

~~GCI 810~~

2 / 1952  
In The Privy Council

UNIVERSITY OF LONDON  
W.C.1.

9 JUL 1953

INSTITUTE OF ADVANCED  
LEGAL STUDIES

ON APPEAL FROM THE SUPREME COURT

BETWEEN :

MINERALS SEPARATION NORTH AMERICAN  
CORPORATION,

*Appellants*

—AND—

NORANDA MINES, LIMITED,

*Respondents.*

# RECORD OF PROCEEDINGS

VOLUME 1

PAGES 1—240

BIRD & BIRD,  
5-11 Theobald's Road,  
London, W.C.1,  
*Appellants' Solicitors.*

LAWRENCE JONES & CO.,  
Winchester House,  
Old Broad Street,  
London, E.C.2,  
*Respondents' Solicitors.*

# In The Supreme Court of Canada

ON APPEAL FROM THE EXCHEQUER COURT OF CANADA

BETWEEN :

NORANDA MINES, LIMITED,

*Appellant;*

— AND —

MINERALS SEPARATION NORTH AMERICAN  
CORPORATION,

*Respondent.*

---

---

## APPEAL CASE

---

---

— VOLUME 1 —

HOLDEN, MURDOCH, WALTON, FINLAY & ROBINSON,  
*Solicitors for Appellant.*

SMART & BIGGAR,  
*Ottawa Agents for Solicitors for Appellant.*

EWART, SCOTT, KELLEY & HOWARD,  
*Solicitors for Respondent.*

30720

UNIVERSITY OF LONDON  
W.C.1.

-9 JUL 1953

INSTITUTE OF ADVANCED  
LEGAL STUDIES

## INDEX

### PART I. — PLEADINGS, ETC.

DOCUMENT	DATE	VOL.	PAGE
Statement of Case . . . . .	June 24, 1947	I	1
Statement of Claim . . . . .	Mar. 1, 1943	I	1
Particulars of Breaches . . . . .	Mar. 1, 1943	I	3
Demand for Particulars . . . . .	May 6, 1943	I	3
Answer to Demand for Particulars . . . . .	May 21, 1943	I	5
Answer to Demand under Rule 22A . . . . .	Nov. 10, 1943	I	5
Statement of Defence . . . . .	June 19, 1943	I	6
Particulars of Objection . . . . .	June 19, 1943	I	7
Schedule I to Particulars of Objection . . . . .	June 19, 1943	I	10
Schedule II to Particulars of Objection . . . . .	June 19, 1943	I	11A

### PART II. — EVIDENCE

DOCUMENT	DATE	VOL.	PAGE
Opening of Plaintiff's Case by Mr. Gowling . . . . .		I	12
Mr. Gowling reads from examination for discovery of Murdoch . . . . .		I	31
FOR PLAINTIFF—			
ARTHUR HOWARD HIGGINS :			
Examination in Chief . . . . .		I	36
Cross-Examination . . . . .		I	79
Re-Examination . . . . .		I	107
Re-Cross-Examination . . . . .		I	118
Remarks of Counsel . . . . .		I	122
FOR PLAINTIFF—			
ELTOFT WRAY WILKINSON :			
Direct Examination . . . . .		I	125
Cross-Examination . . . . .		I	148
Re-Examination . . . . .		I	173
FOR PLAINTIFF—			
CORNELIUS HORACE KELLER :			
Direct Examination . . . . .		I	176
Cross-Examination . . . . .		I	219
Re-Examination . . . . .		I	236
FOR PLAINTIFF—			
HENRY D. WILLIAMS :			
Direct Examination . . . . .		II	241
Cross-Examination . . . . .		II	255
Re-Examination . . . . .		II	275
FOR PLAINTIFF—			
SETH GREGORY :			
Direct Examination . . . . .		II	280
Cross-Examination . . . . .		II	299
Extract from letter R. S. Smart to Ewart Scott & Kelley, Re: Commission Evidence . . . . .	Mar. 11, 1944	II	303
Letter in reply from Ewart Scott & Kelley . . . . .	Mar. 18, 1944	II	304
Opening of Defendant's Case by Mr. Biggar . . . . .		II	308

## EVIDENCE — (Continued)

DOCUMENT	DATE	VOL.	PAGE
<b>FOR DEFENDANT—</b>			
<b>CLIFFORD B. PURVES :</b>			
Examination in Chief .....		II	419
Cross-Examination .....		II	458
Re-Examination .....		III	485
Re-Cross-Examination .....		III	494
<b>FOR DEFENDANT—</b>			
<b>ROBERT L. BENNETT :</b>			
Examination in Chief .....		III	503
Cross-Examination .....		III	548
Re-Examination .....		III	573
Rebuttal			
<b>FOR PLAINTIFF—</b>			
<b>A. H. HIGGINS — Recalled</b>			
Examination in Chief .....		III	583
Cross-Examination .....		III	650
Remarks of Counsel and filing of additional exhibits .....		III	666

## PART III — EXHIBITS

EXHIBIT NO.	DESCRIPTION	DATE	APPEAL BOOK		EXHIBIT BOOK		FIRST REFERRED TO	
			VOL.	PAGE	VOL.	PAGE	VOL.	PAGE
P-50	Patent No. 247,576 in suit .....	Mar. 10, 1925	V	935	.....	.....	I	30
M-2	Statement of flotation agents used by Defendant .....	Mar. 13, 1944	.....	.....	I	26	I	32
M-3	Duplicate of M-4EE .....	.....	.....	.....	.....	.....	.....	.....
P-51	Bottle containing piece of ore .....	.....	.....	.....	.....	.....	I	40
P-52	Bottle of fine ground ore .....	.....	.....	.....	.....	.....	I	40
P-53	Bottle of ground ore with slimes washed out .....	.....	.....	.....	.....	.....	I	40
P-54	Chart-Structural formulae of carbonic acid, its sulphur derivatives and some alkyl radicals .....	.....	.....	.....	I	27	I	46
P-55	Chart-Calculation of quantities for forma- tion of xanthate .....	.....	.....	.....	I	28	I	50
D-56	Results of tests conducted by Higgins .....	.....	V	1043	.....	.....	I	85
D-57	Chart-sulphur derivatives of carbonic acid. .....	.....	.....	.....	I	29-31	I	100
D-58	Chart-Relation of classes of compounds referred to in patent 247,576 .....	.....	.....	.....	I	32	I	106
D-59	Results of flotation tests at Noranda .....	Aug. 29, 1944	V	1035	.....	.....	I	107
D-60	Chart of Sulphur Derivatives of carbonic acid showing inclusion of compounds .....	.....	.....	.....	I	33	I	116
D-61	Agreement as to list of xanthates .....	Nov. 16, 1944	V	1039	.....	.....	I	122
K-1	Drawing of MSNAC—Sub. A. machine .....	.....	.....	.....	I	12	I	138

## EXHIBITS — (Continued)

EXHIBIT No.	DESCRIPTION	DATE	APPEAL BOOK		EXHIBIT BOOK		FIRST REFERRED TO	
			VOL.	PAGE	VOL.	PAGE	VOL.	PAGE
K-2	Report of Lewis & Keller.....	Mar. 28, 1923	IV	771	.....	.....	I	143
K-3	Report.....	May 3, 1923	IV	785	.....	.....	I	143
K-4	Report.....	May 11, 1923	IV	794	.....	.....	I	143
	Table 1 .....		IV	798	.....	.....		
	Table 2 .....		IV	799	.....	.....		
K-5	Telegram Nutter to N.Y. office.....	June 15, 1923	IV	805	.....	.....	I	143
K-6	Article in Mining Journal Press.....	Feb. 9, 1924	IV	856	.....	.....	I	145
K-7	Editorial in Mining Journal Press.....	Aug. 2, 1924	IV	858	.....	.....	I	145
K-8	Abstract from Mining Journal Press.....	Oct. 18, 1924	IV	859	.....	.....	I	145
K-9	Editorial from Mining Journal Press.....	Nov. 22, 1924	IV	860	.....	.....	I	145
K-10	Extract from Mining Journal Press.....	Nov. 1, 1924	IV	860	.....	.....	I	146
K-11	Article in Mining Journal Press.....	Dec. 20, 1924	IV	861	.....	.....	I	146
K-12	Keller Notebook.....	May 1919- June 1924			.....	.....	I	178
	Page 14 .....				.....	.....	I	181
	" 16 .....				.....	.....	I	182
	" 27 .....				.....	.....	I	222
	" 29 .....				.....	.....	I	222
	" 30 .....				.....	.....	I	184
	" 31 .....				.....	.....	I	184
	" 32 .....				.....	.....	I	184
	" 33 .....				.....	.....	I	184
	" 34 .....				.....	.....	I	184
	" 36 .....				.....	.....	I	184
	" 37 .....				.....	.....	I	184
	" 38 .....				.....	.....	I	184
	" 39 .....				.....	.....	I	184
	" 40 .....				.....	.....	I	190
	" 41 .....				.....	.....	I	191
	" 42 .....				.....	.....	I	191
	" 43 .....				.....	.....	I	192
	" 44 .....				.....	.....	I	192
	" 45 .....				.....	.....	I	193
	" 46 .....				.....	.....	I	193
	" 47 .....				.....	.....	I	179
	" 48 .....				.....	.....	I	198
	" 49 .....				.....	.....	I	198
	" 50 .....				.....	.....	I	198
	" 52 .....				.....	.....	I	198
	" 53 .....				.....	.....	I	198
	" 54 .....				.....	.....	I	198
	" 55 .....				.....	.....	I	198
	" 57 .....				.....	.....	I	200
	" 58 .....				.....	.....	I	199
	" 59 .....				.....	.....	I	200
	" 60 .....				.....	.....	I	200
	" 61 .....				.....	.....	I	200
	" 63 .....				.....	.....	I	200
	" 64 .....				.....	.....	I	200
	" 65 .....				.....	.....	I	200
	" 66 .....				.....	.....	I	200
	" 67 .....				.....	.....	I	
	" 68 .....				.....	.....	I	
	" 69 .....				.....	.....	I	240
	" 70 .....				.....	.....	I	235
	" 71 .....				.....	.....	I	
	" 76 .....				.....	.....	I	232
	" 77 .....				.....	.....	I	233
	" 78 .....				.....	.....	I	233
	" 81 .....				.....	.....	I	236
K-13	Report of Keller.....	Sept. 1922	IV	761	.....	.....	I	189
K-14	Lewis Notebook.....	July 1922			.....	.....	I	196

## EXHIBITS — (Continued)

EXHIBIT No.	DESCRIPTION	DATE	APPEAL BOOK		EXHIBIT BOOK		FIRST REFERRED TO	
K-14 (con'd)	Page 67 .....				II		I	233
	" 68 .....				II		I	199
	" 75 .....				II		I	196
	" 76 .....				II		I	196
	" 77 .....				II		I	196
	" 86 .....				II		I	196
	" 92 .....				II		I	196
	" 116 .....				II		I	199
	" 131 .....				II		I	200
	" 132 .....				II		I	225
" 136 .....				II		I	200	
K-15	Lewis Notebook .....	Jan. 4, 1923-						
		May 10, 1923					I	196
K-16	Lewis Notebook .....	May 4, 1923-						
		Feb. 1, 1924					I	196
K-17	Keller report .....	May 7, 1923	IV	792			I	199
K-18	Keller report .....	Dec. 11, 1922	IV	765			I	200
K-19	Laboratory Record Book .....	Jan. 12, 1922-						
		Oct. 27, 1922					I	201
K-20	Laboratory Record Book .....	Oct. 20, 1922-			II		I	201
		Aug. 25, 1923						
K-21	3 sheets of tabulated tests .....	1922 — 23			I	14	I	202
					I	15		
					I	16		
K-22	Page 199 of Laboratory Record Book (Ex. K-20) .....	Feb. 3, 1923			I	17	I	206
K-23	Page 905 of Lewis Notebook (Ex. K-15) ..	Feb. 3, 1923			I	16A	I	208
K-24	Three assay certificates .....	Mar. 15, 1923	IV	769			I	209
K-25	Tabulation of tests with xanthate .....	Mar. 2, 1923-			I	18-22	I	210
		Aug. 23, 1923						
K-26	Lr. Nutter to N.Y. office .....	May 7, 1923	IV	791			I	211
K-27	Lr. Keller to Nutter .....	May 15, 1923	IV	800			I	211
K-28	Lr. Keller & Lewis to Nutter .....	May 16, 1923	IV	802			I	211
K-29	Lrs. Rosenstein to MSNAC, San Francisco	July 21, 1923	IV	821			I	213
K-30	Lr. Keller to Nutter .....	July 25, 1923	IV	824			I	213
K-31	Tel. Nutter to Lewis .....	Aug. 3, 1923	IV	832			I	214
K-32	Lr. Nutter to G. W. Electro Chemical Company .....	Aug. 9, 1923	IV	838			I	215
	Flow sheet for xanthate preparation .....		IV	839				
K-33	Lr. Nutter to Anaconda .....	Aug. 9, 1923	IV	840			I	215
K-34	Lr. Nutter to MSNAC — N.Y. .....	Aug. 9, 1923	IV	837			I	215
K-35	Lr. Keller to Nutter .....	July 23, 1923	IV	823			I	215
K-36	Lr. Keller to Nutter .....	July 27, 1923	IV	826			I	215
K-37	2 lrs. Keller to Nutter .....	Aug. 2, 1923	IV	829			I	216
K-38	3 lrs. Keller to Nutter .....	Aug. 2, 1923	IV	830			I	216
K-39	4 lrs. Keller to Nutter .....	Oct. 15, 1923	IV	847			I	216
		Oct. 17, 1923	IV	848				
		Oct. 29, 1923	IV	849				
		Oct. 29, 1923	IV	851				
K-40	Lr. Keller to Nutter .....	Nov. 26, 1923	IV	852			I	217
K-41	Report Keller & Lewis to Nutter .....	Feb. 7, 1924	IV	854			I	217
K-42	Tabulation re: benzyl xanthate .....	..... 1924			I	23	I	217
K-43	U.S. Patent 2,044,851 .....	June 23, 1936	V	970			I	218
K-44	U.S. Patent 1,728,764 .....	Sept. 17, 1929	V	961			I	218
K-45	Report Keller to Nutter .....	Sept. 11, 1925	IV	865			I	218
K-46	Tabulation re mercaptans .....	1922 — 25			I	13	I	218
K-47	File wrapper and contents of Keller U.S. Application :							
	U.S. Patent 1,554,216 .....	Sept. 22, 1925	IV	875			I	218
	Certificate of Commissioner .....		IV	875				
	Cover .....		IV	876				
	Petition .....		IV	877				
	Specification .....		IV	877				
	Oath .....	Oct. 15, 1923	IV	882				

## EXHIBITS — (Continued)

EXHIBIT No.	DESCRIPTION	DATE	APPEAL BOOK		EXHIBIT BOOK		FIRST REFERRED TO	
			VOL.	PAGE	VOL.	PAGE	VOL.	PAGE
K-47 (con'd)	Official Action.....	Oct. 31, 1923	IV	883				
	Reply to above action.....		IV	885				
	Official action.....	Dec. 3, 1923	IV	886				
	Reply to above action.....		IV	887				
	Interference record 50,394.....	Aug. 4, 1925	IV	887				
	Action advising of interference.....		IV	888				
	Amendment.....		IV	890				
	Amended petition.....		IV	893				
	Supplemental oath of Lewis.....	Mar. 26, 1924	IV	894				
	Supplemental oath of Keller.....	Mar. 25, 1924	IV	895				
	Official action.....		IV	897				
	Substitute power of Attorney.....		IV	897				
	Amendment.....		IV	898				
	Notice of Allowance.....	Aug. 5, 1925	IV	899				
	Covering lr. for final fee.....	Aug. 19, 1925	IV	901				
	The patent as issued.....	Aug. 20, 1925	IV	902				
	Title report.....	June 29, 1927	IV	908				
	Official letter advising of Martin inter- ference 55642.....		IV	909				
	Interference record.....		IV	911				
	K-A	Page 30 of Laboratory Record Book (Ex. K-20)	Nov. 17, 1922			I	16B	I
K-B	Page from Keller notebook.....	Jan. 1924			I	25	I	231
K-C	Page from Keller notebook.....	Jan. 1924			I	24	I	232
W-1	Agreement Martin — Minerals Separation Ltd.....		III	687			II	243
W-2	Agreement Martin—Min. Sep. American Syndicate (1913) Ltd.....		III	684			II	243
W-3	2 sheets Williams notes on Martin inter- view.....		III	683			II	244
W-4	Lr. Martin to Gregory.....	Mar. 19, 1915	IV	690			II	246
W-5	Martin's specifications.....	Mar. 19, 1915	IV	691			II	246
	Kotrix.....		IV	691				
	Stanol.....		IV	695				
	Minola.....		IV	699				
	Grabanol.....		IV	702				
	Pyrox.....		IV	704				
	Unnamed specification.....		IV	709				
W-6	Tel. Williams to Nutter.....	Nov. 13, 1929	V	981			II	247
W-7	Tel. Nutter to Williams.....	Nov. 14, 1929	V	981			II	248
W-8	Lr. Martin to Gregory.....	Feb. 23, 1917	IV	738			II	249
W-9	U.S. Patent 1,236,856 Martin.....	Aug. 14, 1917	IV	747			II	249
W-10	U.S. Patent 1,236,857 Martin.....	Aug. 14, 1917	IV	744			II	249
W-11	Lr. Williams to MSNAC.....	Mar. 21, 1917	IV	738			II	250
W-12	Photostat copy receipt of Martin for \$5000	Mar. 21, 1917	IV	738			II	250
W-13	List of Martin's patent applications.....		IV	743			II	250
W-14	Report of Keller & Lewis.....	Mar. 30, 1923	IV	782			II	251
W-15	Lr. Nutter to MSNAC (duplicate of K-2)	Mar. 28, 1923	IV	771			II	251
W-16	Lr. Williams & Pritchard to MSNAC....	April 30, 1923	IV	789			II	251
W-17	Tel. Williams to Evans.....	Aug. 20, 1926	V	980			II	253
W-18	Lr. Williams to Counsel for Metals Recovery.....	Aug. 20, 1926	V	980			II	253
G-1	Lr. Martin to Gregory.....	Mar. 19, 1915	III	689			II	283
G-2	Lr. Gregory to Martin.....	May 6, 1915	IV	714			II	283
G-3	Martin's Bulletin No. 2.....		IV	725			II	288
G-4	Pages from "Recipe Book".....		IV	751			II	289
G-5	Lr. Gregory to Ballot.....	July 28, 1915	IV	720			II	289
G-6	Lr. Higgins to Gregory re Martin.....	July 30, 1915	IV	721			II	290
G-7	Lr. Gregory to Ballot.....	Aug. 3, 1915	IV	723			II	290
G-8	Lr. Gregory to Ballot.....	Aug. 26, 1915	IV	732			II	290
G-9	Report.....	Aug. 14, 1915	IV	724			II	291
G-10	Lr. Gregory to Ballot.....	Sept. 17, 1915	IV	733			II	291
G-11	Lr. Ballot to Gregory.....	Oct. 1, 1915	IV	736			II	291



