PLAINTIFF'S EXHIBIT
UC-139

Research & Development Department
P. O. Box 579, Niagara Falls, N.Y.
July 19, 1968

M E M O R A N D U M

SUBJECT: Drilling Fluids - The Effect of Pulping Time on S-G200 Versus Viscosity

FROM: E. J. Markiewicz

Essentially, as pointed out by Dr. Park in his memorandum dated June 19, 1968 to Mr. R. G. Woolery (1) "there seems to be no satisfactory method of measuring flow properties of a pure asbestos suspension when it is in a flocculated state," and (2) "the API method can be utilized without major difficulty for the composite system containing asbestos and some clay minerals such as bentonite and attapulgite." Knowing this, Montello, Inc. and this laboratory are still concerned with a method of evaluating asbestos slurries for drilling fluid usage.

Work has been completed showing the viscosity values produced with measurements by both the Fann Model 35 viscometer at 600 and 300 rpm with rotor (R-1), bob (B-1), and spring (F-1), and a Brookfield Model LVT viscometer using a helipath and T-bar at 0.3, 0.6, 1.5, 3.0, 6.0, and 12.0 rpm. Fann Model 35 readings verify that high rpm determinations of pure asbestos slurries do not differentiate very well between the effect of asbestos and the free water available to the rotor and bob of the Fann viscometer. Since this was and is the case, the same slurries were simultaneously evaluated with the Brookfield LVT with helipath and T-bar at the aforementioned rpm's.

In summary, the Brookfield clearly shows the increase in viscosity with the increase in pulping time of S-G200. This will be the case with any untreated Calidria asbestos product. What value the Brookfield viscosity values have to the drilling fluid application has not been ascertained. Apparently, the best approach to usage of asbestos in drilling fluids is to evaluate composite systems with the Fann Model 35 viscometer. This has been done and seems to produce meaningful drilling fluid application.

Attached are plots of the data accumulated. Tables are included in this report and all data are recorded in notebooks and can be included in any subsequent report, e.g., a status report.

E J Markiewicz
E. J. Markiewicz

EJM:dmp
Attach.

A1730C

TABLE I

Fann VG-35 Data SG-200

(Figures 1 and 2)

Sample	Pulping Time min.	Sample lb./bbl.	θ at 600 rpm	θ at 300 rpm	Apparent Visc. (cps)	Plastic Visc. (cps)	Yield Pt. lb./100 ft.^{2}
S-G200	5	5	28.0	18.0	14.0	10.0	8.0
"	10	5	29.0	18.0	14.5	11.0	7.0
"	15	5	29.5	19.0	14.8	10.5	8.5
"	20	5	30.5	23.0	15.3	7.5	15.5
"	5	10	45.0	37.0	22.5	14.5	22.5
"	10	10	43.0	37.0	21.5	8.0	29.0
"	15	10	48.0	41.0	24.0	7.0	34.0
"	5	15	70.0	55.0	35.0	15.0	40.0
"	10	15	82.0	59.0	41.0	23.0	36.0
"	15	15	75.0	55.0	37.5	20.0	35.0
High-Purity Pellets	5	5	26.0	15.5	13.0	10.5	5.0
"	10	5	28.0	17.0	14.0	11.0	6.0
"	20	5	28.0	18.0	14.0	10.0	8.0
"	5	10	44.0	34.0	12.0	10.0	24.0
"	10	10	36.0	31.0	18.0	5.0	26.0
"	15	10	41.0	27.0	20.5	14.0	13.0
"	5	15	105.0	75.0	52.5	30.0	45.0
"	10	15	100.0	67.0	50.0	33.0	34.0
"	15	15	98.0	75.0	49.0	23.0	52.0
T-135 Pellets	5	5	19.0	13.0	9.5	6.0	7.0
"	10	5	23.5	15.0	11.8	8.5	6.5
"	20	5	23.0	15.0	11.5	8.0	7.0
"	5	10	37.0	23.0	18.5	14.0	9.0
"	10	10	36.0	22.0	18.0	14.0	8.0
"	15	10	40.0	23.0	20.0	17.0	6.0
"	5	15	48.0	30.0	24.0	18.0	12.0
"	10	15	47.0	30.0	23.5	17.0	13.0
"	15	15	46.0	31.0	23.0	15.0	16.0
5% Barite Loaded S-G200	5	10	44.0	35.0	22.0	9.0	26.0
"	10	10	46.0	39.0	23.0	7.0	32.0
"	15	10	45.0	39.0	22.5	6.0	33.0
"	5	15	64.0	53.0	32.0	11.0	42.0
"	10	15	70.0	57.0	35.0	13.0	44.0
"	15	15	65.0	52.0	32.5	13.0	39.0

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TABLE I (Continued)

Fann VG-35 Data SG-200

(Figures 1 and 2)

Sample	Pulping Time min.	Sample lb./bbl.	θ at 600 rpm	θ at 300 rpm	Apparent Visc. (cps)	Plastic Visc. (cps)	Yield Pt. lb./100 ft.^{2}
10% Barite Loaded S-G200	5	10	42.0	33.0	21.0	9.0	24.0
"	10	10	45.0	36.0	22.5	9.0	27.0
"	15	10	43.0	37.0	21.5	6.0	31.0
"	5	15	61.0	52.0	30.5	9.0	43.0
"	10	15	61.0	54.0	30.5	7.0	44.0
"	15	15	68.0	53.0	34.0	15.0	38.0

A 17302

TABLE IA

Fann VG-35 Data

Waring Blendor Opened

(Figures 1 and 2)

Product	Time in Waring Blendor min.	θ at 600 rpm	θ at 300 rpm	Apparent Viscosity (cps)	Plastic Viscosity (cps)	Yield Pt. lb./100 ft.^{2}
S-G200 5 lb./bbl.	3	35	27	17.5	8	19
	5	35	26	17.5	9	17
	10	31	24	15.5	7	17
	10	37	29	18.5	8	21
HPP 5 lb./bbl.	5	25	20	12.5	5	15
T-135 5 lb./bbl.	5	22	12	11.0	10	2

A17303

TABLE II

Brookfield Data

(Figure 3)

