample.

B. Washery Products:

Samples of clean coal and discard were obtained by taking increments (of approximately 100 lb.) at 5 min. intervals over the entire widths of the relevant draining, rinsing and dewatering screens. These samples were also screened at 4" on site.

After screening the samples were collected in grain bags and transported to the laboratories of the F.R.I. in Pretoria where they were analysed.

C. Medium in Circulation and Magnetic Separator Underflow:

Samples of the "correct density" medium in circulation and of the underflow from the magnetic separator were taken at 10 min. intervals over the test period.

ANALYSIS OF SAMPLES:

On arrival at Pretoria the samples of raw coal and washery products were air-dried, weighed and screened at $2\frac{1}{2}$ ", $\frac{7}{8}$ " and $\frac{3}{8}$ " (square holes). Results of these screen analyses are reported in Table 2.

RAW COAL:

Representative sub-samples of the different size fractions arising from the screen analysis were prepared for whole coal ash analysis.

CLEAN COAL AND DISCARD:

Representative sub-samples of all the size fractions except the $-\frac{2}{8}$ " size fractions of these products were subjected to detailed float and sink analyses on a fractional basis, at 0.02 intervals in the specific gravity range 1.54 to 1.74. Results of these analyses are reported in Tables 3 - 5.

Whole coal ash analyses were also carried out on representative sub-samples of all the different size fractions of these products.

MEDIUM AND MAGNETIC SEPARATOR UNDERFLOW:

The specific gravity of the medium sample was determined and the magnetic material content and screen analysis of the solids were determined. On the magnetic separator underflow the solids content and the percentage of magnetic material in the solids were determined.

These results are reported in Table 7.

YIELDS OF PRODUCTS:

As no facilities for the weighing of the raw coal and washery products were available the yields for the different separations had to be calculated from ash balances.

EVALUATION OF RESULTS:

Using the yield values obtained from the ash balances together with the float and sink data in Tables 3 - 5, the analyses of the feed for the different separations were reconstituted and distribution factors were calculated. These results are also reported in Tables 3 - 5.

Distribution curves were then drawn for each separation (Figures 1 - 3) and from these curves the specific gravity of separation for each size fraction was determined and probable errors were calculated. The weights of misplaced material in the products (calculated as a percentage of the feed) were also determined.

A summary of plant performance data is given in Table 6.

PRETORIA.
23rd July, 1965.

S.F. STREICHER.
PRINCIPAL TECHNICAL OFFICER.

TABLE 1.
LOAD DETERMINATIONS.

TIME	WEIGHT OF INCREMENT lb.	CALCULATED FEED T.P.H.
9.00	109.5	354.8
9.20	123.5	400.1
9.40	113.5	367.7
10.00	109.5	354.8
10.20	121.5	393.7
10.40	130.5	422.8
11.00	114.5	371.0
11.20	119.0	385.6
11.40	112.0	362.9
13.20	111.0	359.6
13.40	107.5	348.3
14.00	98.0	317.5
14.20	78.0	252.7
AVERAGE	-	360.9

TABLE 2.
SCREEN ANALYSIS OF RAW COAL AND PRODUCT SAMPLES.

SIZE FRACTION	RAW COAL			CLEAN COAL			DISCARD		
	YIELD			YIELD			YIELD		
	WEIGHT lb.	FRACT. %	CUM. %	WEIGHT lb.	FRACT. %	CUM. %	WEIGHT lb.	FRACT. %	CUM. %
4" x 2½"	246.75	18.93	18.93	1858.25	34.72	34.72	1080.25	30.24	30.24
2½" x 7/8"	534.0	40.97	59.90	2522.25	47.13	81.85	1775.75	49.72	79.96
7/8" x 3/8"	209.25	16.06	75.96	711.25	13.29	95.14	526.75	14.75	94.71
-3/8"	310.0	23.79	99.75	251.0	4.69	99.83	186.25	5.21	99.92
Loss	3.25	0.25		9.25	0.17		2.75	0.08	
TOTAL	1303.25	100.00	100.00	5352.0	100.00	100.00	3571.75	100.00	100.00

TABLE 4.
 FLOAT AND SINK ANALYSIS OF THE $-2\frac{1}{2}$ " + $\frac{7}{8}$ " SIZE FRACTION.