## EXHIBITS — (Continued)

EXHIBIT No.	DESCRIPTION	DATE	APPEAL BOOK		EXHIBIT BOOK		FIRST REFERRED TO	
			VOL.	PAGE	VOL.	PAGE	VOL.	PAGE
G-12	Lr. Gregory to Ballot .....	Oct. 15, 1915	IV	736			II	291
G-13	Lr. Gregory to Ballot .....	Oct. 22, 1915	IV	737			II	291
G-14	List of Plaintiff's licensees in Canada .....		V	982			II	295
G-15	Licence form of Plaintiff .....		V	1012			II	295
G-16	Excerpts from minutes of MSNAC directors' meeting .....	1936 — 43	V	1009			II	296
G-17	Lr. Ballot to Gregory .....	July 6, 1915	IV	717			II	300
G-18	Lr. Ballot to Gregory .....	July 20, 1915	IV	718			II	300
G-19	Lr. Gregory to Ballot .....	July 21, 1915	IV	719			II	300
G-20	Lr. Ballot to Gregory .....	Aug. 10, 1915	IV	723			II	300
G-21	Lr. Ballot to Gregory .....	Aug. 31, 1915	IV	732			II	300
D-62	Memo Rosenstein to Nutter .....	May 10, 1923	IV	793			II	320, 365
D-63	Lr. Nutter to Plaintiff .....	May 25, 1923	IV	803			II	320
D-64	Lr. Nutter to Plaintiff .....	May 29, 1923	IV	804			II	320, 367
D-65	Lr. Nutter to Plaintiff .....	June 18, 1923	IV	806			II	320, 369
D-66	Report of tests at Anaconda .....		IV	808			II	320
D-67	Lr. Nutter to Plaintiff .....	June 20, 1923	IV	813			II	320
D-68	Lr. Plaintiff to Nutter .....	June 26, 1923	IV	816			II	320, 369
D-69	Lr. Morrow to Nutter .....	July 6, 1923	IV	818			II	320
D-70	Lr. Nutter to Morrow .....	July 19, 1923	IV	819			II	320
D-71	Lr. Nutter to Morrow .....	July 21, 1923	IV	819			II	320
D-72	Lr. Morrow to Nutter .....	July 26, 1923	IV	825			II	320
D-73	Lr. Nutter to Anaconda .....	Aug. 2, 1923	IV	827			II	320
D-74	Lr. Nutter to Gregory .....	Sept. 4, 1923	IV	842			II	320, 373
D-75	Tel. Nutter to G. W. El. Chem. Co. ....	Sept. 6, 1923	IV	845			II	320
D-76	Tel. Nutter to G. W. El. Chem. Co. ....	Sept. 6, 1923	IV	845			II	320
D-77	Lr. G. W. El. Chem. Co. to Plaintiff .....	Sept. 15, 1923	IV	846			II	320, 373
D-78	Tel. Nutter to Gregory .....	Sept. 27, 1923	IV	847			II	320
D-79	Lr. C. B. A. to Janney .....	Feb. 14, 1924	IV	857			II	320, 376
D-80	Lr. Lewis to Nutter .....	Aug. 4, 1923	IV	832			II	353
D-81	U.S. Patent 1,154,220 Lewis .....	Sept. 22, 1925	V	952			II	360
D-82	Can. Patent 247,791 Lewis .....	Mar. 7, 1925	V	943			II	360
D-83	File Wrapper Can. Patent 247,576 in suit ..	Mar. 10, 1925	V	912			II	407
	Certificate of Commissioner .....		V	912				
	File Record .....		V	912				
	Petition .....	Dec. 5, 1924	V	912				
	Petition .....	Oct. 11, 1924	V	913				
	Power of Attorney to Ridout & Maybee ..	Dec. 5, 1924	V	914				
	Assoc. Power of Attorney to Ridout & Maybee ..	Oct. 21, 1924	V	914				
	Assoc. Power of Attorney to Caron & Caron ..	Oct. 23, 1924	V	915				
	Oath .....	Oct. 11, 1924	V	915				
	Specification .....		V	916				
	Covering lr. for application .....	Oct. 23, 1924	V	922				
	Oath of Albert Caron .....	Oct. 23, 1924	V	923				
	Receipt for filing fee .....		V	924				
	Covering lr. for new petition .....	Oct. 24, 1924	V	924				
	Petition .....	Oct. 23, 1924	V	925				
	Specification as filed .....	Oct. 23, 1924	V	926				
	Receipt for assignment fee .....		V	926				
	Official filing receipt .....	Oct. 28, 1924	V	927				
	Covering lr. to powers of attorney .....	Oct. 29, 1924	V	928				
	Acknowledgement of above .....	Nov. 14, 1924	V	929				
	Official objection to appointment of representative ..	Nov. 25, 1924	V	929				
	Covering lr. for new petition and power of attorney .....	Dec. 13, 1924	V	930				
	Acknowledgement of above .....	Dec. 18, 1924	V	931				
	Notice of Allowance .....	Jan. 6, 1925	V	931				
	Covering lr. for final fee .....	Jan. 16, 1925	V	932				
	Receipt for final fee .....		V	933				
	File cover .....			934				

## EXHIBITS — (Continued)

EXHIBIT No.	DESCRIPTION	DATE	APPEAL BOOK		EXHIBIT BOOK		FIRST REFERRED TO	
			VOL.	PAGE	VOL.	PAGE	VOL.	PAGE
D-84	U.S. Patent 835,120 Sulman .....	Nov. 6, 1906	III	673	.....	.....	II	419
D-85	U.S. Patent 962,678 Sulman .....	June 28, 1910	III	679	.....	.....	II	419
D-86	Chart of Organic radicals .....	.....	.....	.....	I	34	II	420
D-87	Chart of Glycerol and Cellulose and their radicals .....	.....	.....	.....	I	35	II	435
P-88	Copy of pages of Richter's Chemistry .....	1929	V	1019	.....	.....	II	459
D-89A	Assay certificate .....	Oct. 13, 1944	V	1037	.....	.....	III	506
D-89B	Assay certificate .....	Oct. 17, 1944	V	1038	.....	.....	III	506
D-59A	Result of flotation tests at Noranda .....	Oct. 29, 1944	V	1036	.....	.....	III	506
D-90	Laboratory notebook of R. L. Bennett .....	Aug.— Sept. 1944	.....	.....	.....	.....	III	507
D-91	Lr. Quigley to Nutter .....	April 28, 1921	IV	760	.....	.....	III	577
D-92	Tel. Plaintiff to Nutter .....	May 25, 1923	IV	803	.....	.....	III	577
D-93	Tel. Nutter to Morrow .....	July 5, 1923	IV	817	.....	.....	III	577
D-94	Tel. Lewis to Nutter .....	Aug. 6, 1923	IV	833	.....	.....	III	577
D-95	Tel. Nutter to Lewis .....	Aug. 6, 1923	IV	834	.....	.....	III	578
D-96	Lr. Anaconda to Nutter .....	Aug. 8, 1923	IV	836	.....	.....	III	578
D-97	Lr. Nutter to Plaintiff .....	Aug. 30, 1923	IV	841	.....	.....	III	578
D-98	Tel. G. W. El. Chem. Co. to Nutter .....	Sept. 5, 1923	IV	844	.....	.....	III	578
D-99	U.S. Patent 1,364,304 Perkins .....	Jan. 4, 1921	IV	754	.....	.....	III	579
P-100	Supplemental report of tests on Anaconda ore .....	Jun.-Jul. 1923	IV	814	.....	.....	III	581
P-101	Lr. Lewis to Nutter .....	Aug. 7, 1923	IV	835	.....	.....	III	582
P-102	Lr. Martin to Gregory .....	May 25, 1915	IV	716	.....	.....	III	636
P-103	Martin Bulletin No. 1 .....	1915	.....	.....	.....	.....	III	640
P-104	Martin's specifications (Higgins' copy) (Duplicate of W-5 except for Higgins' notes) .....	Mar. 9, 1915	.....	.....	I	1-12	III	640
P-105	Martin's Bulletin No. 3 .....	Sept. 20, 1915	IV	733	.....	.....	III	644
P-106	Martin's Bulletin No. 4 .....	Sept. 20, 1915	IV	735	.....	.....	III	645
P-107	Lr. Higgins to Williams .....	Dec. 11, 1915	IV	737	.....	.....	III	646
P-108	Index to Martin Bulletins .....	1915 — 23	IV	739	.....	.....	III	648
D-109	Lr. Martin to Gregory .....	June 3, 1926	V	976	.....	.....	III	667
D-110	Lr. Plaintiff to Martin .....	June 3, 1926	V	977	.....	.....	III	667
D-111	Lr. Martin to Roberts .....	June 6, 1926	V	977	.....	.....	III	667
D-112	Lr. Plaintiff to Martin .....	June 7, 1926	V	978	.....	.....	III	667
D-113	Lr. Martin to Plaintiff .....	June 12, 1926	V	978	.....	.....	III	667
D-114	Lr. Plaintiff to Martin .....	June 14, 1926	V	979	.....	.....	III	667
D-115	Lr. Martin to Nutter .....	June 28, 1926	V	979	.....	.....	III	668
D-116	Lr. Nutter to Martin .....	July 6, 1926	V	980	.....	.....	III	668
P-117	Table of consumption of flotation reagents in 1923 .....	April 1926	IV	875	.....	.....	.....	.....
M-4A	Lr. Dft. to Plf. .....	Dec. 8, 1925	V	983	.....	.....	.....	.....
M-4B	Lr. Plf. N.Y. to Plf. San Francisco .....	Dec. 11, 1925	V	983	.....	.....	.....	.....
M-4C	Lr. Dft. to Plf. .....	Dec. 28, 1925	V	984	.....	.....	.....	.....
M-4D	Lr. Plf. to Dft. .....	Mar. 9, 1926	V	985	.....	.....	.....	.....
M-4E	Lr. Plf. to Dft. .....	Aug. 2, 1930	V	986	.....	.....	.....	.....
M-4F	Lr. Plf. to Dft. .....	Aug. 12, 1930	V	987	.....	.....	.....	.....
M-4G	Lr. Plf. to Dft. .....	Nov. 1, 1931	V	988	.....	.....	.....	.....
M-4H	Lr. Dft. to Plf. .....	Nov. 10, 1932	V	990	.....	.....	.....	.....
M-4I	Lr. Plf. to Dft. .....	Nov. 16, 1932	V	992	.....	.....	.....	.....
M-4J	Lr. Plf. to Dft. .....	Nov. 17, 1932	V	993	.....	.....	.....	.....
M-4K	Lr. Plf. to Dft. .....	April 4, 1934	V	994	.....	.....	.....	.....
M-4L	Lr. Plf. to Dft. .....	April 24, 1934	V	994	.....	.....	.....	.....
M-4M	Lr. Dft. to Plf. .....	May 23, 1934	V	995	.....	.....	.....	.....
M-4N	Lr. Plf. to Dft. .....	May 25, 1934	V	995	.....	.....	.....	.....
M-4O	Lr. Plf. to Dft. .....	July 16, 1934	V	996	.....	.....	.....	.....
M-4P	Lr. Dft. to Plf. .....	July 18, 1934	V	996	.....	.....	.....	.....
M-4Q	Lr. Plf. to Dft. .....	July 20, 1934	V	997	.....	.....	.....	.....
M-4R	Lr. Dft. to Plf. .....	Nov. 2, 1934	V	997	.....	.....	.....	.....
M-4S	Lr. Plf. to Dft. .....	Nov. 14, 1934	V	998	.....	.....	.....	.....
M-4T	Lr. Dft. to Plf. .....	Nov. 21, 1934	V	999	.....	.....	.....	.....

## EXHIBITS — (Continued)

EXHIBIT No.	DESCRIPTION	DATE	APPEAL BOOK		EXHIBIT BOOK		FIRST REFERRED TO	
			VOL.	PAGE	VOL.	PAGE	VOL.	PAGE
M-4U	Lr. Plf. to Dft. ....	Nov. 26, 1934	V	999				
M-4V	Lr. Dft. to Plf. ....	Jan. 15, 1935	V	1000				
M-4W	Lr. Dft. to Plf. ....	Feb. 12, 1935	V	1000				
M-4X	Lr. Plf. to Dft. ....	Feb. 14, 1935	V	1001				
M-4Y	Lr. Plf. to Dft. ....	Feb. 7, 1936	V	1001				
M-4Z	Lr. Dft. to Plf. ....	Feb. 12, 1936	V	1002				
M-4AA	Lr. Plf. to Dft. ....	Feb. 13, 1936	V	1003				
M-4BB	Lr. Dft. to Plf. ....	Feb. 17, 1936	V	1004				
M-4CC	Lr. Plf. to Dft. ....	Feb. 18, 1936	V	1004				
M-4DD	Lr. Plf. to Dft. ....	Mar. 31, 1936	V	1005				
M-4EE	Lr. Dft. to Plf. (Duplicate of Ex. M-3) ...	April 1, 1936	V	1005				
M-4FF	Lr. Plf. to Dft. ....	April 2, 1936	V	1006				
M-4GG	Lr. Plf. to Dft. ....	April 23, 1936	V	1006				
M-4HH	Lr. Dft. to Plf. ....	April 25, 1936	V	1007				
M-4II	Lr. Plf. to Dft. ....	April 27, 1936	V	1007				
M-4JJ	Lr. Plf. to Dft. ....	May 26, 1936	V	1008				
M-4KK	Lr. Dft. to Plf. ....	May 28, 1936	V	1008				

## PART IV — JUDGMENTS, ETC.

DESCRIPTION	DATE	PAGE
Reasons for Judgment, Thorson, P. ....	May 28, 1947	1044
Formal Judgment of Exchequer Court. ....	May 28, 1947	1110
Consent as to contents of case. ....	Aug. 23, 1948	1111
Order of Supreme Court dispensing with printing of certain exhibits. ....	June 25, 1948	1113
Order of Supreme Court dispensing with printing of Exhibit P-104. ....	Aug. 23, 1948	1114
Solicitor's certificate. ....	.....	1114
Registrar's certificate. ....	.....	1115

DESCRIPTION	DATE	PAGE
IN THE SUPREME COURT OF CANADA		
Reasons for Judgment,		
Kerwin, J. ....	Dec. 5, 1949	1116
Kellock, J. ....	Dec. 5, 1949	1121
Rand and Locke, JJ. ....	Dec. 5, 1949	1131
Estey, J. ....	Dec. 5, 1949	1141
Formal Judgment of Supreme Court of Canada. ....	Dec. 5, 1949	1149
IN THE PRIVY COUNCIL		
Order granting special leave to appeal. ....	July 21, 1950	1150

# In the Exchequer Court of Canada

BETWEEN :

MINERALS SEPARATION NORTH AMERICAN  
CORPORATION,

*Plaintiff;*

— AND —

NORANDA MINES, LIMITED,

*Defendant.*

10

## STATEMENT OF CASE

This is an appeal from the judgment of the Exchequer Court of Canada dated May 28th, 1947, ordering and adjudging that claim 9 of Letters Patent No. 247,576 dated March 10th, 1925 is valid and has been infringed by the defendant.

TAKE NOTICE that the defendant intends to appeal and does hereby appeal from the judgment of the Honourable the President of the Exchequer Court rendered herein on the 28th day of May, 1947.

DATED at Ottawa this 24th day of June, 1947.

20 HOLDEN, MURDOCH, WALTON, FINLAY & ROBINSON,  
*Solicitors for the Defendant.*

To: THE REGISTRAR OF THE EXCHEQUER COURT.

To: MESSRS. EWART, SCOTT, KELLEY, SCOTT & HOWARD,  
*Solicitors for the Plaintiff.*

## STATEMENT OF CLAIM

Filed the First day of March, A.D. 1943.

30 1. The plaintiff is a body corporate and politic duly incorporated under the laws of the State of Maryland, one of the United States of America, and having its chief place of business at number 11 Broadway, in the City of New York, in the State of New York, another of the United States of America.

## Statement of Claim

2. The defendant is a body corporate and politic, duly incorporated under the laws of the Dominion of Canada, and having its head office at 941 Dominion Square Building in the City of Montreal, in the Province of Quebec.

3. By letters patent number 247,576, dated the 10th day of March 1925, the Commissioner of Patents of the Dominion of Canada granted to the plaintiff, as assignee of one Cornelius H. Keller, for a period of eighteen years from the date of the said letters patent, the exclusive right, privilege and liberty of using  
 10 and licensing others to use, in the Dominion of Canada, the process described in the said letters patent and consisting of Froth Flotation Concentration of Ores as described in the specification, a duplicate of which is attached to the said letters patent and made a part thereof, to which letters patent the plaintiff, for greater certainty and particularity, craves leave to refer at the trial or other disposition of this action.

4. The plaintiff has complied with all of the necessary provisions and requirements of the Patent Act and other statutes in that behalf and has paid all necessary fees and the said letters  
 20 patent are now in full force and effect and the sole title to the same is vested in the plaintiff.

5. The defendant has for some time past, without the licence, permission or assent of the plaintiff, infringed the said letters patent, and is still infringing the same and threatens to continue so to do unless restrained by the order of this Honourable Court.

6. By reason of the aforesaid wrongful acts of the defendant, the plaintiff has suffered great damages.

7. Through its aforesaid wrongful acts, the defendant has made large profits.

## 30 THE PLAINTIFF THEREFORE CLAIMS :

- (a) A declaration that the said letters patent are valid.
- (b) A declaration that the defendant has infringed the said letters patent.
- (c) An order for the destruction of, or the delivery up by the defendant of, all products or articles in the possession or control of the defendant which infringe the said letters patent.
- (d) Payment of damages, or an account of profits, as the plaintiff may elect.
- 40 (e) A direction that all necessary accounts may be taken and that all necessary enquiries may be had.
- (f) The costs of this action.

**Particulars of Breaches  
Demand for Particulars**

- (g) Such further or other relief as to this Honourable Court may seem meet.

W. L. SCOTT,  
*Of Counsel for the Plaintiff.*

---

**PARTICULARS OF BREACHES**

1. The defendant, after the date of the issue of the letters patent number 247,576, referred to in the statement of claim herein, to wit, continuously for a period of five years prior to the date of the filing of the statement of claim, has at its mine infringed  
10 claims 6, 7, 8 and 9 of the said letters patent.

DELIVERED with the statement of claim this First day of March, A.D. 1943 by Ewart, Scott, Kelley, Scott & Howard of Suite 211 Blackburn Building, in the City of Ottawa, Canada, Solicitors for the Plaintiff.