	S-G200, 5 lb./bbl. rpm	Spindle	Factor	Average	cps x 10^{-3}	Poises
5 min. pulping	0.6	TA	33.3 M	42.3	14	140.9
	1.5	TA	13.3 M	50.5	6	67.2
	3.0	TA	6.66 M	52.9	3	35.2
	6.0	TA	3.33 M	61.6	2	20.5
	12.0	TA	1.66 M	61.6	1	10.2
10 min.	0.6	TA	33.3 M	61.8	20	205.8
	1.5	TA	13.3 M	73.4	9	97.6
	3.0	TA	6.66 M	82.0	5	54.6
	6.0	TA	3.33 M	86.9	2	28.9
	12.0	TA	1.66 M	91.3	1	15.2
15 min.	0.6	TA	33.3 M	70.3	23	234.1
	1.5	TA	13.3 M	80.0	10	106.4
	3.0	TA	6.66 M	86.4	5	57.5
	6.0	TB	6.66 M	54.9	3	36.6
	12.0	TB	3.33 M	56.3	1	18.8
Waring	0.6	TB	66.6 M	75.6	50	503.5
	1.5	TB	26.6 M	94.2	25	250.6
	3.0	TB	13.3 M	88.9	11	118.2
	6.0	TB	6.66 M	88.3	5	58.8
	12.0	TB	3.33 M	84.6	2	28.2

A17304

TABLE III

(Figure 4)

S-G200, 10 lb./bbl.	rpm	Spindle	Factor		Average	cps x 10^{-3}
5 min.	0.6	TC	166	M	54.3	90
	1.5	TC	66.6	M	60.6	40
	3.0	TC	33.3	M	58.9	19
	6.0	TC	16.6	M	57.9	9
	12.0	TC	8.33	M	56.5	4
10 min.	0.6	TC	166	M	63.0	104
	1.5	TC	66.6	M	71.1	47
	3.0	TC	33.3	M	61.2	20
	6.0	TC	16.6	M	62.8	10
	12.0	TC	8.33	M	61.6	5
15 min.	0.6	TC	166	M	63.2	104
	1.5	TC	66.6	M	73.0	48
	3.0	TC	33.3	M	72.2	24
	6.0	TC	16.6	M	69.3	11
	12.0	TC	8.33	M	68.0	5
Waring	0.6	TD	333	M	52	173
	1.5	TD	133	M	66.6	88
	3.0	TD	66.6	M	58.7	39
	6.0	TD	33.3	M	57.9	19
	12.0	TD	16.6	M	54.3	9

A 17305

TABLE IV

(Figure 5)

	S-G200, 15 lb./bbl. rpm	Spindle	Factor		Average	cps x 10^{-3}
5 min.	0.6	TD	333	M	57.5	191
	1.5	TD	133	M	66.1	87
	3.0	TD	66.6	M	63.3	42
	6.0	TD	33.3	M	55.4	18
	12.0	TD	16.6	M	56.2	9
10 min.	0.6	TD	333	M	60.5	201
	1.5	TD	133	M	78.2	104
	3.0	TD	66.6	M	68.6	45
	6.0	TD	33.3	M	70.3	23
	12.0	TD	16.6	M	62.1	10
15 min.	0.6	TD	333	M	65	216
	1.5	TD	133	M	66.8	88
	3.0	TD	66.6	M	62.2	41
	6.0	TD	33.3	M	57.9	19
	12.0	TD	16.6	M	56.5	9
Waring	0.6	TE	833	M	69.5	578
	1.5	TE	333	M	68.3	227
	3.0	TE	166	M	53.5	88
	6.0	TE	83.3	M	45.8	38
	12.0	TE	41.6	M	44.8	18

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TABLE V

Brookfield Helipath LVT Data

5% Barite Loaded S-G200
10 lb./bbl.

(Figure 6)

	rpm	Spindle	Factor		Average	cps x 10^{-3}
5 min.	0.6	TC	166	M	49.3	81
	1.5	TC	66.6	M	48.8	32
	3.0	TC	33.3	M	51.4	17
	6.0	TC	16.6	M	53.3	8
	12.0	TC	8.33	M	51.8	4
10 min.	0.6	TC	166	M	59	97
	1.5	TC	66.6	M	55	36
	3.0	TC	33.3	M	56.3	18
	6.0	TC	16.6	M	53.7	8
	12.0	TC	8.33	M	55.9	4
15 min.	0.6	TC	166	M	61.5	102
	1.5	TC	66.6	M	60.4	40
	3.0	TC	33.3	M	57.0	18
	6.0	TC	16.6	M	53.2	8
	12.0	TC	8.33	M	58.2	4
3 min. Waring	0.6	TD	333	M	44.5	148
	1.5	TD	133	M	54.6	72
	3.0	TD	66.6	M	43.9	29
	6.0	TD	33.3	M	44.0	14
	12.0	TD	16.6	M	44.4	7

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TABLE VI

5% Barite Loaded Asbestos S-G200

15 g./350 ml. or 15 lb./bbl.

(Figure 7)

	rpm	Spindle	Factor		Average	cps x 10^{-3}
5 min.	0.6	TD	333	M	61	203
	1.5	TD	133	M	68.2	90
	3.0	TD	66.6	M	64.9	43
	6.0	TD	33.3	M	68.6	22
	12.0	TD	16.6	M	68.4	11
10 min.	0.6	TD	333	M	57.5	191
	1.5	TD	133	M	64.1	85
	3.0	TD	66.6	M	61.6	41
	6.0	TD	33.3	M	63.2	21
	12.0	TD	16.6	M	58.2	9
15 min.	0.6	TD	333	M	65.0	216
	1.5	TD	133	M	81.1	107
	3.0	TD	66.6	M	69.4	46
	6.0	TD	33.3	M	69.9	23
	12.0	TD	16.6	M	70.5	11
3 min. Waring	0.6	TE	833	M	55.0	458
	1.5	TE	333	M	60.6	201
	3.0	TE	166	M	57.6	95
	6.0	TE	83.3	M	48.9	40
	12.0	TE	41.6	M	50.8	21

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TABLE VII

10% Barite Loaded Asbestos S-G200

10 g./350 ml. or 10 lb./bbl.

(Figure 8)

	rpm	Spindle	Factor	Average	cps x 10^{-3}
5 min.	0.6	TC	166 M	43.5	72
	1.5	TC	66.6 M	48.2	32
	3.0	TC	33.3 M	49.7	16
	6.0	TC	16.6 M	52.0	8
	12.0	TC	8.33 M	54.6	4
			No Helipath		
10 min.	0.3	TC	333 M	70	233
	0.6	TC	166 M	56.3	93
	1.5	TC	66.6 M	60.0	39
	3.0	TC	33.3 M	47.5	15
	6.0	TC	16.6 M	50.0	8
	12.0	TC	8.33 M	51.5	4
			No Helipath		
15 min.	0.3	TD	666 M	76.5	509
	0.6	TD	333 M	30.0	99
	1.5	TD	133 M	31.2	41
	3.0	TD	66.6 M	30.9	20
	6.0	TD	33.3 M	33.0	10
	12.0	TD	16.6 M	32.6	5
			No Helipath		
3 min. Waring	0.3	TF	3.33 MM	50.5	1,681
	0.6	TD	333 M	42.3	140
	1.5	TD	133 M	46.0	61
	3.0	TD	66.6 M	45.6	30
	6.0	TD	33.3 M	45.0	14
	12.0	TD	16.6 M	46.0	7

A17309

TABLE VIII

10% Barite Loaded Asbestos S-G200

15 g./350 ml. or 15 lb./bbl.

