1916

Problems in flotation

William Henry McCartney

PROBLEMS IN FLOTATION.

By

William Henry McCartney.

A

THESIS

submitted to the faculty of the

SCHOOL OF MINES AND METALLURGY OF THE UNIVERSITY OF MISSOURI

in partial fulfillment of the work required for the

Degree of

BACHELOR OF SCIENCE IN MINE ENGINEERING

Rolla, Mo.

1916.

Approved by. Horace V. Mann

Associate Professor of Metallurgy and Ore Dressing.

Index.

1. Title
2. Object.
3. Introduction.
4. Apparatus.
5. Data, Curves, Figures, etc.
6. Conclusions.

Little has been done to classify oils on the basis of their action as flotation agents, either for their frothing or their selective qualities. The only available information at the present time is an article by C. Y. Clayton and C. E. Peterson in the Mining and Scientific Press of April 22, 1916.

This investigation was undertaken chiefly to aid in effecting such a classification.

Flotation of mineral on the surface of water by means of the frothing process is a problem which is receiving much attention at the present time. Portions of the ore which, after mill treatment in former times were lost, can be and are today retreated by flotation at small cost, and the percentage of extraction of the mill greatly increased. Many mills have increased their percentage extraction from the customary 70 % to 85 % and in some few cases to 92 % of the valuable mineral.

A development of the Hoover type of Minerals Separation testing-machine was used, with an air-lift to complete the circulation of the pulp from the bottom of the spitzkasten to the upper portion of the agitator cell. A half-horsepower motor was used to drive the impeller at a constant speed of 2100 revolutions per minute.

Skimming of the float was effected by means of a flat, round, perforated spoon-skimmer.

The tails were sampled by a glass tube with a wire through it attached to a rubber stopper attached at the lower end. (See diagram). This was placed in the pulp with the bottom end closed. It was then opened and closed again, and when filled was withdrawn.

All the concentrate and the sample of the tails were then placed in pans and dried on a gas hot-plate, weights recorded, and analysed for their zinc content.

All factors of operation remained constant except the kind of oil.

Each charge was as follows:

Water.....3200 gm.
Ore.....400 grm.
Oil..... 4 drops.
Time of run..... 15 minutes
Speed of impeller..... 2100 R. P. M.

The ore showed by checked analysis 1.75 % Zinc. It is from a sludge pond in the Joplin District.

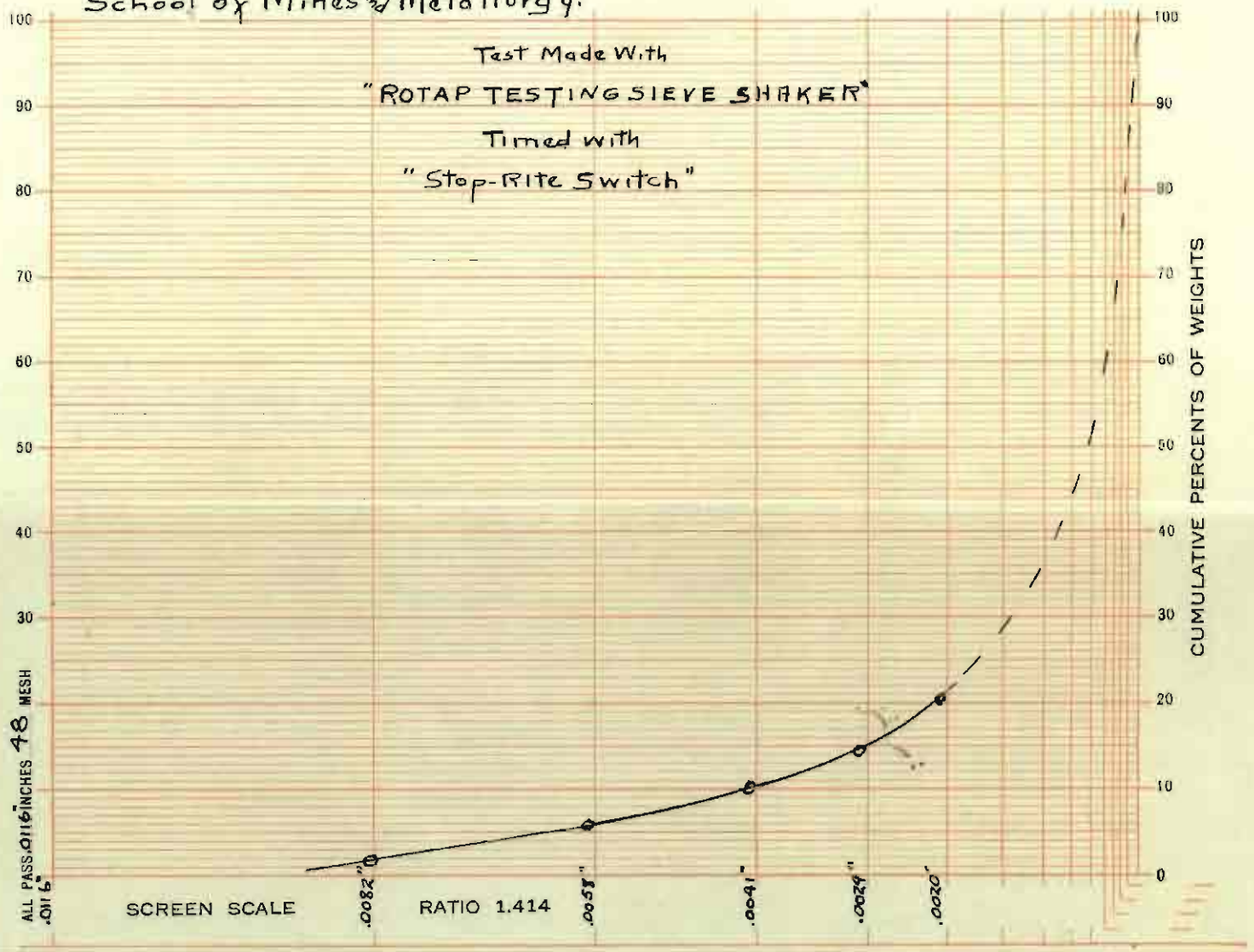
Vogey Ore.