---

**DEMAND FOR PARTICULARS**

1. Attached hereto are schedules 1, 2 and 3 showing various conditioning or collecting agents which during the past twelve years have been used at different times by the defendant and by other defendants in similar actions instituted in this Court under  
20 letters patent 241,574 since March 1st, 1943. Some of the reagents set forth in schedule 2 have been used in combination with one or more of the reagents set forth in schedule 3.
2. The defendant demands particulars as to which of the reagents set forth in schedule 2 are alleged to have been used by it in infringement of the plaintiff's patent.
3. The defendant demands particulars as to whether the plaintiff alleges infringement of its patents by use of one or other of the reagents set forth in schedule 2 with the reagents set forth in schedule 3, and if so, with respect to what particular reagents.
- 30 4. The defendant demands particulars as to whether the plaintiff alleges infringement of its patents by use of one or other of the reagents set forth in schedule 2 with the reagents set forth in schedule 1, and if so, with respect to what particular reagents.

DATED this 6th day of May, 1943.

SMART & BIGGAR,  
*Agents for Holden, Murdoch, Walton, Finlay  
& Robinson, Solicitors for the Defendant.*

## SCHEDULE 1

Sodium Carbonate  
Calcium Hydroxide  
Sodium Silicate  
Copper Sulphate  
Sodium Cyanide  
Sodium Sulphite  
Sodium Sulphide

## SCHEDULE 2

10 Sodium Ethyl Xanthate  
Potassium Ethyl Xanthate  
Sodium Butyl Xanthate  
Potassium Butyl Xanthate  
Sodium Amyl Xanthate  
Potassium Amyl Xanthate  
Potassium Isopropyl Xanthate  
Potassium Pentasol Amyl Xanthate  
Potassium Hexyl Xanthate  
Sodium Aerofloat  
20 Phosphor Cresylic Acid Nos. 15 and 25  
Water Gas Tar  
Thiocarbamid  
Reagent No. 301 sold by American Cyanamid Company

## SCHEDULE 3

B - 60  
Hard Wood Creosote  
Coal Tar Creosote

Answer to Demand for Particulars  
 Answer for Demand under Rule 22a

ANSWER TO DEMAND FOR PARTICULARS

1. The plaintiff objects to the use by the defendant of the following reagents:

10 Sodium Ethyl Xanthate  
 Potassium Ethyl Xanthate  
 Sodium Butyl Xanthate  
 Potassium Butyl Xanthate  
 Sodium Amyl Xanthate  
 Potassium Amyl Xanthate  
 Potassium Isopropyl Xanthate  
 Potassium Pentasol Amyl Xanthate  
 Potassium Hexyl Xanthate  
 Reagent No. 301 sold by American Cyanamid Company.

2. The plaintiff further objects to the use of any of the substances mentioned in the first and third paragraph of the schedule to the Demand when used in connection with any of the reagents mentioned in the first paragraph hereof.

DATED this twenty-first day of May 1943.

20 EWART, SCOTT, KELLEY, SCOTT & HOWARD,  
*Solicitors for the Plaintiff.*

To : R. S. SMART, ESQ., K.C.,  
*Of Counsel for the Defendant.*

---

ANSWER TO DEMAND UNDER RULE 22A

30 In answer to the demand of the defendant, dated the 30th day of October, 1943, served pursuant to the provisions of Rule 22A of the Exchequer Court Rules, the plaintiff states that the date on which he proposes to assert that the invention of the patent sued on, took place, was the 18th day of September, 1922 and that the nature of the evidence on which he intends to rely in establishing that date, is an entry under that date in the inventor's note book, coupled with the evidence of the inventor.

DATED this 10th day of November, 1943.

EWART, SCOTT, KELLEY, SCOTT & HOWARD,  
*Solicitors for the Plaintiff.*



Statement of Defence

## STATEMENT OF DEFENCE

Filed the 19th day of June, 1943.

1. The defendant admits the allegations contained in paragraph 1 of the Statement of Claim, denies the allegations contained in paragraphs 4, 5, 6 and 7 thereof, and puts the plaintiff to proof of the allegations contained in paragraphs 2 and 3 thereof.

2. The defendant has not infringed the letters patent No. 247,576 referred to in the Statement of Claim.

3. The plaintiff is not entitled to the relief claimed because  
10 of its laches and acquiescence, in respect of which the defendant relies upon the following facts:

(a) The said patent expired on the 10th day of March, 1943;

(b) The plaintiff postponed the institution of any action for the infringement of the said patent until the 1st day of March, 1943, immediately preceding the expiry thereof;

(c) On the said 1st day of March, 1943, and during the next few days thereafter the plaintiff instituted this action and actions against nineteen other defendants, all of whom had for many years been continuously using the mineral separation processes which they still use and upon which alone  
20 these actions could be based;

(d) The plaintiff has for many years been fully aware of the nature of the separation processes used as aforesaid by this defendant and the defendants in the other actions mentioned;

(e) The plaintiff deliberately abstained from instituting any action against anyone for the infringement of the said patent notwithstanding the plaintiff's full knowledge of the use of the processes aforesaid having determined to avoid the risk of provoking an attack on the validity of the said patent while the same remained in force in order that it might continue to derive certain benefits accruing to it which it would forfeit if the patent were set aside;  
30

(f) By reason of the plaintiff's having abstained from instituting any action for the infringement of the said patent, this defendant and the other defendants mentioned were induced to believe that there was nothing to prevent them from adopting and using the processes aforesaid and acted on such belief.

4. The said letters patent No. 247,576 are invalid for the reasons set forth in the particulars of objection delivered herewith.  
40

5. The Defendant submits that this action be dismissed with costs.

RUSSEL S. SMART,  
WILLIAM S. WALTON,  
P. C. FINLAY,

*Of Counsel for the Defendant.*

## Particulars of Objection

## PARTICULARS OF OBJECTION

Amended by Order dated the 18th of February, 1944.

Amended by Order dated April 6th, 1944.

Amended by Order dated June 23rd, 1944.

The defendant alleges that Patent No. 247,576 is invalid because:

1. The said patent discloses no invention;
2. If any invention is therein disclosed it was not made by Cornelius H. Keller in the patent mentioned having regard to the  
10 information recorded by Rutherford B. Martin hereinafter referred to and available to the said Keller.
3. If any invention is therein disclosed, the same was known, before such alleged invention was made by Cornelius H. Keller, to the authors of the publications and the applicants for the patents set forth in Schedule 1 hereto, which said publications and patents were published on the days in the said schedule mentioned.
4. If any invention is therein disclosed, such invention was also known or used before the same was made by Cornelius H. Keller therein referred to:
  - 20 (a) In the year 1915 by one Rutherford B. Martin employed during the first part of the said year by the Utah Copper Company near Salt Lake City in the State of Utah and subsequently by the plaintiff;
  - (b) In the year 1915 by officers and employees of the said Utah Copper Company;
  - (c) In the years 1915 and 1916 by officers, employees and attorneys of the plaintiff and its predecessor in title, Minerals Separation American Syndicate (1913) Limited and by the officers and employees of Minerals Separation  
30 Limited, London;
  - (e) In or about the year 1921 by Ralph B. Sayre of Pittsburgh, Pennsylvania.
5. The invention of Rutherford B. Martin (if in fact an invention) was made available to the public before October 23, 1924:
  - (a) By its disclosure in or about the year 1915 to Thomas A. Janney, E. Shores, Andrew Clauson, F. G. Janney and other persons employed by or associated with the Utah Copper Company;
  - 40 (b) By its disclosure in the year 1915 or subsequently to Dr. S. Gregory, A. Howard Higgins, W. A. B. Waling and other persons employed by or associated with the plaintiff company;

**Particulars of Objection**

- (c) By its disclosure on or about September 13, 1923, to persons employed by and associated with the Anaconda Copper Mining Company and by the putting in practice thereof commercially by the said company in or about the said month of September, 1923;
- (d) By the putting in practice thereof commercially by the Utah Copper Company during a period commencing in or about the month of October, 1924;
- 10 (e) By publication in the "Mineral Industry during 1923" Vol. 32, page 757;
- (f) By Minerals Separation American Syndicate (1913) Limited and Minerals Separation, Limited, London, and their respective officers and employees.
6. The specification forming part of the said letters patent contain more or less than was necessary for obtaining it and for which it purported to be made, and such omission or addition was wilfully made for the purpose of misleading.
- (a) The applicant for patent failed to disclose a number of other xanthates which had been tested by him prior to  
20 the date of filing the application for patent in Canada.
- (b) The application for patent failed to give particulars for various ores with respect to which the process as disclosed is not useful.
7. The specification forming part of the said letters patent does not disclose a completed invention. If any invention was made, which is not admitted but denied, it was made by one Carl Pierce Lewis, who filed a joint application with the said Cornelius H. Keller for a patent on the said alleged invention in the United States of America on October 23, 1923, and on which  
30 the plaintiff as assignee of the said Lewis was granted Canadian patent 247,791.
8. If any invention was made and disclosed in the said letters patent 247,576, which is not admitted but denied, it was a joint invention of the said Cornelius H. Keller and Carl Pierce Lewis.
9. The Commissioner of Patents was without authority to grant the said letters patent No. 247,576 because the statutory conditions and provisions of the Patent Act in force at the date of the application for the said letters patent were not fulfilled.
- 40 (a) The specification filed on the 23rd day of October, 1923, made no disclosure of the alleged invention and the patent subsequently granted thereon was for new material not included in the said application;
- (b) The attorneys for the plaintiff and the said Cornelius H. Keller on the 24th day of October, 1924, unlawfully substituted for the specification originally filed a new specification upon which the said patent was granted.

**Particulars of Objection**

- (c) No statutory fee was paid nor was any new filing date allotted with respect to the alleged invention described in the said new specification;
  - (d) The petition and oath accompany the specification filed on the 23rd day of October, 1924, were executed by an attorney, one A. E. Caron in Ottawa, who at the time of execution had in fact no power of attorney and who in any event could not legally execute the petition and oath on behalf of the inventor.
- 10      10. The said Cornelius H. Keller filed an application for patent in the United States of America on the 23rd day of October, 1923, under Serial No. 670,242, which application matured as patent 1,554,216, but the Canadian application containing the subject matter of the said United States application was not filed within twelve months from the earliest date on which any foreign application was filed and the application did not comply with the conditions of section 8 of the *Patent Act*, 1923, then in force.
11. The disclosure and claims of the said patent are insufficient and ambiguous in that
- 20      (a) The specification refers to the use in froth flotation processes of salts of the sulphur derivatives of carbonic acid containing an organic radical whereas many of such salts are not useful in the process described or will not secure the results described;
  - (b) The said specification does not define or select any class of sulphur derivatives of carbonic acid which will obtain the results described when used in a froth flotation process;
  - (c) The specification does not disclose the selection of xanthate as a collecting agent;
  - 30      (d) Nothing is specified as to the alkalinity and acidity of the ore pulp during the carrying out of the process referred to, and without such a specification the patent fails to set forth clearly the essentials of the useful operation of such process as the Patent Act requires;
  - (e) It follows from the patent disclosure that the process may be usefully put into practice with a collecting agent only without a frothing agent, whereas this is impracticable;
  - (f) It is stated in the patent that the collecting agent may be produced by keeping sticks of caustic potash and carbon disulphide in a closed bottle, where as no useful collecting agent can thus be produced without the inclusion of alcohol to which no reference is made;
  - 40      (g) The patent is silent as to the character of the conditioning and the grinding necessary for the ore or pulp, whereas no useful results can be obtained unless the ore or pulp is ground to a suitable fineness and properly conditioned;

**Particulars of Objection**

(h) There is no sufficient disclosure or direction how the salts therein mentioned must be prepared in order to attain the results described.

11 A. The specification does not disclose the best method known to the said Keller when he applied for the said letters patent of preparing the salts therein mentioned for use in the process described and claimed.

12. If any invention is disclosed or claimed in the said patent such invention is not useful.

10 13. The said Cornelius H. Keller, the applicant for the said patent, made no invention, having regard to the common knowledge in the art and to the various patents and publications referred to in Schedules I and II hereto.

14. The claims of the said letters patent which the defendant is alleged to have infringed claim more than the said Keller invented, if he invented anything, in that

(a) They are not confined to ores and/or minerals with which the process claimed will produce any useful result;

20 (b) They are not confined to such xanthates as will produce any useful result in the process claimed.

DELIVERED with the statement of defence this 19th day of June, 1943, by HOLDEN, MURDOCH, WALTON, FINLAY & ROBINSON, Toronto, Ontario, Solicitors for the Defendant.

**SCHEDULE I****A — UNITED STATES PATENTS**

	962,678	Sulman, Greenway & Higgins	June 28, 1910
	1,240,597	Perkins	Sept. 18, 1917
	1,274,505	Bradford	Aug. 6, 1918
	1,228,183	Corliss	May 29, 1917
30	1,228,184	Corliss	May 29, 1917
	1,364,304	Perkins	Jan. 4, 1921
	1,364,307	Perkins & Sayre	Jan. 4, 1921
	1,364,308	Perkins & Sayre	Jan. 4, 1921
	1,370,367	Sayre (filed March 6, 1920)	Mar. 1, 1921
	1,415,899	Sayre	Mar. 6, 1922
	1,448,929	Luckenbach	Mar. 20, 1923
	1,497,699	Sayre (filed Nov. 28, 1923)	June 17, 1924
	1,505,324	Eberenz (filed Oct. 22, 1920)	Aug. 19, 1924
	1,512,139	Sayre (filed Nov. 24, 1923)	Oct. 2, 1924
40	1,554,220	Lewis (filed Mar. 27, 1924)	Sept. 22, 1925

**B — CANADIAN PATENTS**

	209,547	Perkins & Sayre	Mar. 15, 1921
	219,757	Luckenbach	June 20, 1922
	227,193	Tucker & Edser	Dec. 12, 1922
	214,877	Ralph E. Sayre	Dec. 27, 1921

## Particulars of Objection

214,878	Ralph E. Sayre	Dec. 27, 1921
231,290	Ralph E. Sayre (filed May 5, 1922)	May 22, 1923

## C — AUSTRALIAN PATENTS

18,216 of 1920 Luckenbach Process Incorporated Oct. 14, 1920

## D — GERMAN PATENTS

347,750 Egeberg Published Jan. 24, 1922

## PUBLICATIONS

- 10 (a) Book on Flotation by Rickard & Ralston, article "Flotation—Oils", pp. 121–133, published 1917, by Mining & Scientific Press, San Francisco, California.
- (b) Bulletin No. 154, Department of the Interior, Bureau of Mines, published August, 1918.
- (c) "Flotation Process" by Megraw; Megraw-Hill Book Company, Inc., New York, 1916, pp. 217, 218.
- (d) Article by Robert J. Anderson entitled "Oils and Other Reagents in Flotation", published in the issue of Metallurgical and Chemical Engineering of February 1, 1916, pp. 135, 136, 137.
- 20 (e) Richter's Organic Chemistry, 3rd English Edition, pp. 488, 489.
- (f) Mining & Scientific Press, July 30, 1921, pp. 175 and 176, "A New Flotation Agent".
- (g) Australian Institute of Mining and Metallurgy, No. 36 (1919), p. 108.
- (h) Mineral Industry during 1922, Vol. 31, pp. 768, 769.
- (i) Engineering & Mining Journal, August 6, 1921, p. 239.
- (j) W. D. Harkins. "The Fundamental Principles of Flotation and Adhesion". Nat. Acad. of Science Vol. 5 (1919) pp. 569, 573.
- (k) I. Langmuir. "The Mechanism of the Surface Phenomena of Flotation". Trans. Faraday Soc. Vol. 25, Part 111, pp. 64–74.
- 30 Abstracted. Min. & Scientific Press, Vol. 15 (1920) pp. 62–66, 72–74.
- (l) W. D. Harkins. "Jour. Am. Chem. Soc." Vol. 39 (1917) pp. 354, 355, 363, 364, 541, 542, 594–596.
- (m) I. Langmuir. "Surface Tension Phenomena", Met. and Chem. Eng. Vol. 15 (1916) pp. 468, 469.
- (n) I. Langmuir. "The Constitution and Fundamental Properties of Solids and Liquids". Part 11. Jour. Am. Chem. Soc. Vol. 39 (1917) pp. 1849–1850, 1857, 1881.
- 40 (o) Jour. Am. Chem. Society Vol. 42 (1920)—Further paper by Harkins, Clark & Roberts; pp. 700, 710–12.
- (p) Jour. Am. Chem. Society Vol. 43 (1921)—Harkins & Cheng; pp. 35, 53.

## SCHEDULE II

## BIBLIOGRAPHY

822-1 Zeise, W. C.	Schweiggers Jour. Chem. u. Physik 35,173 (1822)	B. 209
822-2 Zeise, W. C.	Schweiggers Jour. Chem. u. Physik 36,1 (1822)	B. 209
824-1 Zeise, W. C.	Berzelius Jahresbericht 3,80 (1824)	B. 209
835-1 Zeise, W. C.	Ann. Physik Chem. Pogg. 35,487 (1835)	B. 210
836-1 Couerbe	Ann. Chem. Phys. (2) 61,248 (1836)	B. 210
836-2 Lisbig & Pelouze	Ann. 19,261 (1836)	B. 210
837-1 Zeise, W. C.	Berzelius' Jahresbericht 16,202 (1837)	B. 209
840-1 Dumas, and Peligot	Ann. Chim. Phys. (2) 74,13 (1840)	B. 208
842-1 de la Provostaye, & Desains	Compt. rend. 15,493 (1842)	B. 212
842-2 de la Provostaye, & Desains	Ann. 44,319 (1842)	B. 212
844-1 Sace	Ann. 51,346 (1844)	B. 209
844-2 Balard	Ann. Chim. Phys. (3) 12,307 (1844)	B. 212
844-3 Balard	Ann. 52,313 (1844)	B. 212
844-4 Erdmann	J. prakt. Chim. (1) 31,4 (1844)	B. 212
844-5 Erdmann	Ann. 52,318 (1844)	B. 212
847-1 Zeise, W. C.	Ann. 62,375 (1847)	B. 208
847-2 Desains	Ann. chim. phys. (3) 20,498 (1847)	B. 208
849-1 Debus	Ann. 72,7 (1849)	B. 209
852-1 Johnson	Ann. 84,340 (1852)	B. 212
853-1 Vogel, A.	Ann. 86, 369-370 (1853)	B. 206
862-1 Hlasiwetz	Ann. 122, 87 (1862)	B. 209
872-1 Mylius, E.	Ber. 5,974 (1872)	B. 211
877-1 Delachanal, M., & M. Mermet	Ann. Chim. Phys. (5) 12, 108-110 (1877)	
877-2 Phipson	Compt. rend. 84, 1459 (1877)	B. 210
878-1 Clarke	Ber. 11, 1505 (1878)	B. 208
881-1 Lobisch, W. & A. Loes	Monatsh. 2, 372-81 (1881)	B. 209; B. 213
881-2 Nickels	Chem. News, 43,148 (1881)	
881-3 Macagno	Chem. News, 43,138 (1881)	
883-1 Hehner & Carpenter	Analyst 8, 37 (1883)	B. 206
884-1 Gastine, M.	Compt. rend. 98, 1588-90 (1884)	B. 206
887-1 Scala	Gazz. Chim. Ital. 17,79 (1887)	B. 211
889-1 Bamberger, E.	Ber. 22,769 (1889)	
890-1 Bamberger, E. & W. Lodter	Ber. 23, 211 (1890)	
890-2 Bamberger, E. & W. Lodter	Ber. 23, 213-15 (1890)	
893-1 Cross, Bevan & Beadle	Ber. 26, 1090 (1893)	
893-2 Cross, Bevan & Beadle	Ber. 26, 2524 (1893)	
899-1 Tschugaeff, L.	Ber. 32, 3332-35 (1899)	
01-1 Cross, Bevan & Beadle	Ber. 34, 1513 (1901)	
02-1 Billmann	Ber. 35, 2184 (1902)	B. 209
02-2 Rupp and Krause	Ber. 35, 4157 (1902)	B. 209