(Figure 9)

Pulping Time	rpm	Spindle	Factor		Average	cps x 10^{-3}
5 min.	0.3	TF	3.33	MM	43.5	1,448
	0.6	TD	333	M	57	189
	1.5	TD	133	M	58.3	77
	3.0	TD	66.6	M	57.8	38
	6.0	TD	33.3	M	63.3	21
	12.0	TD	16.6	M	60.4	10
10 min.	0.3	TF	3.33	MM	27	893
	0.6	TD	333	M	42.2	140
	1.5	TD	133	M	40.5	53
	3.0	TD	66.6	M	41.4	27
	6.0	TD	33.3	M	44.3	14
	12.0	TD	16.6	M	46.5	7
15 min.	0.3	TF	3.33	MM	44.5	1,481
	0.6	TD	333	M	41.3	137
	1.5	TD	133	M	53.7	71
	3.0	TD	66.6	M	49.7	33
	6.0	TD	33.3	M	52.4	17
	12.0	TD	16.6	M	55.2	9
3 min. Waring	0.3	TF	3.33	MM	100	3,330
	0.6	TE	833	M	45	374
	1.5	TE	333	M	52.5	174
	3.0	TE	166	M	52.6	87
	6.0	TE	83.3	M	48.5	40
	12.0	TE	41.6	M	46.1	19

A 17310

TABLE IX

Brookfield Helipath LVT Data

50% SV + 50% Barite, 5 lb./bbl.

(Figure 10)

	rpm	Spindle	Factor	Average	cps x 10^{-3}
5 min. Multi.	0.3	TA	66.6 M	32.3	21
	0.6	TA	33.3 M	26.0	8
	1.5	TA	13.3 M	28.0	3
	3.0	TA	6.66 M	27.9	1
	6.0	TA	3.33 M	30.3	1
	12.0	TA	1.66 M	31.0	0.514
10 min. Multi.	0.3	TA	66.6 M	32.0	21
	0.6	TA	33.3 M	28.1	9
	1.5	TA	13.3 M	31.0	4
	3.0	TA	6.66 M	32.8	2
	6.0	TA	3.33 M	32.6	1
	12.0	TA	1.66 M	34.4	0.571
15 min. Multi.	0.3	TA	66.6 M	29.0	19
	0.6	TA	33.3 M	28.7	9
	1.5	TA	13.3 M	28.3	3
	3.0	TA	6.66 M	30.4	2
	6.0	TA	3.33 M	31.3	1
	12.0	TA	1.66 M	33.4	0.554
3 min. Waring	0.3	TB	133 M	53.0	70
	0.6	TB	66.6 M	37.0	24
	1.5	TB	26.6 M	39.2	10
	3.0	TB	13.3 M	40.2	5
	6.0	TB	6.66 M	40.0	2
	12.0	TB	3.33 M	40.0	1