The Tyler Standard Screen Scale

E 544 B-C

Cumulative Direct Diagram of Screen Analysis on Sample of Material #297

Name University of Missouri School of Mines & Metallurgy. Date May 6, 1916



Indicate the Screen Crushed through and also First Retaining Screen	SCREEN SCALE RATIO 1.414 Openings Inches	Openings Millimeters	Mesh	Diameter Wire Inches	WEIGHTS Sample Weights	Per Cent	Per Cent Cumulative Weights	ASSAYS	CONTENTS	% of Total Contents
	1.050	26.67		.149					SIEVED 20 MIN with shot	
	.742	18.85		.135						
	.525	13.33		.105						
	.371	9.423		.092						
	.263	6.680	3	.070						
	.185	4.699	4	.065						
	.131	3.327	6	.036						
	.093	2.362	8	.032						
	.065	1.651	10	.035						
	.046	1.168	14	.025						
	.0328	.833	20	.0172						
	.0232	.589	28	.0125						
	.0164	.417	35	.0122						
All Pass	.0116	.295	48	.0092	GRAMS					
Ret'd On	.0082	.208	65	.0072	1.0	1.3	1.3			
"	.0058	.147	100	.0042	3.0	4.0	5.3			
"	.0041	.104	150	.0026	3.0	4.0	9.3			
"	.0029	.074	200	.0021	3.5	4.7	14.0			
Pan	.0029	.074	200	.0021	4.5	6.0	20.0			
				Totals	60.0 75.0	80.0 100.0	—			

THE W. S. TYLER COMPANY, CLEVELAND, OHIO

Per J.A.D. Lab.

Machine: ~~Machine~~ Hoover Type

Experimenter: McCartney

ORE: 1.75 % Zn- Joplin Sludge. 400gm to charge.

Missouri School of Mines and Metallurgy

FLOTATION LABORATORY.

Thesis – Problems in Flotation-

OPERATING DATA.