## SCHEDULE II

BIBLIOGRAPHY (*continued*)

04-1	Rosenheim & Davidson	Z. anorg. Chem. 41, 233 (1904)		B. 210
06-1	Johnson	J. Am. Chem. Soc. 28, 1209 (1906)		B. 206
06-2	Frerichs, H. & Rentschler	Arch. Pharm. 244,79 (1906)		
06-3	Ramberg	Z. anorg. Chem. 50,439 (1906)		B. 210
07-1	Harding & Doran	J. Am. Chem. Soc. 29, 1476 (1907)	(2-43)	B. 206
08-1	Candurin, A.	Ber. 41, 4362 (1908)	Chem. Absts.	(3-652)
08-2	Ragg, M.	Chem. Ztg. 32, 654 (1908)	" "	(2-2813)
09-1	Oddo, .B & G. del Rosso	Gazz. chim. ital (1) 39, 11-23 (1909)	" "	B.209
09-2	Rosicky, V.	Z. Kryst. Mineral 46, 357-76 (1909)	" "	(3-1004)
			" "	B. 212
			" "	(3-1978)
10-1	Ragg, M.	Chem. Ztg. 34, 82 (1910)	" "	(4-2104)
12-1	Tarugi & Sorbini	Chem. Zentr. 11, 1398 (1912)	" "	(7-1462)
13-1	Ramberg	Ber. 46, 1698 (1913)	" "	(7-2526)
14-1	Dubsky, J. V.	J. prakt. Chem. (2) 90, 61-118 (1914)	" "	(8-3736)
16-1	Dubsky, J. V.	J. prakt. Chem. (2) 93, 142-161 (1916)	" "	(11-1631)
18-1	Ferrer, J.	Anales. soc. espan. fis. quim. 16, 724-7 (1918)	" "	(14-178)
20-1	Delepine, M. & L. Compin	Bull. soc. Chim. 27, 469-74 (1920)	" "	(14-3026)
21-1	Whitby, A. & J. P. Beardwood	J. Chem. Met. Soc. S. Africa 21, 199-200 (1921)	" "	(15-3050)
21-2	Dubsky, J. V.	J. prakt. Chem. 103, 109-128 (1921)	" "	(16-1211)
24-1	Rosenstein, L.	U.S. Pat. 1,507,089 Sept. 2-1924, (app. Dec. 3-1923)	" "	(18-3457)
24-2	Sayre, R. E.	U.S. Pat. 1,512,139 Oct. 21-1924 (app. Nov. 24-1923)		
25-1	Keller, C. H. (to Minerals Sep. N. Am. Corp.)	U.S. Pat. 1,554,216, Sept. 22, 1925, (app. Oct. 23-1923)		
25-2	Hallet and Ryder	Eng. Mining J. Press. 119,690 (1925)	" "	
25-3	Snell, F. D.	J. Ind. Eng. Chem. p. 197-8 (1925)		
26-1	Berl and Bitter	Cellulosechemie VII, 137 (1926)		
27-1	Foster, L. S.	Univ. Utah, Eng. Expt. Sta., Tech. Paper No. 2 (1927)		
28-1	Lieser, Th.	Ann. 464, 43-55 (1928)	Chem. Absts.	(22-4792)
30-1	Geiger, E.	Helv. Chem. Acta 13,293 (1930)	" "	(24-4148)
30-2	Cambron, A. and G. S. Whitby	Can. J. Research 2, 144-52 (1930)	" "	(24-2111)
31-1	Levi, T. G.	Gazz. chim. ital. 61, 665-72 (1931)	" "	(26-1250)
31-2	Feigl and Weiselberg	Z. Anal. Chem. 83, 93 (1931)		
31-3	Cunningham, O. D. (to P. C. Reilly)	U.S. Pat. 1,813,342, July 7-1931 (app. Sept. 10-1928)		
31-4	Christmann, L. C. & S. A. Falconer (to Am. Cyanamid Co.)	U.S. Pat. 1,823,316, Sept. 15-1931 (app. Jan. 9-1930)		



## SCHEDULE II

BIBLIOGRAPHY (*continued*)

- 31-5 Keller, C. H. (to Min. Se. N. Am. Corp.) U.S. Pat. 1,833,464, Nov. 24—1931  
(app. Sept. 10—1929)
- 31-6 Christmann, L. C. (to Am. Cyanamid Co.) U.S. Pat. 1,837,852, Dec. 22—1931  
(app. May 29—1930)
- 32-1 Rosenstein, L. U.S. Pat. 1,854,525, Apr. 19—1932  
(app. Nov. 11—1929)
- 32-2 Martin, R. B. (to Am. Cyanamid Co.) U.S. Pat. 1,874,564, Aug. 30—1932,  
(app. Oct. 31—1928)
- 32-3 Rankin, L. P. (to Hercules Powder Co.) U.S. Pat. 1,886,587, Nov. 8—1932,  
(app. Jan. 9—1930)
- 32-4 Lieser, Y. & W. Nagel Ann. 495, 235-49 (1932) Chem. Absts. (26-4307)
- 32-5 De Witt, C. C. & E. E. Roper J. Am. Chem. Soc. 54, 444 (1932) " " (26-1840)
- 33-1 Rosenstein, L. (to Shell Development Company) U.S. Pat. 1,903,140, March 28—1933,  
(app. Feb. 1—1932)
- 33-2 Martin, R. B. U.S. Pat. 1,933,179, Oct. 31—1933,  
(app. March 14—1930)
- 34-1 Lieser, Th. & A. Hackl Ann. 511,121-7 (1934) Chem. Absts. (28-5411)
- 34-2 Lieser, Th. & A. Hackl Ann. 511, 128-36 (1934) " " (28-5411)
- 34-3 Wark, I. W. & A. B. Cox Trans. Am. Inst. Mining Met. Engrs. v. 112,  
189-232, (1934)
- 34-4 Keller, C. H. (to Min. Sep. N. Am. Corp.) U.S. Pat. 1,969,269, Aug. 7—1934,  
(app. July 12—1930)
- 34-5 Christmann, L. C. & D. W. Jayne, Jr. (to Am. Cyanamid Co.) U.S. Pat. 1,970,508, Aug. 14—1934
- 35-1 Lieser, Th. & E. Leckzyck Ann. 519, 279-91 (1935) Chem. Absts. (29-7288)
- 35-2 Whitmore, W. F. & E. Lieber Ind. Eng. Chem. Anal, Ed. 7, 127-9 (1935)
- 36-1 Lieser, Th. & R. Thiel Ann. 522, 48-55 (1936) Chem. Absts. (30-3786)
- 36-2 Gaudin, A. M. & Schumann J. Phys. Chem. 40, 257 (1936) " " (30-4443)
- 36-3 Keskyula, Yu, et al Trans. State Inst. Applied Chem. (U.S.S.R.) 30,  
29-67 (1936)  
Chem. Zentr. 1938 I 1454-5 Chem. Absts. (33-8573)
- 36-4 Keskyula, Yu, et al Trans. State Inst. Applied Chem. (U.S.S.R.) 30,  
68-94 (1936) " " (33-8573)
- 36-5 Keller, C. H. (to Min. Sep. N. Am. Company) U.S. Pat. 2,044,851, June 23—1936
- 38-1 Ray, P. A. (to Hercules Powder Co.) U.S. Pat. 2, 106,558, Jan. 25—1938
- 40-1 Jaeger, A. O. & R. Herrlinger (to Am. Cyanamid & Chem. Corp.) U.S. Pat. 2,198,774, Apr. 30—1940
- 42-1 Shupe, I. S. J. Assoc. Official Agr. Chem. 25, 495-8 (1942)

## SCHEDULE II

BIBLIOGRAPHY (*continued*)

845-1 Zeise, W. C.	Ann. 55, 304-17 (1845)	B. 209
873-1 Romer	Ber. 6, 785- (1873)	
08-3 Ragg, M.	Chem. Ztg. 32, 630-1 (1908)	2-2547
09-3 Tshugaev (Chugaec) L. and A. Gastev	Ber. 42, 4631-4 (1909)	4-767
09-4 Weiss	Ind. Eng. Chem. 1, 605- (1909)	3-2922
10-2 Chugaev, L. and V. Fomin	Ann. 375, 288-97 (1910)	4-3199
11-1 Chugaev, L. and P. Koch	Ann. 385, 352-8 (1911)	6-1144
11-2 Ost, H., F. Westhoff, and L. Gessner	Ann. 382, 390- (1911)	5-3574
11-3 Hebert, A.	Compt. rend. 152,869 (1911)	5-2094
12-2 Chugaev, L. and V. Budrick	Ann. 388, 280-93 (1912)	7-3320
12-3 Chugaev, L. & W. Fomin	Ber. 45, 1293-8 (1912)	7-1003
12-4 Gabriel, S. and J. Colman	Ber. 45, 1643- (1912)	6-2618
13-2 Chugaev, L.	Bull, soc. chim. 13, 793-6 (1913)	7-3963
14-2 Chugaev, L. and V. Pastanogov	Z. physik Chem. 85, 553- (1914)	8-453
16-2 Gomez, L.	Anales. soc. espan. fis. quim. 14, 91-102 (1916)	12-584
17-1 de Plaza, Diaz	Anales soc. espan. fis. quim. 15, 54- (1917)	12-476
18-2 von Halban H. and W. Hecht	Z. Elektrochem. 24, 65- (1918) (also J. Chem. Soc. 114 11 222)	13-277
19-1 Koppel, J.	Chem. Ztg. 43, 777-8 (1919)	14-1501
23-1 Twiss, D. F. and F. Thomas	J. Soc. Chem. Ind. 42, 499- (1923)	18-1764
24-3 Calcott, W. S. F. L. English, and F. B. Downing	Eng. Mining J. Press. 118, 980-1 (1924)	19-1111

NOTE: Secondary references marked "B" are page numbers of "Beilstein's Handbuch der Organischen Chemie" 4th Edition; vol. 3 (The Literature to Jan. 1, 1910) Berlin, Julius Springer, 1921.

## Opening Remarks of Counsel

## EVIDENCE AT TRIAL

## COUNSEL :

W. L. SCOTT, K.C., and E. G. GOWLING	}	<i>For the Plaintiff,</i>
---	---	---------------------------

O. M. BIGGAR, K.C., P. C. FINLAY, and CHRISTOPHER ROBINSON	}	<i>For the Defendant.</i>
--	---	---------------------------

HIS LORDSHIP: You are appearing for the plaintiff, Mr. Scott?

MR. SCOTT: Yes, my Lord, with Mr. Gowling.

10 MR. BIGGAR: I appear for the defendant, my Lord, with Mr. P. C. Finlay and Mr. Christopher Robinson.

MR. GOWLING: May it please your Lordship, this is an action for the infringement of a patent which is owned by the plaintiff company. The patent is No. 247,576, issued on March 10, 1925, for an invention of Cornelius H. Keller. For convenience this may be referred to as the Keller patent in suit.

Your Lordship will observe from the title that the invention covered by this patent relates to froth flotation concentration of ores. In order that your Lordship may understand the nature of  
20 the invention, this title will require some explanation, and I think perhaps the best way to start is to give your Lordship a definition of the word "ore". Your Lordship has no doubt seen samples of ore. We have a few samples in the court room. I do not propose to mark them as exhibits, but if your Lordship wishes to see them they will be available.

Ore, as your Lordship knows, is something which is dug out of the crust of the earth. It usually consists of a valuable mineral, such as a metal, together with some worthless material, probably silica or rock, which is called gangue. This bit of ore is a mixture,  
30 but it is not a compound. That is, the valuable mineral constituent is physically mixed up with the gangue, just as though we were to take a handful of, say, ground-up copper and mix it up with a handful of ground stone or sand and bind them together with some suitable adhesive. That is distinguished from a compound which is mixed up chemically. As a simple illustration of a compound I would mention to your Lordship salt, the technical name of which is sodium chloride, the technical formula being NaCl. They are chemically united into a new product which we call salt. In order to separate ore into its constituent parts, you separate them physi-  
40 cally just as though you were to pick out the grains of metal or the grains of the valuable mineral from the grains of the gangue. In order to separate a compound, you would have to put it through some chemical reaction.

## Opening Remarks of Counsel

The process of the concentration of ore — I am referring now to the title of the patent, I am not mentioning the froth flotation, but simply dealing with the concentration of ore — the process of concentration of an ore consists in separating the valuable mineral from the worthless material which we call the gangue. This worthless part containing the gangue is called the tailings after it is ground up and separated. Perhaps a little later I should go back a step and refer to what we call the tailings.

10 These chunks of ore which are dug out of the ground are sent to a mill, where they are ground up. They are broken up into comparatively small pieces, so that the valuable constituent may be picked out from the gangue. In the grinding process the first reduction is to perhaps three-eighths of an inch in size. Then this ground material is sent to another mill, where it is further ground; it is ground up smaller, and at the same time it is mixed with water in the final grinding. So that when we finally grind the ore we have a pulp, and this is called the ore pulp.

HIS LORDSHIP: The ore pulp consists of the ore ground up in its finest state with the addition of water?

20 MR. GOWLING: Yes, my Lord. And as your Lordship will see, in this ore pulp we have the valuable mineral and the gangue.

I might at this point just mention one more division which we will be making in describing the ore pulp. There are really two parts to the ore pulp. In the grinding process some of this material is in the consistency of sand, and some of it becomes very finely ground, something like flour. The part that is more or less like sand is called the sands, and the part that consists of the very fine material is called the slimes.

30 HIS LORDSHIP: The ore is generally ground up to fine powder, like talc, is it?

MR. GOWLING: Yes, my Lord. We do not have to grind it down as fine as flour, but in the grinding process some of it does become very fine, and it has been given that technical name, slimes. Then we use the term "mesh" to designate how fine the ore is ground. For instance, there is what we call a 60-mesh; that is, there are sixty little holes to a linear inch. An 80-mesh would have eighty holes to the linear inch.

40 One of the obvious methods of separating the valuable mineral from the gangue would be to pick it out by hand, and in a mine with a rich ore deposit — rich meaning that it has a lot of valuable mineral — you could pick out the larger chunks by hand. Another method of separating this valuable mineral from the gangue is to place the mixture of ground ore in a tray and shake it. This is for the purpose of having the valuable mineral settle down to the bottom and the gangue come to the top. The valuable mineral is usually heavier than the gangue. This gives that rough division

**Opening Remarks of Counsel**

between the valuable mineral, which is usually a metal, and the gangue. But, as your Lordship will see, these are fairly rough ways of separating the valuable mineral from the gangue.

At this point I might say that for your Lordship's convenience we are going to have daily copy of the evidence, and we will be furnishing your lordship each day with a copy of the transcript.

In this case we are not concerned with the method of separating the ore by hand nor with this process of separating it by using these jigs. The method with which we are concerned here is called  
10 froth flotation. I am not yet at the patent in suit, my Lord. The patent in suit relates to an improvement in the froth flotation of ore.

HIS LORDSHIP: It is not claimed as a new thing, this froth flotation?

MR. GOWLING: No. The basic idea is old. As a matter of fact, the basic idea of froth flotation was also developed by some of the staff of the Minerals Separation Company, which is, I think, the predecessor of the present company. That development was made some time around 1905, and the patents on the basic idea  
20 of froth flotation have of course expired. When I come to the patent in suit I will show your Lordship that it relates to an improvement in that process.

One disadvantage of separating the ore by hand or by these jigs is that this very fine material called the slimes is probably lost because it cannot be divided out by hand because it is too fine. The great improvement which was made by the froth flotation, or one great improvement, is that you can separate even the slimes, so that we save the valuable mineral constituent out of the slimes as well as the more coarsely ground ore.

30 Coming to the froth flotation process itself, that is a basic idea which was invented in 1905. This ground ore is placed in a machine which consists of a large vat which would hold about 240 or 250 gallons. It would be a box about three feet square across the top and perhaps four feet deep. This ground ore, which has been at this stage mixed with some water, is placed in this vat. Further water is added to the ore pulp and it becomes a rather freely flowing pulp. The proportions of mixing are about 4 of the water to 1 of the ore. This ore pulp is then agitated, violently agitated, and another substance is added to that pulp. This other  
40 substance, incidentally, may be added during the grinding process.

The particular order in which I am giving these facts to your Lordship is not very material. Then, as I pointed out a few minutes ago, in the final grinding, which is done with water, at that same time it is possible to add what is called this froth flotation agent, a simple frothing agent; the idea being that when the pulp is violently agitated, the effect of this agent is to create a

## Opening Remarks of Counsel

froth; and this froth should be referred to as a mineral frothing agent. That is, there are some frothing agents which do not float ore and are consequently of no value in this process.

This frothing agent serves two purposes. First of all it is to create a froth in this ore pulp. It is very much, my Lord, as if you added some soapflakes to a dish of hot water and violently agitated it with a stick. You secure a heavy froth of bubbles. In this process the agitation of the ore pulp with this frothing agent produces this heavy concentrated froth of bubbles. But this frothing  
10 agent also performs another function. It has the ability to cause the particles of the valuable mineral to affix themselves to the ore bubbles.

MR. BIGGAR: To affix themselves to what?

MR. GOWLING: To affix themselves to the ore bubbles, or rather air bubbles, I should say.

MR. BIGGAR: To the air bubbles.

MR. GOWLING: I should have said air bubbles. It has the ability to cause the particles of the valuable mineral to affix themselves to the bubbles in the froth, the air bubbles in the froth.

20 HIS LORDSHIP: Yes?

MR. GOWLING: So that when the air bubbles rise to the top of the pulp they carry with them the small particles of valuable mineral or metal. These bubbles do not, however, pick up the gangue. The gangue is left behind in the bottom of the vat. In other words, this process really defies the law of gravity because the frothing bubbles carry the valuable ore to the top and the gangue stays at the bottom.

HIS LORDSHIP: Is that why the gangue is called the tailings?

MR. GOWLING: That is why the gangue is called the tailings.  
30 Instead of just calling it gangue at this stage it is called tailings because in addition to the gangue, which is the worthless part, there are some fine particles of the mineral left behind. These tailings are then run into another machine and the same kind of process is repeated. In actual practice there is a series of these machines connected up with each other. In the first machine the froth rises to the top with a substantial portion of the metal and is floated off the top into another container where it is cleaned and sent off to the smelter. Then the tailings are sent into another machine of the same kind where they are again mixed up and the  
40 process repeated. That can be carried on until the operator feels that he has obtained as much of the valuable mineral out of the ore as it is possible to do economically, so that the final tailings should have very little mineral left in; it is mostly the gangue.