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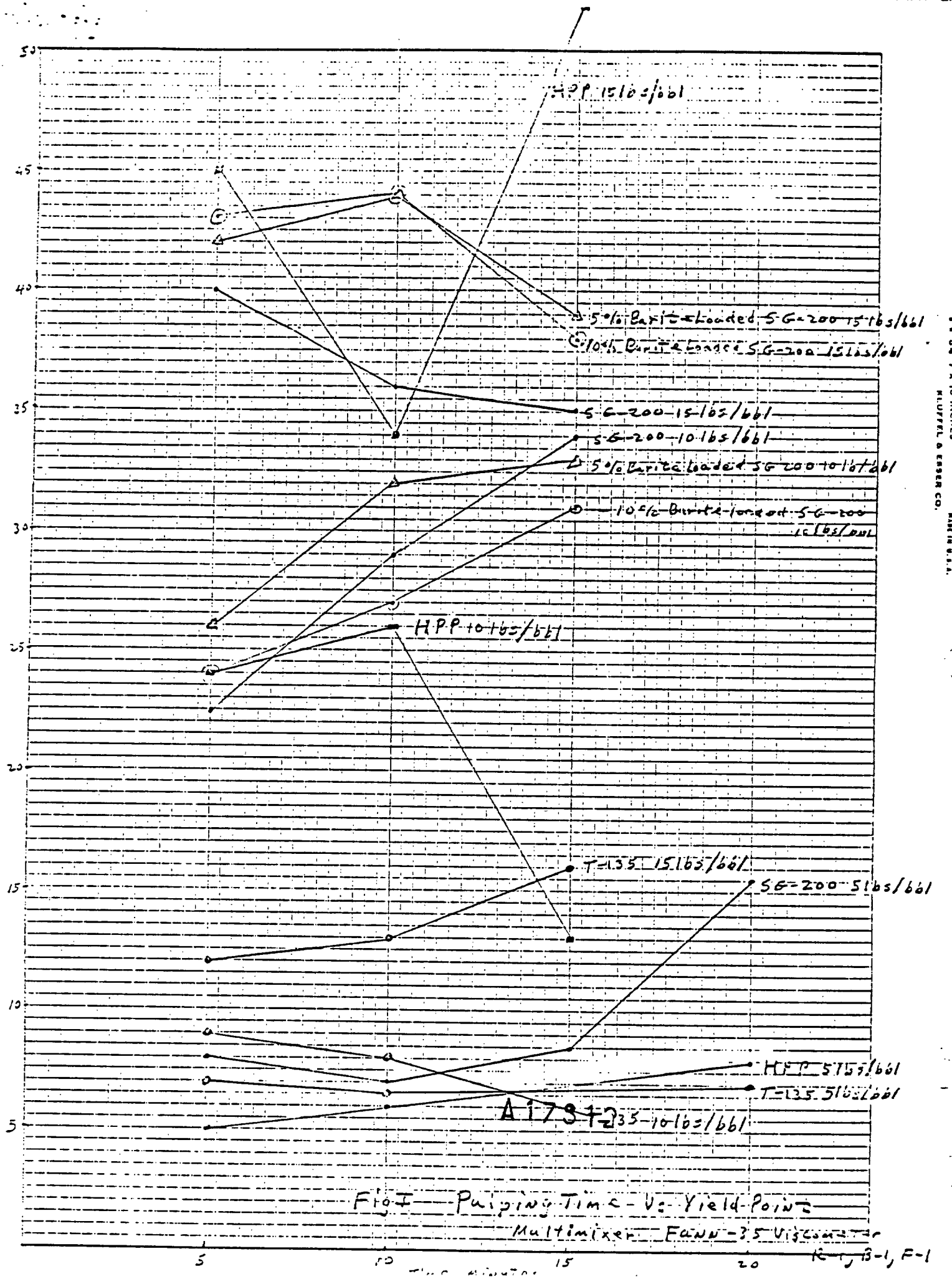
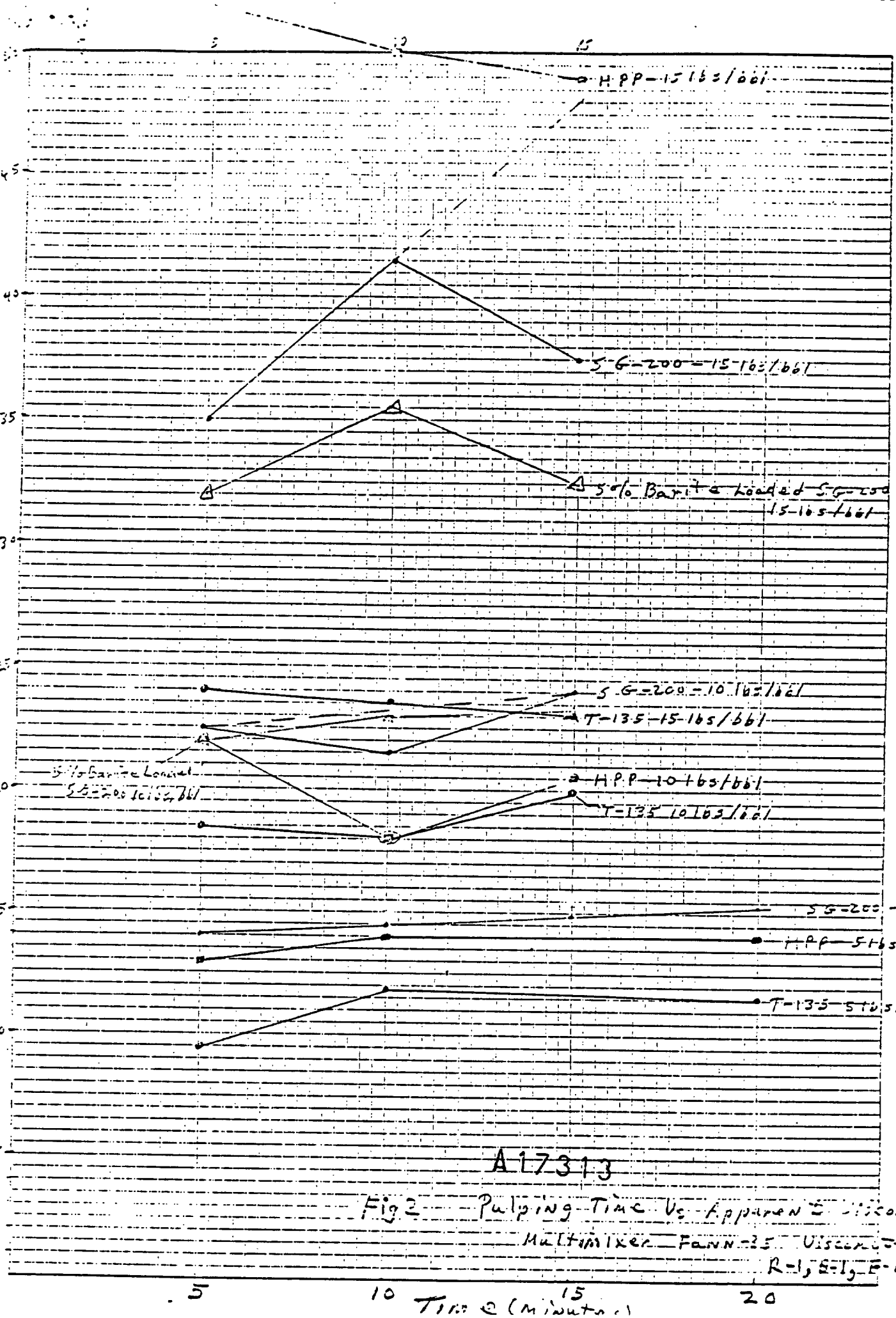


Fig I — Pulping Time - Vs - Yield Point
Multimixer — FANN-35 Viscometer

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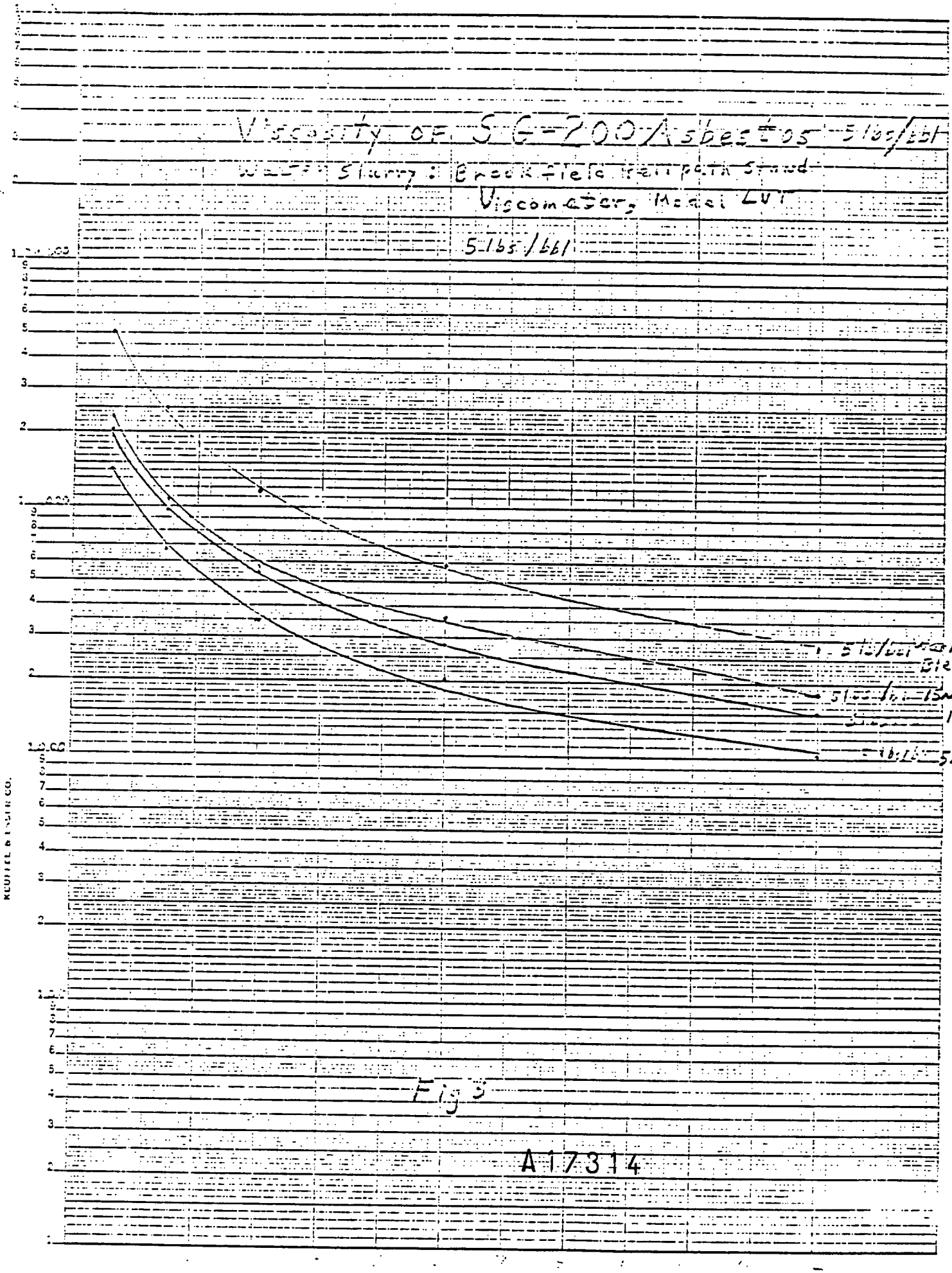
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Fig 2 — Pulping Time Vs. Apparent Viscosity