H_2O	3200	gm
Oil	4 Drops	
Rpm	2100	

Test No	OIL No.	OIL ~~Amt.~~	OIL Kind.	REAGENTS Kind	REAGENTS Amt.	FROTH ~~Kind~~	FROTH ~~Amt.~~	REMARKS.	RESULTS Wt.	RESULTS Per Ct.	RESULTS Wt.	RESULTS Per Ct.	Tails Wt.	Tails Per Ct.	Per Ct. Ext.
1			Commercial Tar Oil No 7 #2			Light		Small amt. medium bubbles Float carries much gangue	2.4	15.3				1.25	
2			Fuel Oil No 15			Very light		Very small bubbles. Small amt of scumy float	1.3	15.8				1.6	
3			Atlantic Red No 5.			None		Small fairly rich scumy float	.5	20.0				3.1	
4			Diamond Refined No 6.			None		Small amt. of small bubble Thin scum, no frothing.	1.1	9.8				3.65	
5			Standard Heavy Engine Oil			None		Very Smal. amt dirty floot	No sample too small					3.15	
6			Pine Prod. Flo Oil No 8			Good		Medium bubbles. fairly large froth – carrying much min	3.2	18.4				3.75	
7		#17	do do	No 9		Light Unstable		Small bubbles - good amt. Carrying much min.	2.4	18.5				2.0	
8		#18	do do	No 10		Much Very Good		Large bubble froth much mineral & more gangue	24.2	24.6				1.65	
9		#22	do do	No 12		Good Unstable		Fair amt of med. sized bubbles. Unstable - much min.	2.0	32.0				2.05	
10			E-2 do	No 13		Light		Small bubbles - even froth Froth medium rich.	2.3	34.5				3.0	
11			S. F. Cylinder Oil No 16			None		Small amt of floot. Poor Grade - Much gangue	5.4	9.2				2.65	
12			Cushings Crude Oil			Light		Thin unstable small bubbles Only fair amt of min in floot	1.6	20.2				4.15	
13			Black Oil No. 18.			None		No froth - Only thin films of min and oil floating small amt.	1.0	34.0				1.7	
14			Tar Oil No 17			None		do Rich floot	.5	17.4				1.2	
15		#1	Pine Oil No 6			Light Much		Small frail bubbles carrying much mineral. Good amt of froth	7.9	50.2				1.6	
16			Refined Tar Oil No 9			None		No froth. Rich oily scum.	3.2	45.9				2.45	
17			Ref. Mol. Creos. Flo. Oil No 200			Light		Rich conc. small bubbles and amt. Scum. much min.	12.8	34.7				2.15	
18			Cr. do do do	No 400		Good		Froth fairly stable. Dirty Med. bubbles. Much froth.	10.9	27.5				1.04	

Flotation Sheet Form 121 1400 1 16

Machine .....

Experimenter .....

Missouri School of Mines and Metallurgy

FLOTATION LABORATORY.

OPERATING DATA.

ORE

Test No	OIL No.	OIL Amt.	OIL Kind.	REAGENTS Kind	REAGENTS Amt.	FROTH Kind	FROTH ~~Amt.~~	REMARKS.	Conc RESULTS Wt.	Conc Per Ct.	Tails Wt.	Tails Per Ct.	Per Ct. Ext.
19			Crude Wd. Terp. Flo	No 80		Very light		Small bubbles. Unstable Carrying fair mineral	2.0	22.1		—	
20			Spec. Rosin Oil	do No 15.		do		Small frail bubbles grading to scum. Rather dirty	1.5	16.4		1.5	
21			Cr. Wd. Terp.	do No 75		Unstable		Small unstable bubbles Amt of Min. is fair	2.9	21.4		—	
22			Spec. Pine Oil	do No 1580		Very Good Much		Med. size strong bubbles - Much froth - but rather dirty	35	14.7		.6	
23			Specific Cr. Wd Oil	No 350		Unstable		Small frail bubbles. Good amt of min in float	3.4	33.2		.75	
24			Pure Pine Oil	Steam Ref #5		Good		Small tough bubbles. Fair amt of min in float.	3.7	23.9		1.55	
25			Flo. Oil No 200	Creosote.		Fragile		Small bubbles - carry fair amt of mineral	1.2	35.7		1.0	
26			Coal Tar Products. Sample No	1		None		Small scum of min floating - No froth	.5	22.4		1.45	
27			do	2		Frail		Small bubble float - Rich float. but small amount.	3.4	45.9		No Zn	
28			do	3		None		Very thin scum of min - Good conc.	1.0	35.1		do.	
29			do	4		None		Slight min bearing film floating. Small amt.	2.3	32.1		1.95	
30			do	5		None		Poor scum of light min. Dirty scum.	1.35	13.0		—	
31			(Water Gas Tar Oil)	No 9		None		Thin film of med. grade conc. Small amt.	.7	22.0		2.0	
32			Coal Tar from Gas Ovens.			None		Same - but richer float	3.5	46.8		1.75	
33			Sta. A Hagledo G & Co. Water Gas Tar.			None		Slight scumy float Rich in mineral	1.79	43.1		2.4	
34			Caster Oil			None		Scum of oil and mineral and gangue.	1.3	26.6		1.1	
35			Sperm Oil			None		Poor scumy float Medium grade	.9	17.7		1.85	
36			Corn Oil			None		Small bubble scumy float Poor grade of conc.	4.3	19.9		1.05	

Machine

Experimenter

Missouri School of Mines and Metallurgy

FLOTATION LABORATORY.