This froth which carries the valuable mineral is called the concentrate. Your Lordship will now see the significance of the

## Opening Remarks of Counsel

title, froth flotation concentration of ores, which means that you concentrate the valuable mineral constituent by floating it in this froth.

HIS LORDSHIP: In the frothy?

MR. GOWLING: Yes. It will be obvious that the success, or a considerable part of the success, of this process depends on creating a satisfactory froth by the use of a suitable agent and having this froth pick up the metal or whatever valuable mineral you are endeavouring to recover. I may say that one of our expert witnesses,  
 10 my Lord, will demonstrate how this is done with this miniature machine here, so that your Lordship will get a general idea as to how this process is carried on. It is not going to be a test in any sense of the word. It proves nothing. It is just to give your Lordship a practical idea of what we are talking about in this case. I always think it is helpful to see the thing in operation.

HIS LORDSHIP: Yes.

MR. GOWLING: We have here samples of ore and samples of ground ore which your Lordship can look at, if you wish. We are not marking them as exhibits because it is just what you see in  
 20 every mine or rather in every place where they are concentrating ores.

This concentrate is, of course, then passed on to the smelter; that is, the valuable mineral which we have recovered with this froth is passed on to the smelter for further treatment. But we are not concerned with anything beyond—

HIS LORDSHIP: Beyond the flotation process?

MR. GOWLING: . . . beyond the flotation process. At the time the invention in question was made there were several flotation agents in general use and these will also be referred to later.

30 HIS LORDSHIP: There were several flotation agents in general use?

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: I suppose one flotation agent might serve in one mine where the mixture of the minerals in the ore is of a certain kind?

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: And another agent might be satisfactory when the composition of the various minerals in another ore is of a different kind?

40 MR. GOWLING: That is exactly the situation, my Lord; and each of the inventors who develop an agent extol the virtues of their particular agent, and it then comes down to the usual competition as to which agent is best for each particular ore.

HIS LORDSHIP: I suppose the chemists in each mine will make their variations in the agents that they use, depending upon the mixture of the minerals in the particular ore of that mine?

## Opening Remarks of Counsel

MR. GOWLING: That is right, my Lord. They select an agent that will handle the ore in the mine which has certain characteristics which are amenable to that particular agent.

HIS LORDSHIP: Then one agent will do the job in one mine and may not do the job at all in another mine?

MR. GOWLING: That is right, my Lord.

HIS LORDSHIP: Where the composition of the various minerals in the ore is different.

MR. GOWLING: Yes, my Lord. Some of these agents are, of  
10 course, in common use. One of the early ones was a substance called pine oil; and in some cases you use a combination of these agents for particular ores. You could, for instance add some sulphuric acid along with the pine oil, so that your flotation agent might be a combination of a number of these flotation agents.

This process can be used for another purpose, and that is to separate two minerals from each other. That is, you commonly find lead and zinc in an ore body.

HIS LORDSHIP: That is, the process not only separates the mineral from the gangue but also separates one kind of mineral  
20 from another kind?

MR. GOWLING: That is right, my Lord. As a typical illustration I would give your Lordship the lead-zinc ore. If this process is used on a combination of lead and zinc in an ore body, the lead for instance could be first separated by using a suitable flotation re-agent or agent. I may say that your Lordship will find that the words "agent" and "re-agent" are used interchangeably. I have been using the word "agent" because I think that, technically speaking, the word "re-agent" signifies a chemical action. I am not prepared to say what goes on in this mixture, my Lord. I cannot  
30 suggest to your Lordship just what these agents do in the mixture. What we know is that when you add the agent to the pulp you do obtain this ore concentrate. But I think the terms are used interchangeably in the trade.

HIS LORDSHIP: They are used interchangeably?

MR. GOWLING: I think so. I notice in some commission evidence we have had, some of the witnesses have called it "re-agent" and some "agent". If there is any difference that we are concerned with, one of the expert witnesses can clear that up.

This process of separating two different minerals from each  
40 other is usually called selective flotation; that is, you are selecting one metal in preference to another. It is also referred to as preferential flotation or differential flotation. The term which I think is most commonly used is selective flotation.

HIS LORDSHIP: Is this separation of the two minerals carried on after there has been a separation of the two of them together from the gangue?



## Opening Remarks of Counsel

MR. GOWLING: Not necessarily, my Lord.

HIS LORDSHIP: Perhaps you might have a disappearance of one of the minerals with the gangue.

MR. GOWLING: In the first process.

HIS LORDSHIP: In the first process.

MR. GOWLING: Yes.

HIS LORDSHIP: Oh, in the first process?

MR. GOWLING: Yes. For instance, you could take this ore containing both lead and zinc, and if I remember correctly from  
10 what the experts have told me, the first step which is taken is to float off the lead.

HIS LORDSHIP: Float off the lead?

MR. GOWLING: Yes, float off the lead, leaving in the tailings the gangue and the zinc. Then I believe you can select a suitable agent which will float off the zinc.

HIS LORDSHIP: From the gangue?

MR. GOWLING: From the gangue, leaving finally the tailings which is the gangue and any remaining parts of both lead and zinc that were not recovered in the process.

20 The invention made by Mr. Keller, as I say, relates to this general froth flotation process.

HIS LORDSHIP: The invention made by whom?

MR. GOWLING: Made by Mr. Keller, who is the inventor named in the patent in suit.

HIS LORDSHIP: Yes. You say it was an improvement?

MR. GOWLING: We say that was an improvement in this process.

HIS LORDSHIP: An improvement in the flotation process?

MR. GOWLING: Yes. Mr. Keller's proposal was to use a new  
30 agent in that process; that is, a new flotation agent. This new flotation agent which Mr. Keller proposed fell into a group of organic chemicals which are known as sulphur derivatives of carbonic acid. That is the broad name for this group.

HIS LORDSHIP: Sulphur derivatives of carbonic acid?

MR. GOWLING: Yes, my Lord. That is the broad name for the group of chemicals which Keller proposes to use as flotation agents.

HIS LORDSHIP: Yes.

MR. GOWLING: There are quite a large number of compounds  
40 in this group of chemicals, and one particular class of chemical compound falling within this broad group is known as xanthates. That is spelled x-a-n-t-h-a-t-e-s, my Lord.

HIS LORDSHIP: Yes.

## Opening Remarks of Counsel

MR. GOWLING: That is a term which we will hear in the course of this trial; in fact, this particular class known as xanthates is the one with which we are really concerned in this action, because the claims in suit are directed to the use of certain xanthates in the froth flotation concentration of ores. It will probably be necessary during the course of the trial to explain something about these xanthates, my Lord, but I am going to leave that to our expert witnesses. I am endeavouring to deal only with matters which I hope will not be seriously challenged by my friends, to  
 10 give your Lordship a general picture of this part and also of the patent in suit. As I say, our expert will confirm what I have said and elaborate on it to some extent; and of course he is subject to cross-examination on everything which I have said as well.

HIS LORDSHIP: Yes.

MR. GOWLING: However, I should like to say this about the xanthates. There are a number of them, and one of their characteristics is that they are made with a metal.

HIS LORDSHIP: Which?

MR. GOWLING: They are made with a metal; that is, at least  
 20 one group is made with what we commonly know as metals; and two that we will be discussing during the course of the trial perhaps a little more than the others are potassium xanthate and sodium xanthate. The significance in those two names is that one is made with the metal potassium and the other is made with the metal sodium. Xanthate itself is a crystalline salt; and I will leave with these other bottles, my Lord, a small bottle or small vial in which we have put a little sample of this xanthate, so that your Lordship will just see what it is.

MR. BIGGAR: All xanthates, or are you speaking about potas-  
 30 sium xanthate?

MR. GOWLING: This particular sample, my Lord, is potassium xanthate. Potassium ethyl xanthate is the correct or full name. As I say, I am simply leaving this in case your Lordship is interested in seeing just the physical substance of a xanthate; and this particular one is potassium ethyl xanthate.

HIS LORDSHIP: Are you filing that?

MR. GOWLING: I was going to suggest that we do not file any of these. They are not going to be identified as particular xanthates. I am simply leaving them so that your Lordship can  
 40 see the physical characteristics. They do not prove anything. Would your Lordship like to see this?

HIS LORDSHIP: Yes.

MR. GOWLING: That particular sample, as your Lordship will see, is just a light yellow crystalline substance.

HIS LORDSHIP: I suppose that is called xanthate because that has something to do with yellow?

## Opening Remarks of Counsel

MR. BIGGAR: That is right, my Lord.

MR. GOWLING: Yes, that is right, my Lord. That product, xanthate, is not itself a frothing agent.

HIS LORDSHIP: You say that xanthate is not itself a frothing agent?

MR. GOWLING: No, it is not. In other words, xanthate is used in combination with frothing agents. You mix up the ore, the ground ore and the water to form the pulp in the usual way, adding whatever frothing agent is desirable for the separation of the particular ore with which the metallurgist is dealing, and also add  
10 this product xanthate.

HIS LORDSHIP: You add the frothing agent to the ore pulp?

MR. GOWLING: The ore pulp.

HIS LORDSHIP: And then add the xanthate?

MR. GOWLING: Yes, my Lord. The xanthate could be added in the grinding process, if you wished, but it is not necessary.

HIS LORDSHIP: It is not a matter of sequence?

MR. GOWLING: No. There is no significance in the particular sequence. The result of adding this xanthate is that you have a  
20 better, more efficient concentration of the ores. I might say, my Lord, that this product, xanthate, is something I would refer to as practically a universal agent. That is, it is used pretty much regardless of what other frothing agents are used or pretty much regardless of what ore is used. It is put forth as a valuable flotation agent for practically any ore and for use with practically any frothing agent.

It may be helpful to your Lordship if, before I proceed with our evidence, I just briefly review some patent law which will distinguish between the specification in the claims for your Lordship  
30 and also distinguish between process and product claims.

HIS LORDSHIP: Yes.

MR. GOWLING: I do not think your Lordship will want me to go too fully into it. Some of it is rather elementary.

HIS LORDSHIP: None of it is too elementary for me, Mr. Gowling.

MR. GOWLING: I suggest that your Lordship is too modest in that respect. With your Lordship's permission I shall review briefly some of the principles which will have to be used as a guide for your Lordship. I might first distinguish between the specifica-  
40 tion and the claims of the patent. As your Lordship will have seen, all patents contain these two parts. That is, the first part—

HIS LORDSHIP: Is it not all called specification?

MR. GOWLING: The English terminology is to call the entire patent the specification, and that has been pretty well adopted here. But in general discussion of patents we usually refer to the first part as the specification and the second part as the claim.

## Opening Remarks of Counsel

MR. BIGGAR: I do not.

HIS LORDSHIP: You divide the specification into disclosure and claim?

MR. GOWLING: That is right. My friend, Mr. Biggar is quite right. He follows the English practice, which is quite right. I think I may have copied from the other side of the line, to the south of us, a little more than my friend Mr. Biggar has. In any event, that is the correct way to describe the specification. The first part is the disclosure and the second part is the claim.

10 HIS LORDSHIP: It is the specification which is broken into two parts. The first part will be the disclosure or description?

MR. GOWLING: That is right.

HIS LORDSHIP: And the second part the claim?

MR. GOWLING: Yes, the claim; and if it is a machine, you would have a third part, which is the drawings. The division is made into the separate parts pursuant to section 35 of the Patent Act, 1935.

HIS LORDSHIP: That requires the two parts, does it?

MR. GOWLING: Yes, my Lord.

20 HIS LORDSHIP: What is the section?

MR. GOWLING: Section 35 of the present Patent Act; and that section is a re-enactment of similar provisions which were contained in former Acts. I do not think I can do better, perhaps, than read this section, my Lord. Section 35 reads:

30 "35 (1) The applicant shall in the specification correctly and fully describe the invention and its operation or uses as contemplated by the inventor, and set forth clearly the various steps in a process, or the method of constructing, making, compounding or using a machine, manufacture or composition of matter, in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most closely connected, to make, construct, compound or use it. In the case of a machine he shall explain the principle thereof and the best mode in which he has contemplated the application of that principle. In the case of a process he shall explain the necessary sequence, if any, of the various steps, so as to distinguish the invention from other inventions. He shall particularly indicate and distinctly claim the part, improvement or combination which he claims as his invention."

40

In other words, the disclosure is to be a complete description of the general nature of the invention.

HIS LORDSHIP: I suppose the purpose of that is that when it becomes public property, it will be worth something.

## Opening Remarks of Counsel

MR. GOWLING: It will be worth something.

HIS LORDSHIP: So that the public can use it.

MR. GOWLING: Yes. And these specifications are addressed to men skilled in the art. They are not addressed to the leading scientists of the world. They are addressed to the average man who is dealing with the art to which the patent relates. That is, a radio patent would be addressed to the ordinary radio engineer, not just the mechanic in the shop and not the leading scientists in the universities. The average radio technician should understand  
10 radio patents; and in this case the skilled metallurgist or the skilled chemist should be able to understand the specification of the patent in suit.

HIS LORDSHIP: That is, the ordinary metallurgist should be able to read the specification, and then compound a frothing process which will separate the ore from the gangue.

MR. GOWLING: Exactly. That is right, my Lord. These specifications are drawn in the light of what is called the common knowledge of the day. That is, it is not necessary for the inventor to go back into matters which are commonly known to everybody.

20 HIS LORDSHIP: Yes.

MR. GOWLING: For instance, just again referring to the patent in suit, it would obviously be superfluous for Mr. Keller to go into detail as to the original froth "process."

HIS LORDSHIP: Because that would be known.

MR. GOWLING: That would be known. The patent was issued in 1905 or 1906, or somewhere along there; and anybody wishing to refer to it could obtain it through the usual sources. So he could start there with that knowledge disclosed in the previous patent and show his invention in the light of that common knowledge.

30 Then, as your Lordship will see, subsection 2 of section 35 deals with the claims. It reads:

"(2) The specification shall end with a claim or claims stating distinctly and in explicit terms the things or combinations which the applicant regards as new and in which he claims an exclusive property or privilege. It shall bear the name of the place where and the date when it is made, and be signed by the applicant."

HIS LORDSHIP: As I understand it, that has been termed a fencing in of the claims, of the monopoly.

40 MR. GOWLING: Yes, it is a fencing in. It is to tell the public what the public must not do. It is delimiting.

HIS LORDSHIP: It is saying, "this is my monopoly."

MR. GOWLING: "This is my monopoly; you must not do what I have claimed." It is possible that the inventor may have invented more than he claims. If he has invented more than he claims, the

## Opening Remarks of Counsel

public can use it because the public is only limited by what is in the claim.

HIS LORDSHIP: Yes.

MR. GOWLING: So if the inventor makes his claims too narrow, then that is his loss because others can use whatever is disclosed as long as it is not claimed. On the other hand, the danger of making the claim too broad is—

HIS LORDSHIP: —That he is claiming something that is not his.

MR. GOWLING: Yes, that he is claiming something that is not  
10 his, and the claims can be set aside in Court. This might be a typical example. If Mr. Keller in this patent had started out by saying, "I claim the process of concentrating ores by froth flotation, the claim would obviously be bad.

HIS LORDSHIP: Yes; as being too broad.

MR. GOWLING: As being too broad.

The other distinction which I was going to make, my Lord —and which is probably now obvious—is that a difference exists between claims to an apparatus and claims to a process; that is, in this patent we are not concerned with any invention relating to  
20 the machinery in which the process is carried on.

HIS LORDSHIP: No.

MR. GOWLING: Furthermore, we do not claim xanthate to be a new substance.

HIS LORDSHIP: This is only a claim in respect of a process?

MR. GOWLING: Only with respect to a process, my Lord; and there are no claims at all in this patent covering either the apparatus in which the process is carried on nor to these sulphur derivatives of carbonic acid.

HIS LORDSHIP: There is no claim for apparatus or for substance?

30 MR. GOWLING: That is right, my Lord.

HIS LORDSHIP: The claim is for an improvement in a known process?

MR. GOWLING: Yes, my Lord. That is, our claims are for the use in this process of these particular substances. I was going to read to your Lordship—

HIS LORDSHIP: The claim is for what?

MR. GOWLING: The use in the process of these particular flotation agents.

HIS LORDSHIP: Yes.

40 MR. GOWLING: And the particular claims in suit are limited to the use of xanthates in the process. The claims in suit are actually six, seven—

HIS LORDSHIP: The claims in suit are what?

MR. GOWLING: Six, seven, eight and nine.

## Opening Remarks of Counsel

HIS LORDSHIP: Very well. These are the only ones that need to be looked at.

MR. GOWLING: That is right. They are the ones upon which we rely; and we, of course, must show that the defendant has used the process defined in these particular claims.

HIS LORDSHIP: Is there a denial of use?

MR. GOWLING: Yes, my Lord. The defence denies that the patent has been infringed, which is in effect a denial of use.

HIS LORDSHIP: Yes.

10 MR. GOWLING: But my friends have admitted what they are doing. There may be some points on which my friends can argue that they do not infringe, but there will be no dispute as to what the defendants are doing. My friends were kind enough on our examination for discovery to produce that. We will read that into the record.

HIS LORDSHIP: That will all be read into the record?

MR. GOWLING: Yes.

HIS LORDSHIP: There is no controversy, then, as to what the defendants are doing?

20 MR. GOWLING: No, there is no controversy as to what the defendants are doing. There may be a controversy as to whether what they are doing comes within the scope of the claim.

HIS LORDSHIP: As to whether it constitutes a use of the process disclosed in the claim.

MR. GOWLING: That is right, my Lord.

I am going to read to your Lordship a couple of these claims in suit, just to give your Lordship the distinction between what have been called broad claims and specific claims. I point out that in claim No. 1—

30 HIS LORDSHIP: Which claim are you referring to now?

MR. GOWLING: I was going to read claim No. 1, although it is not in suit, to show your Lordship how broadly the invention has been claimed in the patent.

HIS LORDSHIP: The claims in the patent do not necessarily hang together in any order or sequence, do they?

MR. GOWLING: No, my Lord.

HIS LORDSHIP: Is there any such thing as a controlling claim or anything of that sort?

40 MR. GOWLING: No. The Patent Office has developed a certain practice which they like inventors to follow. For instance, I have always considered it good policy to, first of all, state your invention, claim your invention broadly, and then gradually narrow it down by your subsequent claims.

HIS LORDSHIP: That is really what I had in mind.

## Opening Remarks of Counsel

MR. GOWLING: It is sometimes a little difficult where you have what may be called different species of claims, and you have a broad claim and then you may go off on two or three different tangents in claiming your combinations. But, generally speaking, I think that most of the practitioners before the Patent Office start off with a fairly broad claim, so that the Examiner may first of all see how broadly the invention is claimed, and then they follow through with the development. As your Lordship will understand, in a very complicated apparatus, say a carburettor, you  
 10 might have a multiplicity of claims to describe the entire carburettor. But with a simple invention such as this one we start off with a fairly broad claim and then narrow it down. I do not think, though, that the attorney who drew this followed quite the order that I have mentioned, because I have noticed that some of the later claims are a little broader than the intermediate ones. As I say, it is sometimes a little difficult to follow that order.