SPECIFIC GRAVITY	CLEAN COAL		DISCARD		RECONSTITUTED FEED		DISTRIBUTION FACTOR
	YIELD		YIELD		YIELD		
	FRACT. %	CUM. %	FRACT. %	CUM. %	FRACT. %	CUM. %	
F. 1.54	91.57	91.57	2.85	2.85	76.30	76.30	-
1.54	2.47	94.04	0.56	3.41	2.15	78.45	95.3
1.56	2.69	96.73	0.24	3.65	2.27	80.72	98.2
1.58	1.73	98.46	0.78	4.43	1.56	82.28	91.7
1.60	0.16	98.62	1.08	5.51	0.32	82.60	40.6
1.62	0.59	99.21	2.98	8.49	1.00	83.60	49.0
1.46	0.25	99.46	4.53	13.02	0.99	84.59	21.2
1.66	0.09	99.55	5.74	18.76	1.06	85.65	6.6
1.68	0.05	99.60	5.57	24.33	1.00	86.65	4.0
1.70	0.06	99.66	3.67	28.00	0.68	87.33	7.4
1.72	0.14	99.80	6.82	34.82	1.29	88.62	9.3
S. 1.74	0.22		65.17		11.39		-
TOTAL	100.02	100.02	99.99	99.99	100.01	100.01	

TABLE 5.
 FLOAT AND SINK ANALYSIS OF THE - 7/8" + 3/8" SIZE FRACTION.

SPECIFIC GRAVITY	CLEAN COAL		DISCARD		RECONSTITUTED FEED		DISTRIBUTION FACTOR
	YIELD		YIELD		YIELD		
	FRACT. %	CUM. %	FRACT. %	CUM. %	FRACT. %	CUM. %	
F. 1.54	88.32	88.32	4.85	4.85	74.05	74.05	-
1.54	3.21	91.53	1.06	5.91	2.84	76.89	93.7
1.56	2.21	93.74	1.36	7.27	2.06	78.95	88.8
1.58	2.05	95.79	1.67	8.94	1.99	80.94	85.4
1.60	0.61	96.40	1.89	10.83	0.83	81.77	61.4
1.62	1.05	97.45	3.48	14.31	1.47	83.24	59.2
1.64	0.77	98.22	3.56	17.87	1.25	84.49	51.2
1.66	0.53	98.75	5.00	22.87	1.30	85.79	33.8
1.68	0.37	99.12	5.15	28.02	1.19	86.98	26.1
1.70	0.21	99.33	5.68	33.70	1.14	88.12	14.9
1.72	0.14	99.47	4.70	38.40	0.92	89.04	13.0
S. 1.74	0.53		61.60		10.97		-
TOTAL	100.00	100.00	100.00	100.00	100.01	100.01	

TABLE 6.
PLANT PERFORMANCE DATA.

SIZE FRACTION	RAW COAL ASH %	CLEAN COAL		DISCARD		CUT POINT	E.P.	MISPLACED MATERIAL %		
		YIELD %	ASH %	YIELD %	ASH %			CLEAN COAL	DISCARD	TOTAL
4" x 2½"	15.8	89.3	12.6	10.7	42.6	1.63	0.014	0.6	1.0	1.6
2½" x 7/8"	17.5	82.8	12.0	17.2	44.0	1.63	0.019	1.3	1.3	2.6
7/8" x 3/8"	17.9	82.9	12.7	17.1	43.1	1.64	0.041	2.1	2.5	4.5
-3/8"	16.5	-	13.9	-	39.0	-	-	-	-	-

TABLE 7.
ANALYSIS OF MEDIUM SAMPLE.