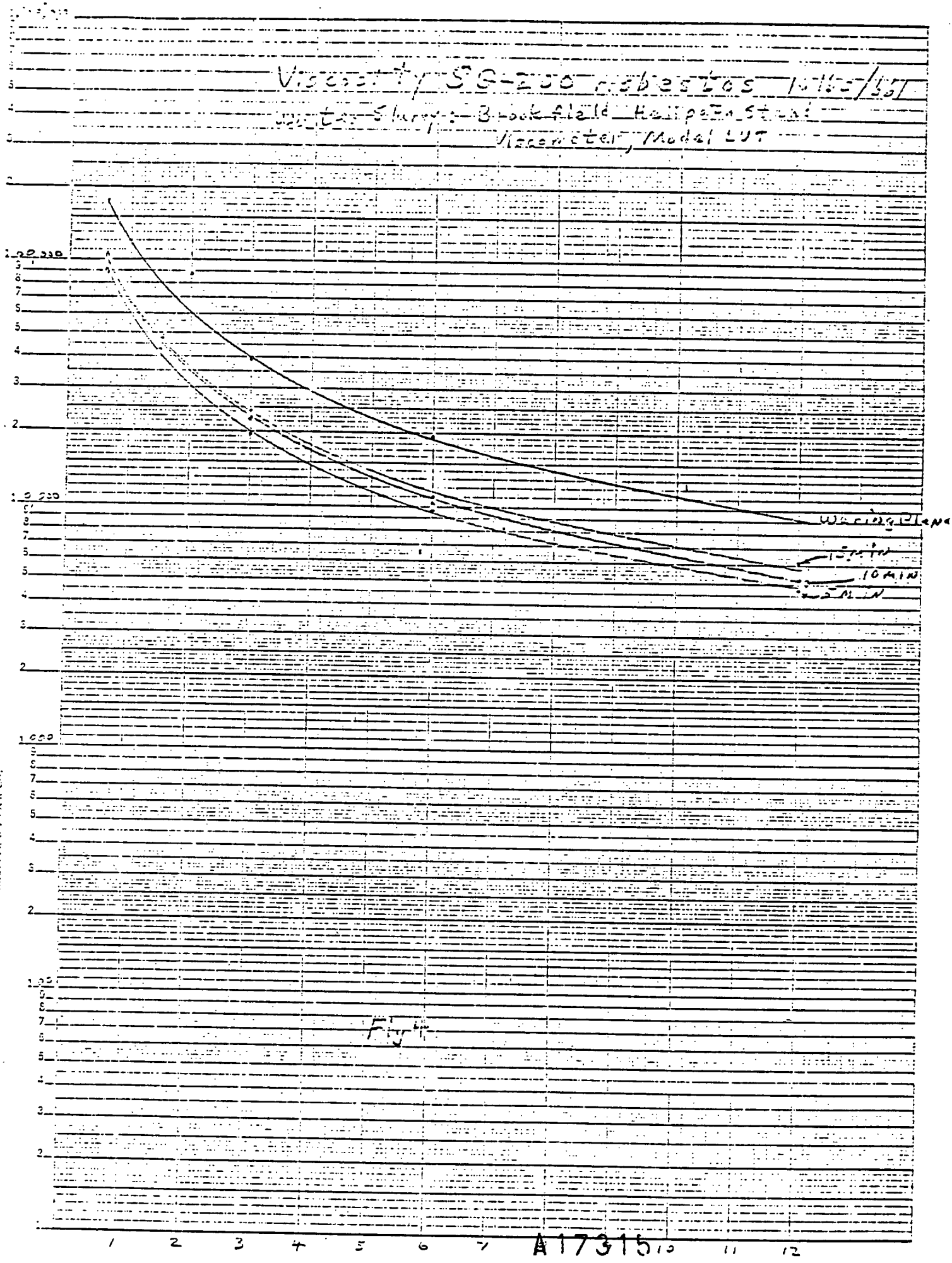
Multimixer — Fann-35 Viscometer

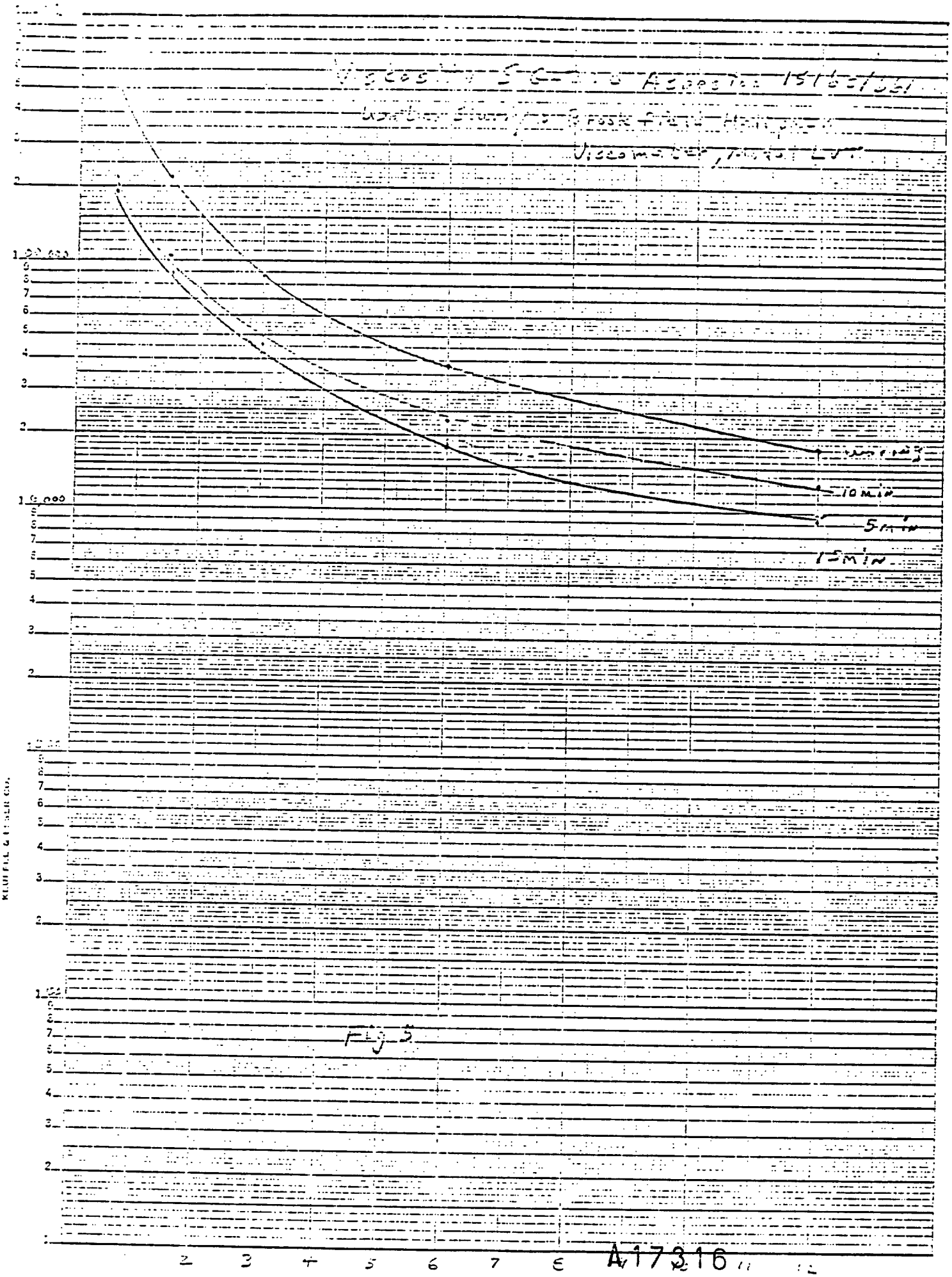
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