MR. BIGGAR: And there is no obligation to do it.

MR. GOWLING: No. It is simply a matter of co-operating with the Patent Office.

20 As I mentioned, claim No. 1 is broader than those on which we are relying. It is:

“The process of concentrating ores which consists in agitating a suitable pulp of an ore with a mineral-frothing agent and a sulphur derivative of carbonic acid adapted to form in solution anions and cations and adapted to co-operate with the mineral-frothing agent . . .

If I might just interject there, my Lord, this restriction that the sulphur derivative of carbonic acid is adapted to form in solution anions and cations is a limitation on the sulphur derivative, which  
 30 will be explained by a witness. Claim No. 1 goes on:

“. . . to produce by the action of both a mineral-bearing froth containing a large proportion of a mineral of the ore, said agitation being so conducted as to form such a froth, and separating the froth.”

The last process is to take the froth off the pulp.

HIS LORDSHIP: That is a broad claim?

MR. GOWLING: Yes, my Lord. Now if we go to claim No. 6 we will see that it is restricted to this particular group of sulphur derivatives called xanthates. It reads:

40 “The process of concentrating ores which consists in agitating a suitable pulp of an ore with a mineral-frothing agent and an alkaline xanthate adapted to co-operate with the mineral-frothing agent to produce by the action of both a mineral-bearing froth containing a large proportion of a mineral of the ore, said agitation being so conducted as to form such a froth, and separating the froth.”



## Opening Remarks of Counsel

I have been told, my Lord, that that word "alkaline" should perhaps be more correctly stated as "alkali". I do not quite appreciate the significance of this, but I see a note to that effect here.

Claim No. 7 brings it down to a xanthate broadly in a certain type of what is called a circuit:

"The improvement in the concentration of minerals by flotation which comprises subjecting the mineral in the form of a non-acid pulp to a flotation operation in the presence of a xanthate."

- 10 Perhaps I should just say a word about this non-acid pulp. The pulp may be a mixture of ore and water, and it may be acid, alkaline or neutral. For instance, if you put in sulphuric acid, it would be acid; or if you put in a suitable alkali, you would make it alkaline; or, you may simply have it neutral. This claim is limited to the carrying on of the process with a pulp which is not an acid one. And, as your Lordship will see, it is not limited to any particular froth flotation agent, as long as the process is carried on in the process of a xanthate.

HIS LORDSHIP: Any xanthate?

- 20 MR. GOWLING: Any xanthate.

HIS LORDSHIP: So it claims the presence of xanthate in the widest way?

MR. GOWLING: That is right, my Lord. I think it might help your Lordship if I read the other two claims in suit. Claim 8:

"The improvement in the concentration of minerals by flotation which comprises subjecting the mineral in the form of a non-acid pulp to a flotation operation in the presence of potassium xanthate."

HIS LORDSHIP: That narrows it down to that particular kind.

- 30 MR. GOWLING: Yes, my Lord. Then, claim 9:

"The improvement in the concentration of minerals by flotation which comprises subjecting the mineral in the form of a non-acid pulp to a flotation operation in the presence of a xanthate and a frothing agent."

That is very much like No. 7, my Lord, except that it specifically mentions that the xanthate is to be in the presence of any flotation reagent.

So your Lordship will see that all these claims are directed to the use of a xanthate in this particular process.

- 40 HIS LORDSHIP: Is that the improvement in the process that the plaintiff claims?

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: The use of a xanthate in the process.

MR. GOWLING: That is right, my Lord.

HIS LORDSHIP: That is claimed to be new?

## Opening Remarks of Counsel

MR. GOWLING: That is what we claim to be new. Your Lordship will appreciate that if there is a claim in this patent which is too broad it can be set aside, but there is a specific provision in our present Act that if one claim happens to be invalid, that does not necessarily invalidate the other claims.

HIS LORDSHIP: That is, there may be one claim that is too broad, but if there is one claim that is neither too broad nor too narrow that is sufficient to hold the patent?

10 MR. GOWLING: That is right, my Lord. So all we need to consider in this case is the validity and the infringement of the actual claims in suit.

In opening our case we will not be introducing evidence to sustain the patent, as it were, because at the moment the patent is presumed to be valid.

HIS LORDSHIP: The onus of establishing invalidity is on the defendant, is it?

MR. GOWLING: That is right, my Lord. So our case will consist of explaining to your Lordship some of the technical terms in the  
20 patent and outlining, largely as I have done—perhaps with some repetition—the nature of the invention, and then proving that the defendant is doing what we claim in the claims in suit.

HIS LORDSHIP: Without your consent?

MR. GOWLING: Without our consent. Then my learned friends will no doubt introduce evidence to attack the validity of the patent, and later on we will reply.

MR. BIGGAR: My learned friend has taken on commission the evidence of three witnesses—rather elaborate evidence—two at  
30 San Francisco and one at New York; and he has also the evidence of a fourth witness, on discovery. He has asked us to agree that the evidence of that witness should be permitted to go in as if it were taken on commission. I should like to know whether he proposes to use that commission evidence.

MR. GOWLING: Yes, my Lord. I was going to deal with that. My friends were kind enough to say that we might use the examination which the late Mr. Smart conducted of Dr. Gregory, and I was going to suggest that this evidence be considered as if it had been taken on commission, instead of on discovery.

MR. BIGGAR: Your statement of the evidence that you were  
40 going to give suggested that you did not intend to use this. If you are going to use it, I should like to know.

MR. GOWLING: Yes; we are going to put them all in.

As a matter of practice, my Lord, it seems to me that commission evidence is already part of the record. I have given this some thought. It is not like discovery evidence, which does not become part of the record until we read it in. Dr. Gregory's evidence could

## Opening Remarks of Counsel

not be part of the record except for the kindness of my learned friends in agreeing that they might consider it to be such.

MR. BIGGAR: I think there is some doubt about the matter in so far as the Exchequer Court practice is concerned.

MR. GOWLING: As my learned friend has stated, under the Exchequer Court rules there is some doubt as to how the evidence should be treated; but in any event, we understand each other.

MR. BIGGAR: Yes.

10 MR. GOWLING: We are going to have it all in. One little book seems to have been mislaid temporarily, but we will find that.

My Lord, I might mention here that as a general rule the commission evidence is read at some stage of the proceedings. I would suggest that in this case the commission evidence be left for the time being. It seems to me that to read it now would only be confusing and serve no useful purpose. Your Lordship will appreciate better the significance of this evidence after you have heard at least the plaintiff's case and probably the defendant's case. Much of this evidence deals with matters which would  
20 ordinarily be dealt with in reply. That is, we examined some of these witnesses in anticipation of the attack that our friends would be making on the patent. However, if as we proceed it should seem at any time appropriate to read the commission evidence, I am sure that my learned friends and I can agree with your Lordship as to when that should be done. But I am quite sure that no good purpose would be served by reading from that handsome green volume at the moment.

There is one other suggestion that I should like to make with respect to evidence. Occasionally there is some confusion as to the  
30 function of an expert witness. There is no disagreement between my friends and myself on this point, I am sure, for we have discussed it many times in this court. An expert witness must not interpret the patent. That is for your Lordship to do.

HIS LORDSHIP: What exactly do you mean by interpreting the patent?

MR. GOWLING: An expert witness can describe the invention which is set forth in the patent. He can explain to your Lordship the meaning of technical terms, but he must not attempt to draw a conclusion as to whether the specification describes a patentable  
40 invention.

HIS LORDSHIP: He must not, for instance, express any opinion as to whether what is described in the disclosure part of the specification is new?

MR. GOWLING: That is right, my Lord. The expert witnesses will describe—or at least one of them will—what was old in the art, and what appears from publication, and what appears in the

## Opening Remarks of Counsel

patent in suit. Then the duty of the court is to take the expert evidence and draw a conclusion from it.

HIS LORDSHIP: Do you mean that an expert may not point out the difference between what is claimed and what was previously known?

MR. GOWLING: Yes, my Lord, he may point out that difference, but he should stop short of saying that that is a patentable difference.

10 HIS LORDSHIP: He may go so far as to say what is old and what is claimed, but he may not say whether the difference is patentable?

MR. GOWLING: That is right, my Lord. There is really no doubt here as to the function of expert witnesses, but sometimes experts go a little beyond their function and attempt to interpret the patent. We will be very careful in examining our expert to see that he furnishes your Lordship with the facts, but that he does not draw any conclusion, for it is the duty of the court to draw the conclusion from the facts.

20 HIS LORDSHIP: It is for the court to say whether a claim is patentable?

MR. GOWLING: Yes, my Lord. The expert will also explain to your Lordship what the defendant is doing. After he has done that, and explained what is covered by the patent, then it will be for your Lordship to decide whether there has been infringement. The expert stops just short of where your Lordship's duty begins.

MR. BIGGAR: May I intervene, my Lord, to say that if you care to look at it your Lordship will find a very authoritative and complete discussion of the scope of an expert witness' evidence  
30 stated by Lord Tomlin, giving judgment in the House of Lords, in *British Celanese, Ltd. v. Courtaulds, Ltd.*, (1935) 52 R.P.C., 171, at 196. That is the classical statement on the matter. I may add that we find it difficult to live up to, my Lord; it is a counsel of perfection.

MR. GOWLING: I entirely agree with my learned friend on that.

MR. BIGGAR: Still, it is something to aim at.

MR. GOWLING: My Lord, I am now about to commence our evidence by the introduction of the patent in suit.

(The Court recessed for ten minutes).

40 MR. GOWLING: My Lord, I was just about to begin by introducing the patent in suit. For the purpose of the record, I may say that the patent in suit corresponds exactly with United States patent No. 1,554,216. I was going to ask that the patent in suit be marked as plaintiff's exhibit 50. The reason for that is to avoid confusion with the exhibits filed on commission. There is a certified copy of the patent in suit already before the court.

## Opening Remarks of Counsel

EXHIBIT No. P-50: Filed by  
Mr. Gowling } Patent in suit.

As I have stated, this is identical with United States Patent No. 1,554,216, dated September 22, 1925, application filed October 23, 1923. I think we might put in a copy of that patent, but we will defer that for the moment.

MR. SCOTT: Perhaps his Lordship would like to have a printed copy.

10 MR. GOWLING: Yes, his Lordship might find it convenient to have a printed copy, so we might as well file it as an exhibit.

HIS LORDSHIP: The whole of the specification is the same as in the Canadian patent, is it?

MR. GOWLING: Yes, my Lord.

MR. BIGGAR: Should we give this a new number? It is already in the United States commission evidence as Exhibit K-47. That exhibit includes not only the patent itself, but the United States file wrapper.

20 MR. GOWLING: Then we will not file the United States patent separately.

My Lord, after consulting with my confreres we have decided that instead of reading the patent through at this moment it would be more useful to your Lordship to have our expert witness deal with it in his evidence. Ordinarily, in the opening statement the patent is read and explained, but I have explained the substance of the invention to your Lordship, and to avoid too much repetition I am instructed to allow the expert to deal with the patent.

I will now turn, therefore, to the examination for discovery of Mr. James Y. Murdoch.

30 HIS LORDSHIP: Are you putting all that in?

MR. GOWLING: No, my Lord; I am going to read only part of it into the record.

HIS LORDSHIP: The portion that goes in will be Exhibit 5.

MR. GOWLING: Strictly speaking, my Lord, I think it should not be considered as an exhibit. It should be read into the record as part of the testimony.

MR. BIGGAR: I agree with that, my Lord.

HIS LORDSHIP: In other cases we have usually marked the examination, or the portion that is read, as an exhibit.

40 MR. GOWLING: My learned friend Mr. Biggar and I discussed this on a previous occasion, my Lord, and after going into it very fully we came to the conclusion that it was preferable just to read in the evidence and not mark it as an exhibit. Where the whole evidence is put in I have seen it filed as an exhibit, as your Lordship says. If your Lordship will permit me to do so, I would simply

## Opening Remarks of Counsel

read in a short portion of this evidence. It throws some light on the case.

HIS LORDSHIP: It does not matter one way or the other, because only that portion of the examination that is put in should be looked at.

MR. GOWLING: That is right, my Lord. And, as your Lordship knows, under Exchequer Court practice my learned friends could ask your Lordship to look at other passages in explanation of what we put in. Sometimes there is a quarrel about that. In any event, I desire to read in only a short portion, largely for the purpose of identifying the defendant company and of introducing evidence of what the defendant is doing.

HIS LORDSHIP: Then you might indicate what you intend to read in.

MR. GOWLING: I intend to read from Q. 1 to Q. 42, inclusive

“1. Q.—Mr. Murdoch, I understand you are the President of the defendant Company? A.—Yes.

2. Q.—How long have you been President, Mr. Murdoch? A.—Since 1922, the commencement of the Company.

3. Q.—That is when the Company was incorporated? A.—Yes.

4. Q.—Is the Company incorporated by an Ontario Charter? A.—Yes.

5. Q.—And is its Head Office in the Royal Bank Building, in Toronto? A.—That is right.

6. Q.—And that is the Company which is the owner and operator of the famous Noranda Mines, of Noranda, Quebec? A.—Yes.

7. Q.—And has it carried on mining operations since 1922? A.—Not at Noranda.

8. Q.—But it is the same Company that has operated since 1922? A.—That is right.

9. Q.—Has the Company other mining properties that are in operation? I don't want to inquire into irrelevant matters, but I just want to know generally—? A.—Yes, they operate another Company in Quebec, and control three gold mines in Ontario, and two gold mines in Nicaragua—

10. Q.—I was mainly interested in the Quebec Company, Mr. Murdoch; it is the Ontario Company which actually operates the mine at Noranda, the large mine? A.—That is right.

11. Q.—There was a demand for particulars filed in this case, setting forth a number of re-agents which have been used by the defendant Company in carrying out its mining processes. Are you familiar with these, Mr. Murdoch? A.—No, I haven't seen it, but I was told there was a demand.

## Opening Remarks of Counsel

12. Q.—Have you some technical qualifications, as well as being a member of the Bar? A.—No.

13. Q.—What I was going to ask you was, would you be able to verify the fact that the re-agents mentioned in this demand have been used in the carrying on of the mining operations of the defendant Company? A.—I have seen that demand.

10 MR. SMART: I may say that in anticipation of this examination we have had a list prepared of the different re-agents used from time to time. (Document produced). This Exhibit is self-explanatory.

And as far as the process used is concerned, we have a paper here describing it. (Document produced). This is the McLaughlin article describing the process which has been carried on during the past six years,—

14. Q.—Say for six years prior to the institution of the action? A.—Well I don't know what changes have been made in it, to tell you the truth.

20 MR. SMART: This paper was published in 1930, and we are informed that as far as we are concerned that it was the process described in this paper of 1930 that has been adhered to until the present time, except in so far as there is a difference of re-agents indicated by this list of re-agents. A.—I think that is right." (McLaughlin Article marked Ex. 1).

EXHIBIT M-1: Filed by } The McLaughlin Article.  
Mr. Gowling }

30 "MR. SMART: Exhibit One is a reprint from the Canadian Mining and Metallurgical Bulletin of February 1930, being part of the publications of the Institute of Mining and Metallurgy for 1930.

And this document which Mr. Murdoch has produced and which will be marked as Exhibit Two, is a memorandum prepared from the records of the Defendant, showing the particular flotation agents for various circuits treated, in pound per ton of ore treated during the period from 1929 to the end of February 1943, also showing the tonnage treated.

Any document referred to in the plaintiff's affidavit on production should be offered in evidence subject to any objection as to relevancy, by either party.

40 MR. GOWLING: That is right.

(Memorandum referred to marked Exhibit Two.)"

EXHIBIT M-2: Filed by } Memorandum produced by  
Mr. Gowling } Mr. Murdoch.

MR. GOWLING: That last paragraph which I have read, my Lord, refers to an agreement between my friends and Mr. Scott.

## Opening Remarks of Counsel

My friends kindly agreed that we could produce any document referred to in the affidavit on production without the formality of having it identified by a witness.

Then on the examination I offered another document. The examination continues:

“MR. GOWLING: Might this document also be offered in evidence, although it is not mentioned in the affidavit on production?”

10 MR. SMART: You can examine the witness.

15 Q.—In your files that have been produced is a letter dated April 1st, 1936, bearing the signature of your secretary, Mr. Murdoch, or what purports to be the initials of your secretary, Mr. Murdoch, addressed to Mr. Boyd. Can you identify that as a letter sent to Mr. Boyd by someone in the defendant Company? A.—Yes, I recognize the initials of my secretary.

(Letter referred to marked Exhibit Three.)”

20 MR. GOWLING: I may say, my Lord, that on the examination of Mr. Murdoch there are a number of letters referred to as having passed between the plaintiff and the defendant. Pursuant to the agreement with my friends I propose to file the complete file of correspondence between the parties. Therefore I do not think it is necessary to identify these few letters that were marked on the discovery. We did not mark all the letters that were written by one party to the other, but my friends marked a few here and there.

HIS LORDSHIP: How will this letter be identified?

MR. GOWLING: I think that Exhibit M-3 could be the complete file of correspondence.

30 MR. BIGGAR: Be careful about that, because there is already Exhibit M-3 on the examination.

HIS LORDSHIP: Could the letters not be given the same number that they were given on the examination, and the whole file of correspondence given another number?

MR. BIGGAR: I have no objection to that. Probably we shall only have to refer to the whole file, so that practically it may be all right.

40 MR. GOWLING: We will furnish my friends and the court with a list of these letters, a sort of index, and I think that will solve any difficulty.

HIS LORDSHIP: What shall we do with this letter?

MR. GOWLING: This can be marked as Exhibit M-3.

HIS LORDSHIP: The file that you have need not be broken up.



## Opening Remarks of Counsel

EXHIBIT M-3: Filed by            } Letter of April 1, 1936,  
  } Mr. Gowling    } addressed to Mr. Boyd.

MR. GOWLING: I am continuing to read the examination:

- 10    "16. Q.—I understand that towards the end of 1925 the plaintiff Company approached the defendant Company with a view to interesting the defendant in taking a licence under the patent in suit. Will you verify that, Mr. Murdoch?  
A.—Not to me.
17. Q.—You were not approached directly? A.—No.
18. Q.—When was the Patent in suit first brought to your attention? A.—I think in 1930.
19. Q.—About 1930? A.—That is by the plaintiff.
20. Q.—And the earlier correspondence indicates that the defendant had submitted some samples of ore to the plaintiff Company for testing purposes. Were you aware of that fact at that time? (No answer)
- 20    21. Q.—Then what was your first connection with the plaintiffs in 1930? A.—Somebody,—a Mr. Quigley visited the property and then wrote me,—that is my recollection from reading the correspondence.
22. Q.—And for some time I understand there were discussions between the officers of the plaintiff Company and the Defendant Company as to whether the defendant would be interested in taking a Licence? A.—That is right.
23. Q.—Do you recall how often you had interviews with officers of the plaintiff Company? A.—The only one I can recollect is one that took place in Montreal.
- 30    24. Q.—Do you know when that would be? A.—If I saw the correspondence I could tell you,—it was Mr. Roberts I see.
25. Q.—About 1934, Mr. Roberts? A.—Yes.
26. Q.—The correspondence indicates that you met Mr. Roberts and Mr. Perry in 1930? A.—Mr. Perry is the gentleman who has since deceased?
27. Q.—Yes? A.—Yes.
28. Q.—And as far as you remember that was the only conference you had with officers of the plaintiff Company? A.—That is the only one I remember of.
- 40    29. Q.—Do you know who Mr. Perry was? A.—No; he was as I recollect it the Montreal contact man of the plaintiff; what his position with the plaintiff was I don't remember.
30. Q.—And there was correspondence after that meeting, between the two companies, which indicates that the negotiations for the Licence or the discussions of a Licence, I should

## Opening Remarks of Counsel

say, were carried on for another couple of years. Were you aware of that fact? A.—Yes.