OPERATING DATA.

ORE

Test No	OIL No.	OIL Amt.	OIL Kind.	REAGENTS ~~Kind~~ ~~Amt.~~	FROTH Kind	FROTH ~~Amt.~~	REMARKS.	RESULTS Wt.	Per Ct.	Wt.	Per Ct.	Tails Wt.	Tails Per Ct.	Per Ct. Ext.
37			China Wood Oil		None		Some min in float. Small amt of conc	1.4	24.2				1.6	
38			Olive Oil		None		Min. in thin filmy float Small amt. of float	1.3	21.05				2.65	
39			Menhaden Oil (Tech)		Light		Small bubble scummy froth carrying much min.	2.2	27.35				2.0	
40			Rape Seed Oil		None		Scummy froth carrying good amt of min.	3.0	31.1				—	
41			Soya Bean		None		Thin film carrying small amount of mineral	1.1	18.9				.25	
42			Menhaden Oil (Pure)		None		Very light thin film of min. Small amt.	1.1	23.9				2.35	
43			Poppy Seed Oil		Very light		Small amount of small bubble scum which soon grades to scum. Poor	.69	24.0				—	
44			Neat's Foot Oil		None		Small scum of min.	2.2	24.3				—	
45			Rosin Oil		Very light		Frail small bubbles. Froth showing mineral and gangue	2.75	23.6				1.4	
46			Cotton Seed Oil		do		Light rich scummy froth. Not lasting -	5.56	43.7				1.15	
47			Paraffin Oil		None		Slight amt of scum.	5.2	24.6				1.15	
48			Lindseed Oil Raw		None		Same - small amt	.5	30.8				1.5	
49			do	Boiled	Very light		Small scummy frot carrying some min.	1.36	25.0				1.75	
50			Kerosene		do		Ephemeral froth to small to sample -	—	—				—	
51			Coal Tar		None		Slight scum of min floating	3.15	38.5				2.35	
52			Oeleic Acid		Good		Fair amt of small bubble froth. Fair grade of min.	8.85	33.7				1.5	
53			Eucalyptus Oil		Good		Small bubbles. Good grade and amt of conc. on froth	4.3	48.3				1.0	
54			Cresylic Acid		Good		Rich light froth. Bubbles small and frail.	9.5	43.0				1.5	