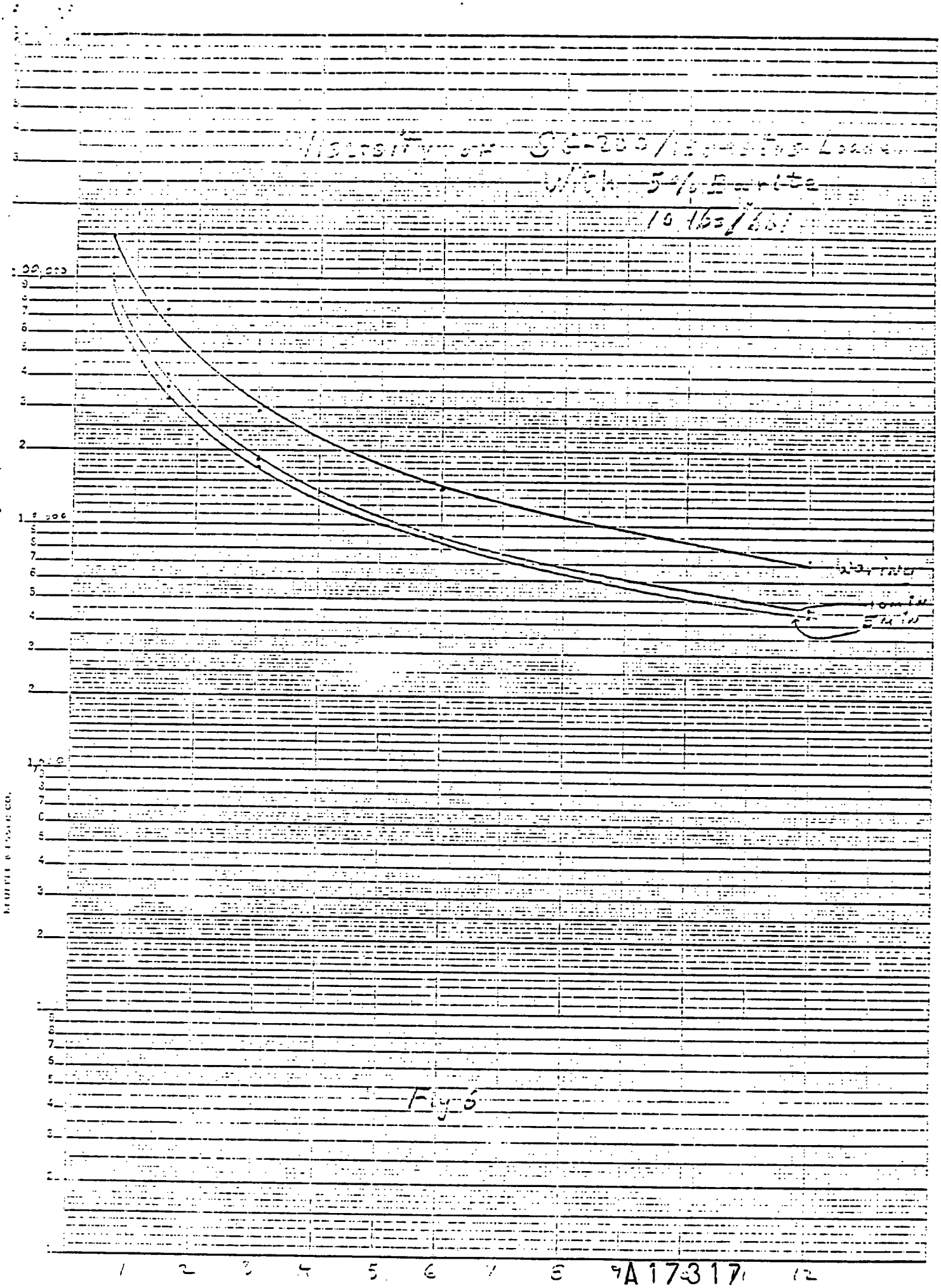
KEUFFEL & ESSER CO. MADE IN U.S.A. 10 X 10 TO THE INCH 46 0660 7 X 10 INCHES