31. Q.—And was that being done under your personal supervision? A.—Yes.

32. Q.—And what final conclusion did you reach concerning those negotiations? A.—Well, very early after their approach, that is the approach by the plaintiff, I decided that in my opinion we should not pay any royalty.

10 33. Q.—And you wrote to Mr. Boyd to that effect on February 12th, 1936, I believe? A.—I think the letter speaks for itself.

34. Q.—And after this decision was reached and communicated to the plaintiff Company, the correspondence indicates that the plaintiff continued in its endeavor to interest your Company in the Patent,—do you remember that? A.—Well, they were very intermittent; as I recollect it there would be a couple of years go by before we would hear of it again.

20 35. Q.—And their efforts in that respect were not of any avail? A.—That is correct.

36. Q.—And did the plaintiff ever do anything to suggest to you or to the defendant Company, that it could use these processes without payment of royalty? A.—What is the question?

37. Q.—Did the plaintiff Company do anything to suggest to you that it acquiesced in your use of the patented process, without payment of royalty? A.—Just by inaction.

30 38. Q.—Just by inaction, you say; there was no definite communication from the plaintiff to your Company, that it had decided to abandon its claim for royalties? A.—No.

39. Q.—And it never did anything in an active way to indicate that it was acquiescing in the use by Noranda of what we call the patented processes? A.—Not in an active way, more by inaction, I would say.

40. Q.—You say more by inaction? A.—Yes.

41. Q.—Did the defendant Company ever take any steps or take any action itself to bring the matter to a head, except of course writing, as it has done, to the plaintiff Company, stating that they declined to take a License? A.—I don't think so.

40 42. Q.—No action was ever taken by the defendant Company for a declaratory judgment that the Patent was either invalid or not infringed? A.—I would not know why we should."

That is as far as I care to read this Examination into the record as far as the plaintiff's case.

Opening Remarks of Counsel  
For Plaintiff—Arthur Howard Higgins

MR. BIGGAR: My friend's use of the Examination gives us the right to put in the rest of it. We will consider that, though I doubt if there is anything more we will wish to put in.

HIS LORDSHIP: We can deal with that when we come to your case.

MR. BIGGAR: Very well, my Lord.

MR. GOWLING: I am at the point, my Lord, where I am going to call a witness. I think if he were called now he could give his qualifications in general matters before the noon adjournment.

10 HIS LORDSHIP: Yes.

MR. GOWLING: I had tried to time this to take up the morning, but I overlooked the fact that we opened at 10.30 instead of 11 a.m.

HIS LORDSHIP: If you wish to stop after you qualify him you may do so.

MR. GOWLING: Thank you, my Lord. I should like, if I may, to pick an appropriate spot.

HIS LORDSHIP: Yes.

---

20 ARTHUR HOWARD HIGGINS. Sworn. Examined by  
Mr. Gowling.

1. Q.—What is your address, Mr. Higgins? A.—London, England.

2. Q.—What is your occupation? A.—I am a consulting metallurgist.

3. Q.—Are you associated with the plaintiff company? A.—I am retained by the plaintiff company as consultant.

4. Q.—But you are not an officer of the plaintiff company? A.—No, I am not.

5. Q.—How long have you been under retainer from the plaintiff company, and its predecessor? A.—Since July, 1925.

6. Q.—I am going to ask you to give evidence as an expert on matters pertaining to the recovery of minerals from ore. I should therefore like you to state your qualifications with respect to matters in this art? A.—I received my scientific and technical education at the Bradford Technical College and the Royal School of Mines, London. In 1903 I joined the firm of Minerals Separation Limited, the predecessor of the plaintiff corporation, and was continuously employed by them until December, 1916, as far as I remember, when I was transferred to the Minerals Separation North American Corporation.  
40 I was in their employment until 1925, when I left them and went back to London and opened an office there.

For Plaintiff—Arthur Howard Higgins

7. Q.—Have you ever testified in other actions relating to this particular art? A.—Yes. I have testified in several actions relating to the froth flotation art.

HIS LORDSHIP: The art is described as froth flotation?

MR. GOWLING: Froth flotation separation of ores.

HIS LORDSHIP: Separation of ores by froth flotation?

MR. GOWLING: Yes, by froth flotation.

HIS LORDSHIP: That is the art?

MR. GOWLING: Yes, my Lord. I think that any expert in  
10 that field has a much more extensive knowledge than that one particular art. I am sure that Mr. Higgins' knowledge goes far beyond the froth flotation separation of ores.

HIS LORDSHIP: Yes. I mean, that is the art that you have been referring to in your questions?

MR. GOWLING: Yes.

Q.—Perhaps, Mr. Higgins, you would state whether you have made any inventions in this art; and if so, what they were? A.—Yes. I have made several inventions. The first one was the soluble flotation agent patent. I do not remember the number.

20 MR. BIGGAR: I wonder if the witness would mind speaking a little louder. It is rather difficult to hear him across the room.

HIS LORDSHIP: Yes. There is a certain amount of competition.

MR. BIGGAR: Yes.

MR. GOWLING: That is a good suggestion.

9. Q.—Will you continue, please? A.—I carried out the experiments in the basic patent. I was the first man to see mineral-bearing froth. That was in 1905. Since then I have made several inventions that I cannot remember offhand the exact title of. Some of them referred to machines and some of them to processes.

30 10. Q.—The basic froth flotation principle was made possible through your invention? A.—Well, the United States court decided that Sulman, Picard and Ballot invented it, but I carried out the experiments.

11. Q.—I believe you are also familiar with the particular matters in issue between the parties in this action? A.—Yes, I am.

12. Q.—And you were present and heard my opening statement to the court? A.—Yes, I was.

13. Q.—Do you agree with the statement which I made with respect to this particular art? A.—Yes, generally. I might have a  
40 little objection to one or two details, but nothing serious.

14. Q.—Are you familiar with the Keller patent in suit? A.—I am.

15. Q.—Do you know Cornelius H. Keller, the inventor named in the patent? A.—Yes, I do.

For Plaintiff—Arthur Howard Higgins

16. Q.—When did you first meet Mr. Keller? A.—I believe it was in 1918, although I am not absolutely certain.

17. Q.—What was Mr. Keller doing at that time? A.—He was an assayer employed by the company in San Francisco.

HIS LORDSHIP: 18. Q.—An assayer employed by what company? A.—The plaintiff company in San Francisco.

MR. GOWLING: 19. Q.—What was your position with the company at that time? A.—I was their chief metallurgist.

20. Q.—Were you also in San Francisco? A.—Yes. I was in San Francisco at that time.

21. Q.—So that Keller would be one of your staff? A.—Yes.

22. Q.—When did you first learn about Mr. Keller's invention which is described in the patent in suit? A.—I believe it was in the early part, perhaps, of May of 1923.

MR. GOWLING: My Lord, I am going to have the witness next deal with the invention itself, and that will take some time. I think your Lordship would find it to your advantage to have the story continue without interruption, and I would suggest that this might be a convenient time to adjourn.

20 HIS LORDSHIP: That might be all right. You have qualified him to your satisfaction.

MR. GOWLING: Yes, my Lord. These are general statements which he will be giving, and he will proceed immediately with a description of the matter referred to in issue.

HIS LORDSHIP: Is there any cross-examination on the qualifications first, before the court accepts the witness as an expert?

MR. GOWLING: No; I think not, my Lord. The usual practice has been to allow the expert to finish his entire testimony without interruption by cross-examination.

30 HIS LORDSHIP: There is no preliminary cross-examination purely confined to the matter of qualification?

MR. GOWLING: No, my Lord.

HIS LORDSHIP: Then, under the circumstances we will adjourn now to resume at 2 o'clock, I should think.

MR. GOWLING: I was going to suggest 2.15, my Lord, in view of the difficulty of getting lunch.

HIS LORDSHIP: Then we will adjourn until 2.15.  
—Court adjourned at 12.40 p.m. until 2.15 p.m.

#### AFTERNOON SESSION

40

November 13th, 1944.  
2.15 P.M.

MR. A. H. HIGGINS. Examination by Mr. Gowling continued:  
23. Q.—Mr. Higgins, I should like you to take the patent in suit

For Plaintiff—Arthur Howard Higgins

and explain the invention therein described, and particularly point out the meaning of the technical language which has been used in the specification? A.—The patent is directed to the improvements in froth-flotation concentration of ores. Counsel has already pointed out that an ore is a mixture of metaliferous mineral or valuable mineral with gangue. I have a specimen here which contains copper, and it shows rather nicely, although it is not very large, the sparkling mineral, brassy in colour, and the whitish, stony looking gangue. Your Lordship will notice that the mineral is somewhat  
 10 small in size. It varies a great deal in different ores. In some ores it can be broken up and picked out by hand; in others, we use the gravity concentrating process.

MR. GOWLING: Would your Lordship like to see that?

HIS LORDSHIP: Yes.

MR. GOWLING: 24. Q.—You were mentioning that you sometimes use the gravity process for separating it? A.—Yes. The gravity process takes account of or makes use of the difference in the specific gravity of the mineral, the metaliferous mineral and the gangue stuff; the metaliferous mineral usually having a much higher  
 20 specific gravity than the gangue stuff, it is possible by shaking it in water, either up and down or long ways, to make the mineral separate from the worthless gangue. One of the examples of the patent refers to that gravity process. It is usually applied to an ore where it is possible, so as to avoid grinding the ore up to such a fine state of division as is necessary in the flotation process, so that when the gravity process is finished, has done all the work in concentrating that it can do, the tailings from the gravity concentrator pass along to the flotation plant. In the flotation plant you need a very much finer state of division than in the gravity  
 30 plant. Usually for flotation we grind the ore up to such a size that it looks rather like powder. Would you show his Lordship that? I washed off what we call the slimes.

25. Q.—Pardon me. I was going to say we might call the first bottle “A”. We will put an “A” on the vial, in case your Lordship is interested later on in differentiating between the two.

HIS LORDSHIP: Yes.

MR. GOWLING: They are not exhibits.

MR. BIGGAR: If they are going to be referred to, I think they should be exhibits.

40 HIS LORDSHIP: I suppose if they are referred to, they ought to be marked.

MR. GOWLING: Yes.

HIS LORDSHIP: Otherwise there might be confusion.

MR. GOWLING: Perhaps my friend would allow them to be marked. We are not going to put these forward as any particular

For Plaintiff—Arthur Howard Higgins

ore. That is the reason I did not ask to mark them. Unless my friend will agree, we could not very well put them in without identifying them as Anaconda ore or something like that.

HIS LORDSHIP: No.

MR. BIGGAR: I am quite satisfied they should be identified as material prepared for washing, and material prepared for flotation, if you like, one or the other.

MR. GOWLING: Thank you.

10 HIS LORDSHIP: Then we will mark the first bottle.

MR. GOWLING: Perhaps we will mark the sample ore, if your Lordship wishes.

HIS LORDSHIP: All right, the sample ore.

MR. GOWLING: That will be what exhibit?

THE CLERK: Exhibit P-51.

HIS LORDSHIP: Then the ore will be Exhibit P-51. That is the first bottle. How do you describe that?

EXHIBIT P-51: Bottle containing a piece of ore.

THE WITNESS: Ore ground to a suitable size for flotation.

20 HIS LORDSHIP: 26. Q.—Bottle of ore ground to suitable size for flotation? A.—Yes.

27. Q.—That will be Exhibit P-52. This is the first bottle? A.—Yes.

EXHIBIT P-52: Bottle of fine ground ore.

MR. GOWLING: The coarser one is the second.

THE CLERK: That is No. 2, that is P-52.

THE WITNESS: The ore is 51, and this is 52, and that will be 53.

MR. ROBINSON: P-51 is the ore.

HIS LORDSHIP: And 52 is the finely ground ore.

30 MR. GOWLING: That is the fine ground ore.

THE CLERK: No, sir. I am afraid not.

HIS LORDSHIP: Ask him again.

THE CLERK: Which is the ore?

THE WITNESS: This one.

THE CLERK: 51 is the ore.

THE WITNESS: This is 52.

HIS LORDSHIP: This ground one is 52.

MR. GOWLING: 28. Q.—That is 52, which I think you were mentioning, Mr. Higgins, contains the slimes? A.—Yes; and it obscures  
40 the size of the tailing particles, so I washed off that slime. After having dried the sands, I put them in the bottle, P-53.

HIS LORDSHIP: 29. Q.—Then the bottle of ore without the slime is 53? A.—Yes, 53.

For Plaintiff—Arthur Howard Higgins

MR. GOWLING: 30. Q.—P-53 will be the ground ore with the slime washed out. Why do you call them slimes? Perhaps you would define “slimes”. A.—Slimes are what we refer to as the finest part of the ore mixed up with water. That usually has a slippery feeling something like very fine mud. It is technically known as slimes.

EXHIBIT P-53: Bottle of ground ore with slimes washed out.

MR. BIGGAR: A little louder, please.

HIS LORDSHIP: 30(a). Q.—Technically it is known as slimes?  
 A.—Yes. At first sight it looks as though P-52 is more finely ground  
 10 than P-53, but that is not the state of affairs at all. They are both  
 ground to the same mesh, roughly, 80 mesh. That will give your  
 Lordship some idea of what 80 mesh is. It is rather like fine  
 table salt.

MR. GOWLING: 30(b). Q.—Now, Mr. Higgins, would you turn to the patent and explain the nature of the invention there?

MR. BIGGAR: I object to that question. That is just the kind of thing that an expert cannot say.

HIS LORDSHIP: You mean the nature of the invention?

MR. BIGGAR: Yes. My friend's first question was quite right.

20 HIS LORDSHIP: Excuse me a minute while I get a reference book.

MR. BIGGAR: My friend's first question was put perfectly, what is the explanation of the technical terms. I was going to suggest to him that he should point out the technical terms that he wanted defined. But this present question is, “Please tell us what Keller invented” which is to be found from the patent.

MR. GOWLING: 30(c). Q.—You were going to proceed with the flotation process, Mr. Higgins? A.—Yes.

30 HIS LORDSHIP: I will just read this. The reporter need not take this down. Very well, Mr. Gowling.

MR. GOWLING: What I had in mind is this, my Lord. In the patent the inventor has recorded certain experiments.

HIS LORDSHIP: Yes.

40 MR. GOWLING: My submission is that the expert witness may describe these experiments, and he obviously cannot pick out two or three points like anions and cations, and explain what an anion or a cation is without referring to the context. As I pointed out, my Lord, I did not read the patent as I felt that there would be a dispute about some of the technical evidence, and I felt, in fairness to my friends and the experts, that they should make the explanation and be subject to cross-examination. The witness will not express any opinion as to whether something which is in the patent is patentable, nor will he attempt to interpret the patent, except to explain what took place in these experiments and explain the flota-



For Plaintiff—Arthur Howard Higgins

tion process as part of common knowledge, which will enable your Lordship to see the steps which were taken.

HIS LORDSHIP: Yes. That seems to me to be perfectly in order.

MR. GOWLING: I think the witness was going to proceed with some general information on flotation, but avoiding reading the patent, as it were, just for the purpose of explaining the flotation process.

HIS LORDSHIP: Yes.

MR. GOWLING: This may cover some of the ground I covered,  
10 but in much clearer language.

HIS LORDSHIP: Yes.

MR. BIGGAR: If my friend puts the question, we can then tell as to what the witness is asked to direct himself.

MR. GOWLING: The witness has just explained Exhibits P-52 and P-53. I would ask the witness to explain how the flotation process is carried on.

HIS LORDSHIP: That is, the known flotation process?

MR. GOWLING: The known flotation process, prior to the Keller invention.

20 HIS LORDSHIP: Yes.

MR. GOWLING: And at the same time he will, in due course, through his explanation, tell your Lordship the new step taken by the inventor.

MR. BIGGAR: Oh, oh.

MR. GOWLING: He will tell your Lordship in this way. I have already indicated that the patent says it covers sulphur derivatives of carbonic acid. I think your Lordship requires some explanation as to what a sulphur derivative or carbonic acid is.

HIS LORDSHIP: Yes.

30 MR. BIGGAR: I do. If you direct yourself to that, there will not be any objection from this side of the room.

MR. GOWLING: I do not like to direct the witness as to the sequence in which he should give his evidence on a matter of this kind. I think if I attempt to ask him questions and receive these short answers, we will find that I am having the machine explained when the witness would think it more enlightening to tell you something about the process.

HIS LORDSHIP: Why not let the witness go ahead with his description of it?

40 MR. GOWLING: Of the process?

HIS LORDSHIP: Of the known process.

MR. GOWLING: That is right, my Lord.

For Plaintiff—Arthur Howard Higgins

HIS LORDSHIP: Prior to the Keller patent.

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: And explain everything about it.

MR. GOWLING: (30d). Q.—Would you proceed, Mr. Higgins?  
 A.—In practical operations of the froth flotation process, the final grinding invariably takes place in the presence of water. The mixture of water and ore is known as pulp. I should like to show your Lordship an illustration of the operation of the flotation process. If you are willing to see that, I should like to point out that we have had  
 10 to grind the ore dry so as to carry it here conveniently, and that we shall have to mix it with water to make the pulp. That is the only way in which it will differ from a large scale operation. May I proceed now, your Lordship?

HIS LORDSHIP: Yes.

MR. GOWLING: 30(e). Q.—Come around this way, please. A.—Very well. The machinery in which the operation is carried out is almost immaterial, you can use it with so many different kinds of machines. This has the advantage that it is made of glass so that you can see through the sides what is going on. This is the agitator. This  
 20 central shaft carries a number of round bars. It is enclosed in a hollow shaft carrying some of the bars which do not move when the central agitating shaft turns around. Down the hollow stem air is admitted when it is necessary. We have ordinary tap water in there and we put in the ore. It is ground up to the same size as your Lordship sees in Exhibit P-52.

HIS LORDSHIP: 30(f). Q.—Yes. That is with the slimes in it?  
 A.—Yes, with the slimes. Flotation works better generally with the slimes in than without.

30 30(g). Q.—It works better with the slimes in it, generally? A.—Yes, generally speaking.