S.G. 1.63
MAGNETIC MATERIAL IN SOLIDS 90.5%

SCREEN ANALYSIS

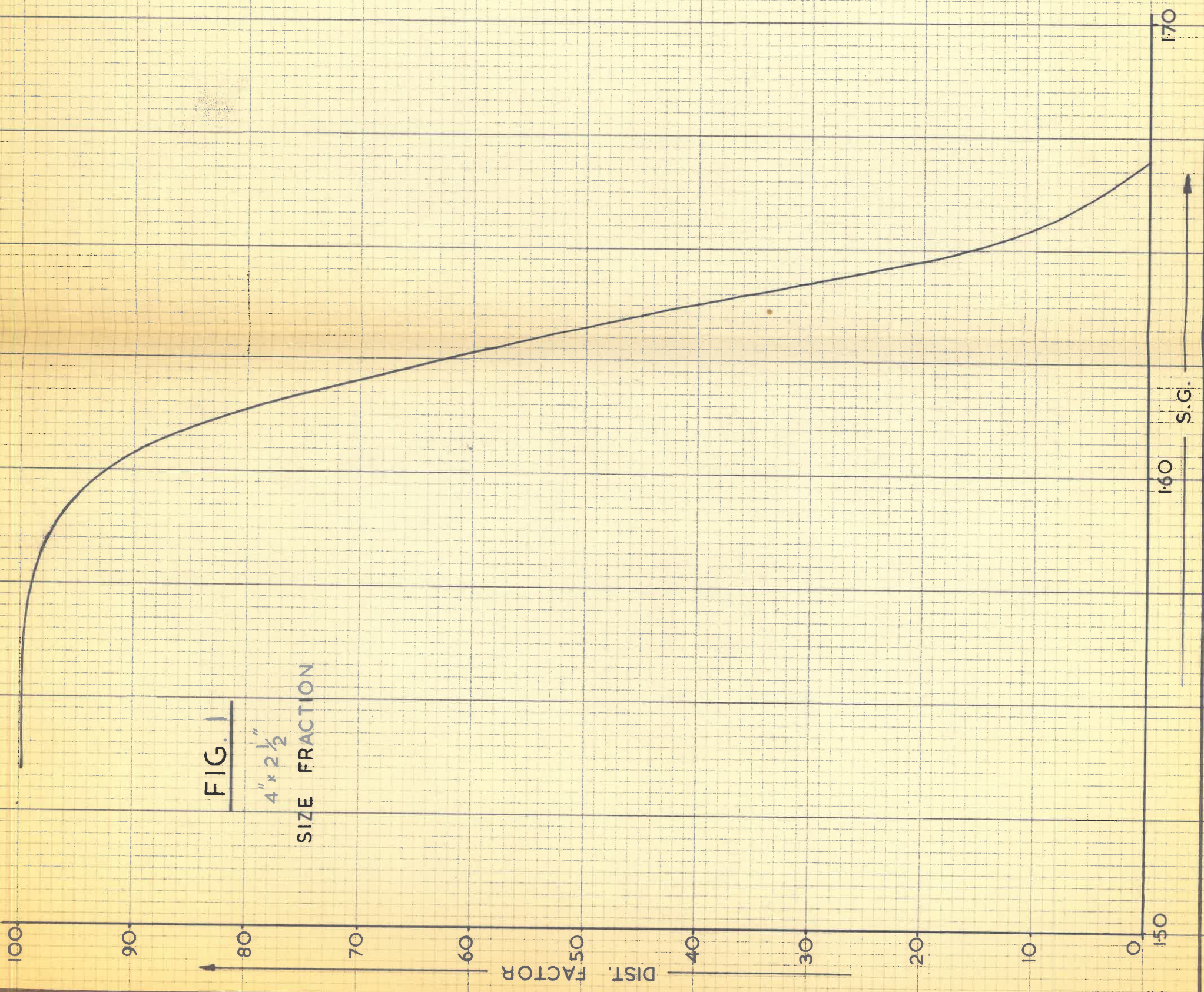
+100 MESH BSS	5.7%
-100 +200 MESH BSS	1.6%
-200 BSS +325 TYLER	4.1%
-325 TYLER	88.6%

ANALYSIS OF MAGNETIC SEPARATOR UNDERFLOW.

SOLIDS CONTENT 27.7 grams per Liter.