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Viscosity SG-200 asbestos 1.0%/5%
water Slurry - Brookfield Helipath Stand
Viscometer, Model LVT
WARING BLEND
1 MIN
10 MIN
A17315


10 MIN
5 MIN
15 MIN
A17316



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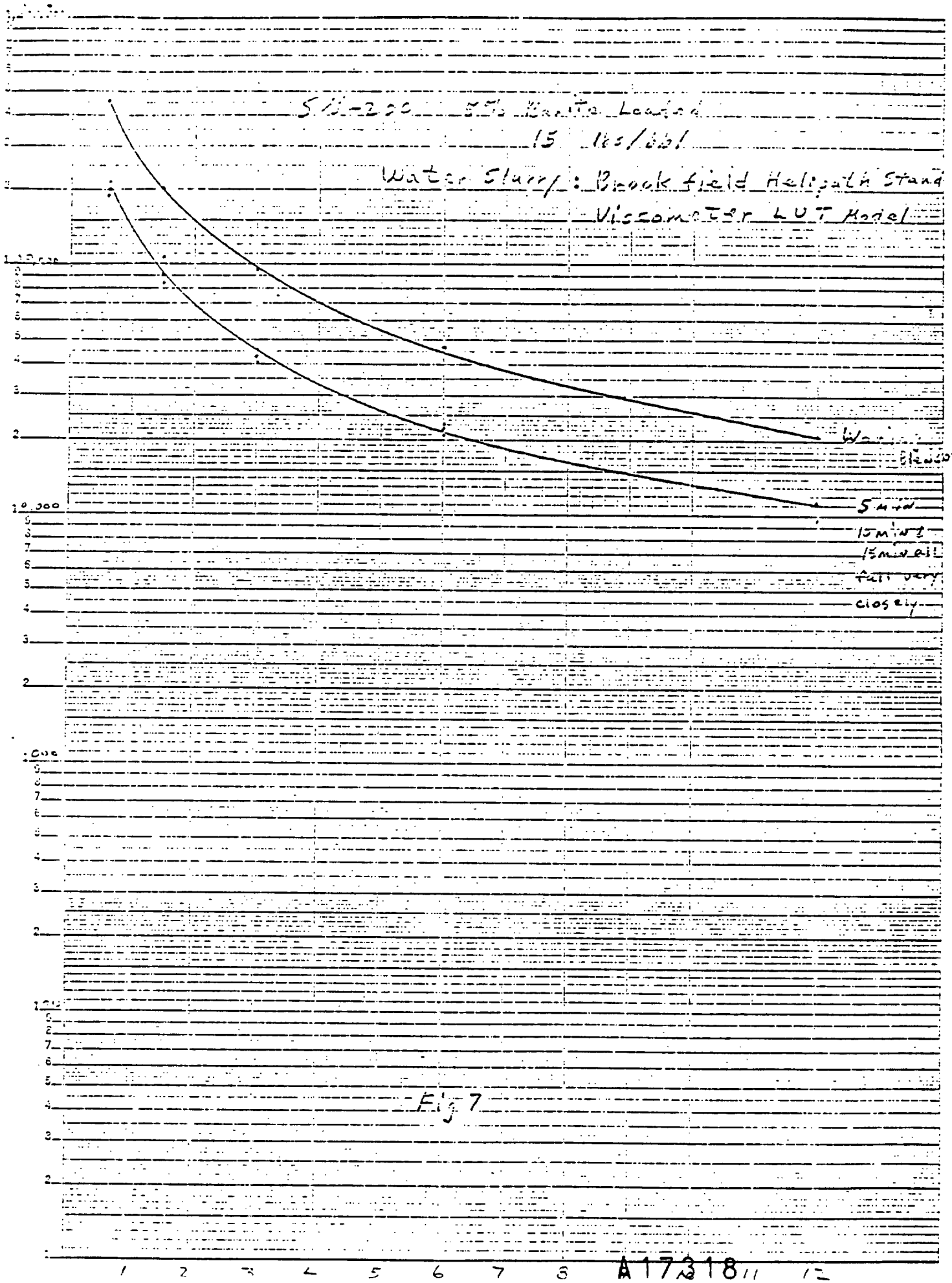
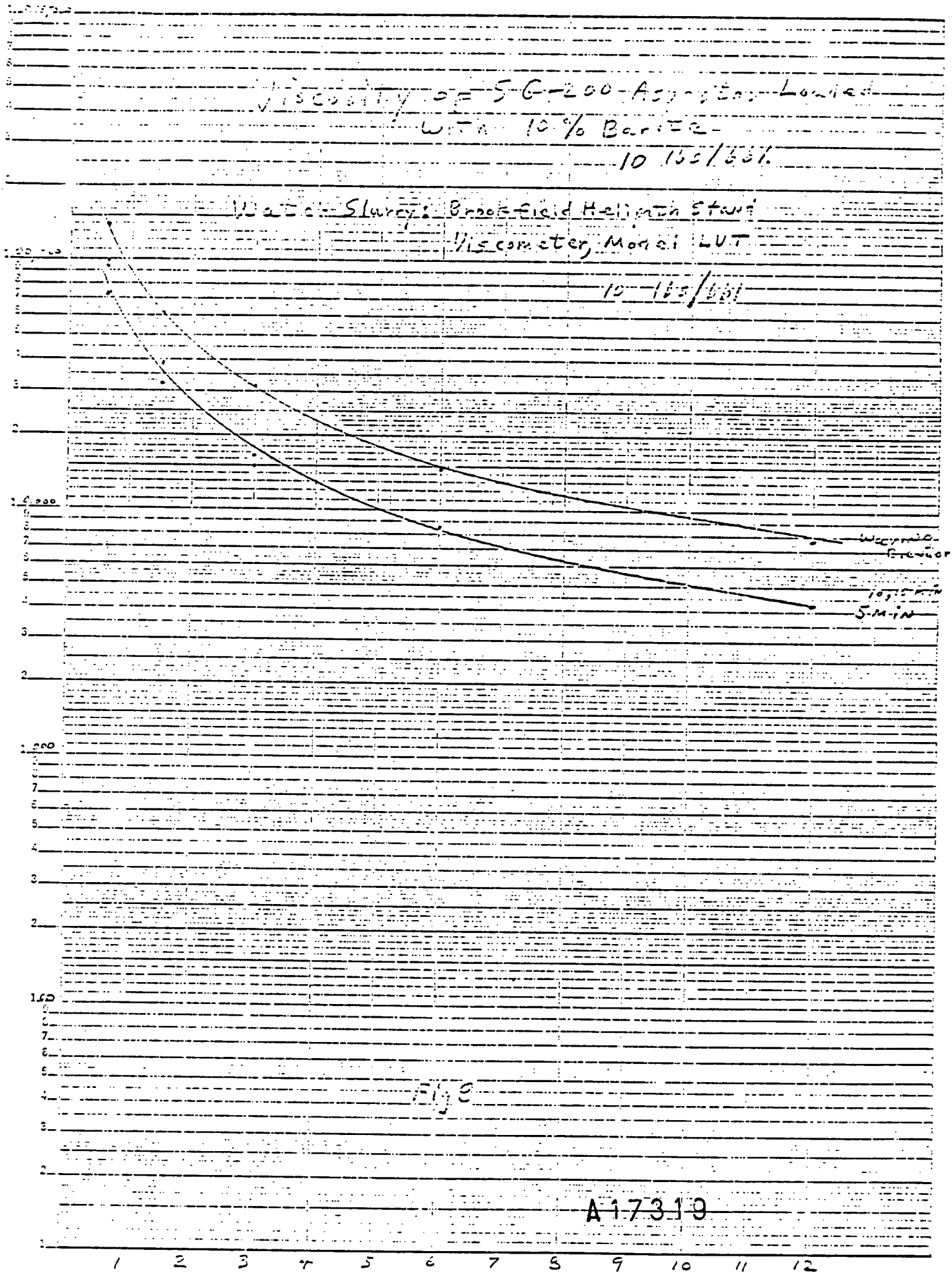