Machine

Experimenter

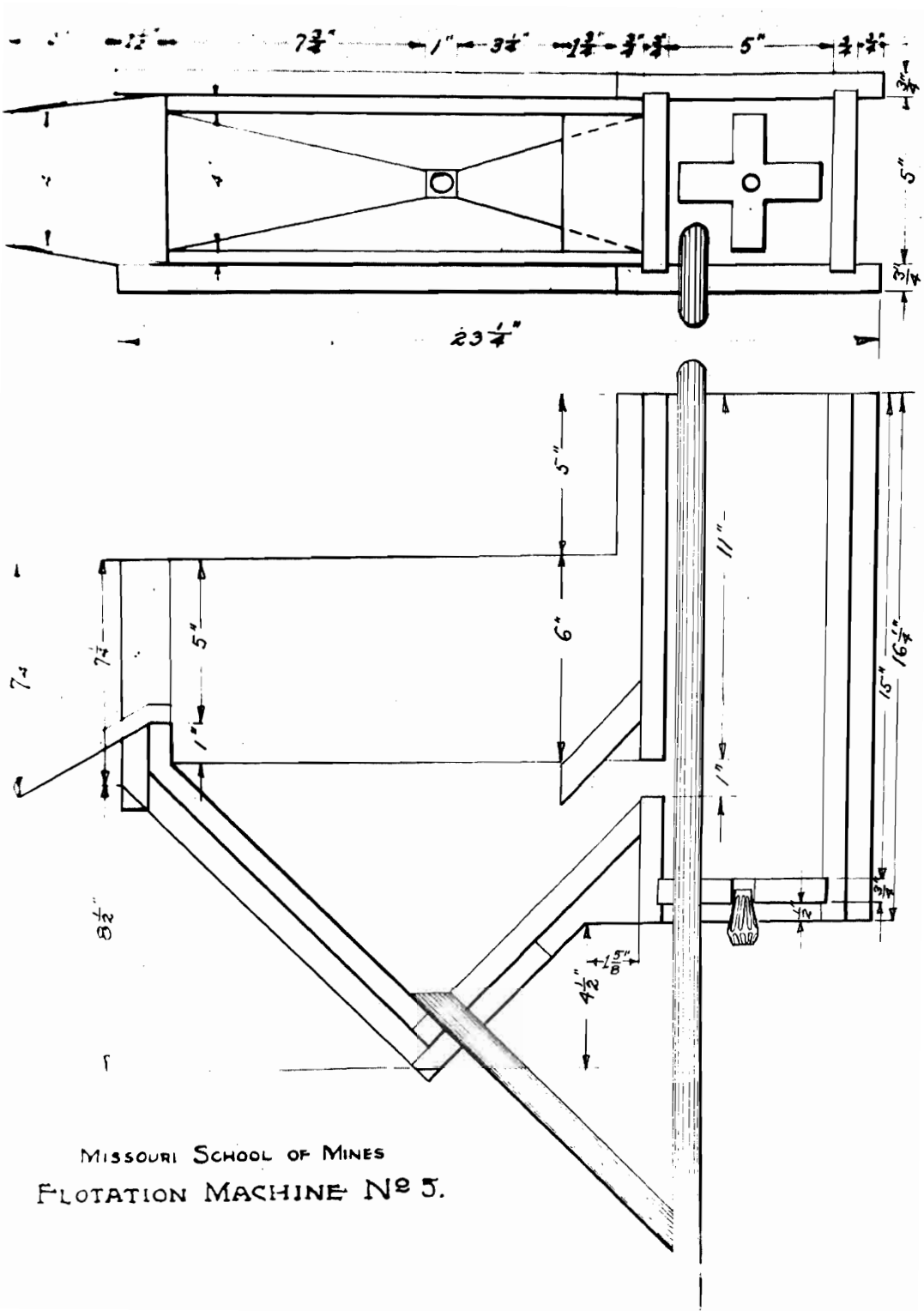
Missouri School of Mines and Metallurgy

FLOTATION LABORATORY.

OPERATING DATA.

ORE

Test No	OIL No.	OIL Amt.	OIL Kind.	REAGENTS Kind	REAGENTS Amt.	FROTH Kind	FROTH Amt.	REMARKS.	Conc RESULTS Wt.	Conc Per Ct.	Tails Wt.	Tails Per Ct.	Per Ct. Ext.
56			Creosote Oil	20%		Frail		Light small bubble froth grading into scum	3.1	34.7		1.15	
58			Banetts Flo	0.1	No 1	None		Small amount of poor grade float	.4	15.9		1.55	
59			do		No 2	None		do - Better Conc.	1.4	25.5		1.25	
60			do		No 3	Fair		Small bubble frail froth Small amt Rich in min.	2.5	45.3		1.15	
61			Cruce Cotton Seed	0.1		None		Small amount of good grade conc.	2.02	25.4		.75	
62			Pancoline			do		Small amount of poor grade float	9.58	20.7		.75	
103		Mix	Cushings Crude Cresylic Acid	70% 30%		do		Good selection - Small amount of float.	4.5	40.8		2.2	
104		Mix	Cush. ngs Crude Creosote	70% 30%		do		Fair amt of scum but poor quality.	1.67	29.5		3.5	



MISSOURI SCHOOL OF MINES

FLOTATION MACHINE Nº 5.

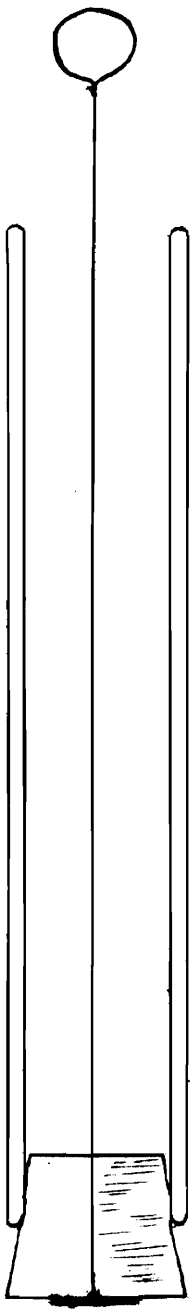


Fig R.

Diagram Showing Sampler Used.

The oil showing the best individual selective properties is No. 53 Eucalyptus Oil.

The oil showing the best frothing qualities is No. 22 Special Pine Oil No. 1580.

The best selector with frothing qualities is the same as the first mentioned, No. 53 Eucalyptus Oil.

The best frother with selective qualities is No. 54 Cresylic Acid.

Errors may have occurred due to any one or all of the following conditions:

1. The machine is of wood, and portions of the oils are often retained in cracks and exert an influence on the action of the oil in the next charge, which influence may materially affect the experiment.
2. The method of sampling.