MAGNETIC MATERIAL IN SOLIDS 2.2%

FIG. 1
4" x 2 1/2"
SIZE FRACTION



100
90
80
70
60
50
40
30
20
10
0

DIST. FACTOR

150

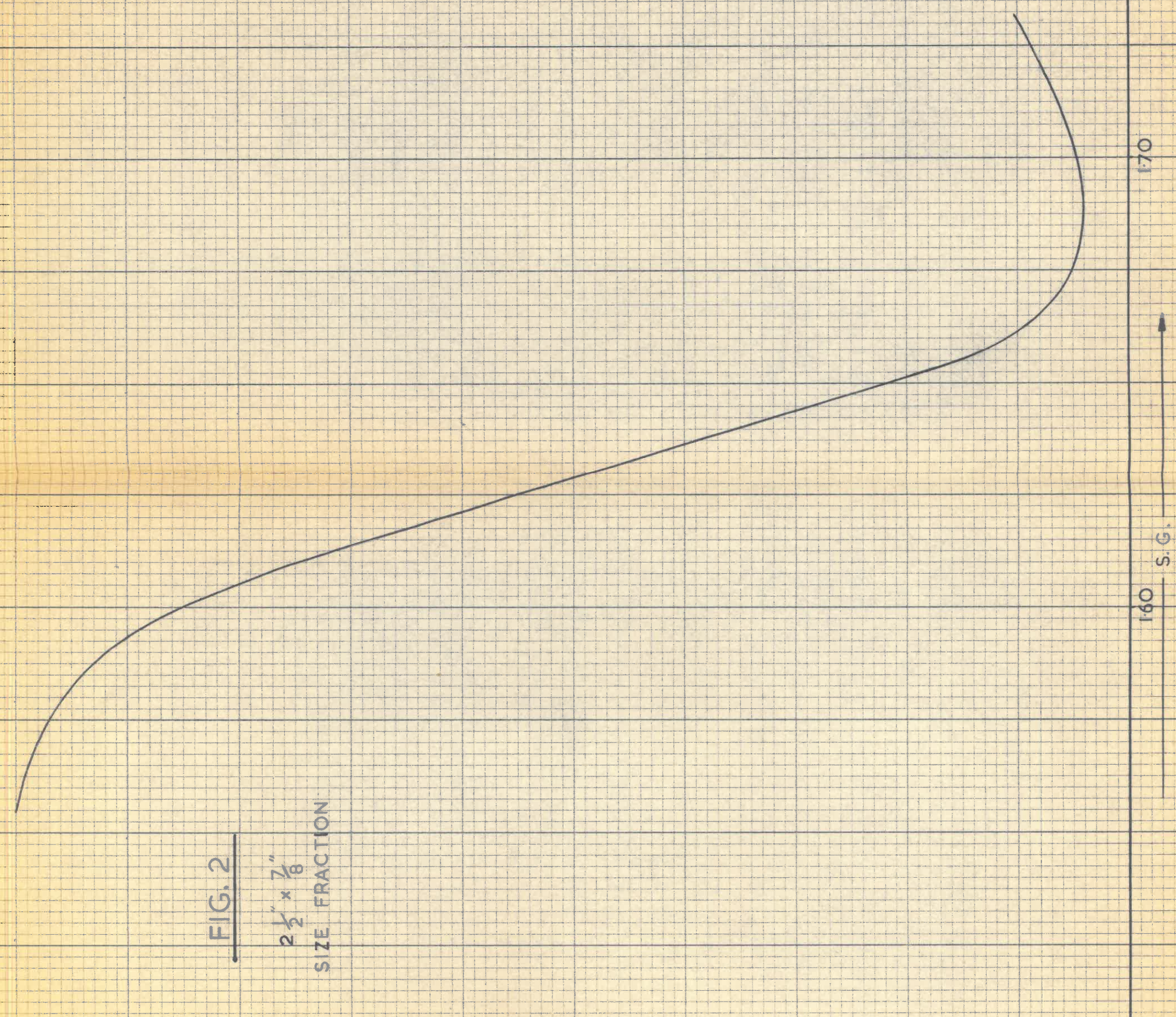
160 S.G.

170

FIG. 2

$2\frac{1}{2} \times \frac{7}{8}$

SIZE FRACTION



100
90
80
70
60
50
40
30
20
10
0

DIST. FACTOR

150

160 S.G.

170

FIG. 3

$\frac{7}{8} \times \frac{3}{8}$ "

SIZE FRACTION