S-200 SF Kaolin Loaded
15 lbs/bbl
Water Slurry : Brookfield Helipath Stand
Viscometer LVT Model
Viscosity η (cps)
w/ Waring Blendor
5 min
10 min
15 min
Full Velocity
Closely
1
2
3
4
5
6
7
8
A17318

Fig 7


Viscosity of S-G-200 Aqueous Loaded
with 10% Barite
10 lbs/bbl
Water Slurry: Brookfield Helipath Stand
Viscometer, Model LVT
10 lbs/bbl
Waring Blender
10-MIN
5-MIN
Fig 9
A17319
1 2 3 4 5 6 7 8 9 10 11 12

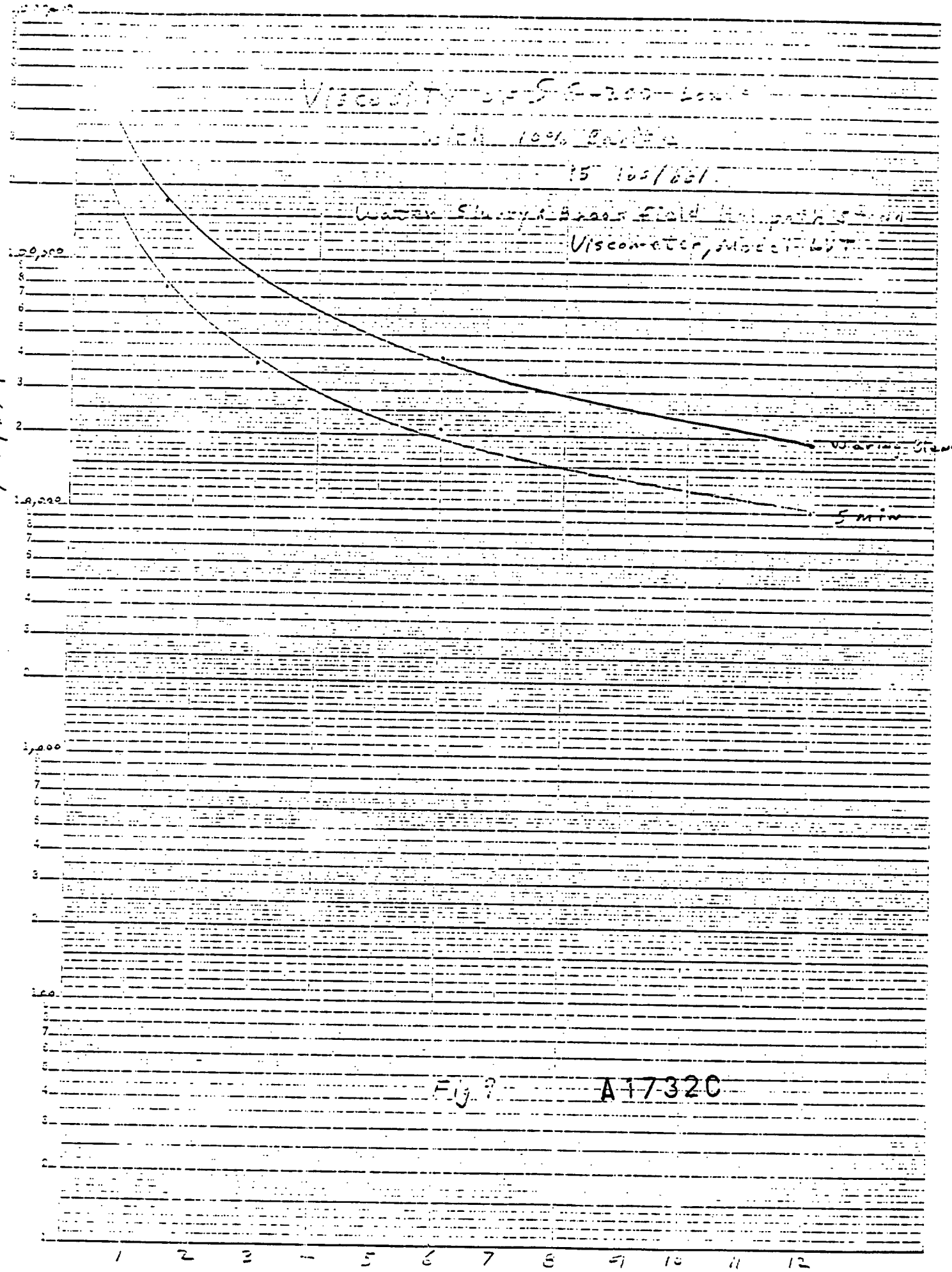


Fig. 2 A17320

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