MR. GOWLING: Pardon me, but the reporter is having difficulty in hearing with the machine in operation, and it might be better if he moved over to your side of the room.

THE WITNESS: May I suggest that your Lordship could see it better if you came down here.

HIS LORDSHIP: Yes.

THE WITNESS: We will start the agitation going, putting in first of all a little caustic soda to make what we call an alkaline pulp or, as they refer to it in the mills, circuit; because the water  
 40 is returned, after it has been used once, again and again.

HIS LORDSHIP: You add caustic soda.

MR. GOWLING: 30(h). Q.—What is the purpose of adding that?  
 A.—This ore works better in an alkaline pulp than it does in a neutral pulp. Then we put in one drop of pine oil. Pine oil is a mineral fruthing agent. Then at once your Lordship will notice the

For Plaintiff—Arthur Howard Higgins

contrast between the tailings and the concentrate. I am going to put in some xanthate.

HIS LORDSHIP: 30(i). Q.—What kind of xanthate is that? A.—It is potassium ethyl xanthate.

MR. GOWLING: 30(j). Q.—How much did you add? A.—Five c.c.'s of a 1 per cent solution. It requires a minute or so to mix up the ingredients thoroughly. There is practically no air going in at the present moment. That is with one minute's agitation. Now we will let the air in. As you watch, you can see the almost black  
10 froth coming off. Through the sides of the glass you can see the colour of the pulp. The tailings are suspended in that so that you cannot at the moment see the tailings. The material overflowing into the basin is the concentrate. Now we stop the agitation and your Lordship will see, settling down to the bottom of the agitating vessel, the tailings almost white in colour. The concentrates are almost black. Would your Lordship like to see this a bit closer?

HIS LORDSHIP: Yes.

THE WITNESS: I will pour some of that back.

MR. GOWLING: 30(k). Q.—What kind of ore is that, Mr. Higgins?  
20 A.—This is a copper ore containing bomite.

30(l). Q.—Is that why it is black? A.—Yes. You cannot feel any grease on that. Of course, we put in such a minute quantity of oil, one drop in all that 500 grams.

30(m). Q.—Mr. Higgins, the patentee states: "This invention relates to the froth-flotation concentration of ores, and is herein described as applied to the concentration of certain ores with mineral-frothing agents in the presence of certain organic compounds containing sulphur." Perhaps you would explain what are meant by those organic compounds containing sulphur. If you wish, you may  
30 refer to the following paragraph which deals with the same matter? A.—In that paragraph, the patentee discloses that he is not—

MR. BIGGAR: Now, now, the witness has really not answered the question at all.

MR. GOWLING: I think he has. I think your Lordship will appreciate that. Could I just draw your Lordship's attention to a question which was asked by the late Mr. Justice McLean, after some discussion of this question. This was in the Philco case, in which the same problem arises. I think your Lordship will appreciate the difficulty of finding the dividing line between what the  
40 witness should say and what he should not say. We are here interested in having your Lordship understand the facts.

HIS LORDSHIP: Yes.

MR. GOWLING: After some discussion as to what witnesses can say and cannot say, Mr. Justice McLean said, "I would just like to have the witness do what you did this morning, only taking

For Plaintiff—Arthur Howard Higgins

less time, of course, just to describe that Langmuir patent, its construction and what it does.”

HIS LORDSHIP: I suppose if he were to say that it purports to disclose such and such—

MR. GOWLING: I would not want the witness even to go that far, my Lord. I think my friend would find, when he answers the question, it will be more of a criticism of the language he uses than the purpose which he is effecting.

HIS LORDSHIP: Yes.

10 MR. GOWLING: I am asking him, in effect, to tell your Lordship what these certain organic compounds are and how they act in this flotation.

MR. BIGGAR: That is all right. There is no objection to that.

HIS LORDSHIP: That is perfectly all right.

MR. GOWLING: Yes. I think the witness may have some difficulty with the language. He is not a lawyer, and perhaps cannot read that case with the same accuracy as my friends and I have done.

HIS LORDSHIP: Yes.

20 MR. GOWLING: 30(n). Q.—Would you proceed, Mr. Higgins, please. A.—The use of the word “certain” is not clear at that particular point. As we pass down we shall find that he finally tells us what those certain compounds are.

31. Q.—Would you proceed, Mr. Higgins? In the next paragraph he says:

30 “It has been found that certain sulphur derivatives of carbonic acid greatly increase the efficiency of the froth-flotation process when used in connection with mineral-frothing agents. The increased efficiency shows itself sometimes in markedly better recoveries, sometimes in effecting the usual recoveries with greatly reduced quantities of the usual mineral-frothing agents, and sometimes in greatly reducing the time needed for agitation to produce the desired recoveries.”

He refers there again to certain sulphur derivatives of carbonic acid. Would you explain what those are? A.—Sulphur derivatives of carbonic acid are derivatives in which some of the oxygens of carbonic acid have been substituted by sulphur. There are several of them, but we do not know which he is selecting, because he only says “certain”.

40 32. Q.—In the following paragraph does he indicate which sulphur derivatives of carbonic acid he has in mind or proposes to use? A.—Yes. In the next paragraph he limits it to salts of sulphur derivatives of carbonic acid. Salt is the result of union between a metal and an acid. We start with carbonic acid; we put sulphur in it, and then we put the metal in, and we have got a salt.

For Plaintiff—Arthur Howard Higgins

33. Q.—Then he mentions the fact that those derivatives contain an organic radical, such as an alkyl radical, and known as xanthates, as the new substance. A.—That is a more detailed description of his agent, and this introduces, in addition to the sulphur and the metal, the alkyl radical. Now I think I had better have that chart.

MR. GOWLING: My Lord, the witness has prepared two charts, in order to explain to your Lordship something about these sulphur derivatives of carbonic acid, and I think the charts might be  
10 marked.

34. Q.—Mr. Higgins, you might explain what the chart does? A.—This chart which I have drawn up shows the structural formula of carbonic acid, the structural formula of the sulphur derivatives of carbonic acid, and in the right-hand column, some of the alkyl radicals.

EXHIBIT P-54: Filed by  
Mr. Gowling

20

Chart showing structural formula of carbonic acid, structural formula of sulphur derivatives of carbonic acid, and some alkyl radicals.

35. Q.—Would you proceed with your description of carbonic acid and those derivatives? A.—On the left-hand side there is carbonic acid,  $H_2CO_3$ . Below that is the structural formula. There is an oxygen on the extreme left connected to a carbon atom by two bonds, and then to the carbon atom are connected two hydroxyl groups, that is the OH groups, with a single bond each. Those oxygens are theoretically capable of substitution with sulphur. We do not actually do it by taking an atom of sulphur and pushing an atom of oxygen out. It is done by indirect means. We have  
30 the possibility of substituting one or two or three of the oxygens. If we substitute one oxygen we have two places in which we can put the sulphur. That is done in the next column. The O in the OH group can be replaced by the sulphur, or the sulphur can replace the O which is bonded to the carbon atom by two bonds.

36. Q.—Would you now point out the difference between the formula at the top in the left-hand column and the formula at the top in the second column? One is  $H_2CO_3$  and the other is  $H_2CO_2S$ . What is the significance of that difference? What has happened to make that change? A.—One of the oxygens has been replaced by  
40 a sulphur atom, so that we have no longer got three oxygens; we have only got two, because we have put in one sulphur in place of the third oxygen.

37. Q.—What is it called at that stage? A.—Mono-thio carbonic acid.

For Plaintiff—Arthur Howard Higgins

38. Q.—What does “mono” mean, and what does “thio” mean?  
A.—“Mono” means one, and “thio” comes from the Greek for sulphur.

39. Q.—So what does the term mono-thio carbonic acid mean?  
A.—It means carbonic acid with a sulphur atom in it.

HIS LORDSHIP: 40. Q.—Carbonic acid with one sulphur atom added? A.—No, substituted.

41. Q.—Substituted for an oxygen atom? A.—Yes.

MR. GOWLING: 42. Q.—Is there more than one mono-thio carbonic acid atom? A.—Yes, there are two shown there. They have slightly different properties chemically.

43. Q.—Would you explain to his Lordship this bonding that you have mentioned, taking by way of illustration, if you like, the first mono-thio carbonic acid? How is that bound together? A.—The carbon occupies the central position, and it has four arms sticking out, you might say, each of which is anxious to grab hold of some other atom. The carbon here has seized with two of its arms the two arms of an oxygen atom. And then on the other hand having got two arms left free to seize something, it has seized one of the SH radicals that has been wandering about loose somewhere, and it also has seized an hydroxol atom, the OH radical.

44. Q.—What is a radical? A.—A radical is part of a compound. OH is a radical, part of water. Water is HOH.

45. Q.—How many arms or bonds has carbon? A.—Four.

46. Q.—So the whole four must be grabbing hold of something in this formula? A.—Yes, certainly. Carbon has always four, except in carbon monoxide, where nobody really knows whether it has two or four. That is the only exception that I know of. Otherwise it has always got four bonds.

47. Q.—Will you take the second column and explain what has happened there? A.—In the second column, that is the central column, we have two of the oxygens of the carbonic acid substituted by two sulphurs.

HIS LORDSHIP: 48. Q.—Two of the oxygen atoms substituted by two sulphur atoms? A.—Yes, my Lord. Two of those are possible: one in which the sulphur replaces the oxygen of the OH group—we have two in that position—and one in which only one sulphur replaces the oxygen of the OH group, the other one having replaced the sulphur, which was bound up with two links.

MR. GOWLING: 49. Q.—What is that called? A.—That is xanthic acid.

50. Q.—What is the technical name at the top of the column there? A.—Di-thio carbonic acids.

51. Q.—What does “di” mean? A.—That means there are two sulphur atoms in the compound.

For Plaintiff—Arthur Howard Higgins

52. Q.—So that xanthic acid is a di-thio carbonic acid? A.—Yes.

53. Q.—I do not think you explained how you get xanthic acid from the di-thio carbonic acid? A.—The hydrogen of the OH group in the di-thio carbonic acid is replaced by an alkyl radical. I am afraid I got too far. Then it becomes xanthic acid. So that the xanthic acid has central carbon with sulphur bonded by two bonds on the left, one SH group and one  $OC_2H_5$  group. There the  $C_2H_5$  replaces the hydrogen, and that makes xanthic acid. Further down the column, when we substitute potassium for hydrogen in xanthic acid we get potassium xanthate.

54. Q.—Mr. Higgins, referring again to xanthic acid, can you substitute any of the alkyl radicals for the hydrogen of the di-thio carbonic acid? A.—Yes.

55. Q.—What are the alkyl radicals? Perhaps you should explain that term “alkyl radicals”. A.—The alkyl radicals are the residue of hydro carbon groups, the saturated hydro carbons. Methane is the first of them,  $CH_4$ . That is marsh gas.

HIS LORDSHIP: 56. Q.—That is not shown on this chart? A.—No. It does not exist by itself as  $CH_3$ , but it is the methyl group that is left when you take away one hydrogen from marsh gas. It can enter into composition or chemical reactions in much the same way that a metal does. There are a number of those alkyl radicals. Ethyl is one of them, and propyl, butyl, amyl and hexyl, and so on, a good many of them. They differ from each other by one carbon and two hydrogens.

MR. GOWLING: 57. Q.—You mentioned a group of alkyl radicals, and you referred to these as being the residue of saturated hydrate marbons. I think you should explain what is meant by saturated hydro carbon and the residue therefrom. A.—A saturated hydro carbon has all its affinities or four arms sticking out satisfied by the union with hydrogen atoms. The first carbon atom we have has got four arms sticking out, and it will attach four hydrogens, so that its formula is  $CH_4$ .

58. Q.—How do you get methyl from that? A.—You cannot get methyl to exist by itself.

59. Q.—I mean theoretically. A.—Theoretically you take one of the hydrogens away.

60. Q.—Then your  $CH_4$  becomes  $CH_3$ ? A.—Yes.

61. Q.—And that is called methyl? A.—That is right.

62. Q.—A minute ago you said that you could substitute any one of this alkyl group for the hydrogen of a di-thio carbonic acid to obtain xanthic acid. Is that right? You made that statement? A.—Yes.

63. Q.—What do you do to take the next step to potassium xanthate? A.—You substitute the remaining hydrogen attached to the sulphur with potassium.

For Plaintiff—Arthur Howard Higgins

HIS LORDSHIP: 64. Q.—So you have eliminated the two hydrogens? A.—Yes.

65. Q.—You have substituted for one of them an alkyl radical? A.—Yes.

66. Q.—And substituted for the other, potassium? A.—Yes, the metal potassium.

MR. GOWLING: 67. Q.—Can you substitute any other metals for the remaining hydrogen? A.—Yes; almost any metal can be substituted.

10 69. Q.—What are the practical ones which are used in producing xanthate? A.—Sodium and potassium.

69. Q.—Is potassium xanthate the full chemical name of that product? A.—No. It is always known as potassium xanthate, but it is really potassium ethyl xanthate.

70. Q.—Why do you call it potassium ethyl xanthate? A.—Because of the ethyl group entering into its composition.

71. Q.—The ethyl radical? A.—Yes.

HIS LORDSHIP: 72. Q.—It contains the alkyl radical described on this chart as ethyl? A.—Yes, my Lord.

20 MR. GOWLING: 73. Q.—And if you had substituted amyl instead of ethyl for the hydrogen, what would you then call it? A.—Potassium amyl xanthate.

74. Q.—But it would still be referred to generally as potassium xanthate? A.—No. not generally. If you say potassium xanthate alone, you mean potassium ethyl xanthate. But if you substitute the amyl radical you indicate that you have not got the common one, ethyl, so you put it as potassium amyl xanthate. And similarly with potassium butyl xanthate.

30 HIS LORDSHIP: 75. Q.—If you use the term “potassium xanthate” alone, that indicates that the alkyl radical that it has got is ethyl? A.—Yes, my Lord.

MR. GOWLING: 76. Q.—What is in the third column, under “Tri-thio carbonic acid”? A.—The third column shows the substitution of the three oxygens in carbonic acid by sulphur, so that no oxygen is left in the molecule at all, and you got  $H_2CS_3$ .

77. Q.—How many of these are there? A.—There is only one of these possible.

78. Q.—Can you derive xanthate from tri-thio carbonic acid? A.—Not without turning it back again into di-thio carbonic acid.

40 79. Q.—What is the potassium tri-thio carbonate which is mentioned at the bottom? A.—That is the potassium salt of the tri-thio carbonate. It has two potassium atoms and three sulphurs.

80. Q.—How do you derive that from the tri-thio carbonic acid? A.—By the substitution of the two potassium atoms for the two hydrogen atoms.



For Plaintiff—Arthur Howard Higgins

81. Q.—How does that differ from potassium xanthate? A.—First of all, in having three sulphurs instead of two, and two potassiums instead of one, and the SK group, the sulphur potassium group, instead of the  $OC_2H_5$  group.

HIS LORDSHIP: 82. Q.—It has no alkyl radical in it? A.—It has no alkyl radical in it, my Lord.

MR. GOWLING: 83. Q.—You might summarize this by mentioning which are the sulphur derivatives of carbonic acid? A.—Two monothio carbonic acids in the first column of the central classification, their salts, and the two di-thio carbonic acids and the tri-thio carbonic acid.

HIS LORDSHIP: 84. Q.—Why are they described as sulphur derivatives of carbonic acid? A.—That is what the patent describes. That is what I had to find out, what they were, before I could use them.

MR. GOWLING: 85. Q.—Why do you call them that, Mr. Higgins? I do not think you understood his Lordship's question. Why are they called sulphur derivatives of carbonic acid? A.—Because they are substances which contain sulphur and which are derived from carbonic acid.

HIS LORDSHIP: 86. Q.—The sulphur is not derived from carbonic acid, is it? A.—No, my Lord. The carbonic acid is, you might say, the parent, and the sulphur derivatives are the new relations you have made.

87. Q.—Sulphur has been added in varying degree to the carbonic acid, and the total is called a sulphur derivative? A.—No, my Lord; sulphur has not been added, it has been substituted.

MR. GOWLING: My Lord, there is another chart which I think will make that clear. We have here a chart giving the calculation of quantities for the formation of xanthate. I think the explanation in this second chart will clear up the point that your Lordship has in mind.

MR. BIGGAR: I think we are agreed about what is meant by a sulphur derivative, my Lord.

MR. GOWLING: I offer this chart as Exhibit 55.

EXHIBIT P-55: Filed by Mr. Gowling } Chart of calculation of quantities for formation of xanthate.

88. Q.—Would you explain how xanthate is formed, Mr. Higgins, using this chart? A.—Xanthate is formed by mixing together caustic alkali, alcohol and carbon disulphide. In order to know the best proportions or the proper proportions to use, it is necessary to know something about the atomic weights and molecular weights and so forth. Each atom of each element has a special weight. The atomic weight of hydrogen is 1; of carbon, 12; of oxygen, 16; of sodium, 23; of sulphur, 32; of potassium, 39. It does not matter

For Plaintiff—Arthur Howard Higgins

much whether these are grams or grains or ounces; they are relative weights. You want to know what the alcohol weighs. Alcohol is  $C_2H_5OH$ . That is the ethyl group again. That is in the central column. There are two carbons. Carbon weighs 12; that is 24. And there are 6 hydrogens; that is 6, for each one weighs 1. And there is one oxygen, 16. So we find that the total molecular weight of alcohol is 46. Then we come to sodium hydrate: one Na which is 23; one oxygen, 16; one hydrogen, 1; that is a total of 40.

89. Q.—You are now giving the molecular weights of the ingredients which you mix together to make xanthate? A.—Yes, that is correct.

90. Q.—You have just mentioned sodium hydrate. The next ingredient is what? A.—Potassium hydrate. Its molecular weight is 56. Then there is carbon disulphide, whose weight is 76. For convenience, we have the specific gravity of the alcohol, that is  $C_2H_5OH$  — the figure 5 has been left out on this chart which I now insert — and the specific gravity of carbon disulphide. Those are both liquids, and in the chemical laboratory it is more convenient to measure them than to weigh them out. So a simple calculation is that 7893 grams of alcohol will measure 10,000 cc.'s of alcohol.

91. Q.—In other words, you are converting weights into volume? A.—Yes. It is a simple way of doing it in the laboratory. In order to make the xanthate, if we want sodium xanthate we take the sodium hydrate.

92. Q.—What is the common term for that? A.—Caustic soda.

93. Q.—Is that the caustic alkali that is mentioned in the chart? A.—Caustic alkali includes both the caustic soda and the caustic potash. It may be either. If you want to specify which it should be, you say caustic soda or sodium hydrate.

94. Q.—That is your first ingredient. What do you do with that? A.—We weigh out 40 grams of sodium hydrate, and we want 58.3 cc.'s of alcohol to combine with it. Instead of weighing out 46 grams of alcohol, it is very much more convenient to measure out 58.3 cc.'s, which is exactly the same quantity. In the same way, we measure out 60.1 cc.'s of the carbon disulphide.

HIS LORDSHIP: 95. Q.—Instead of the 76 grams? A.—Yes. As a result of the reaction we get 144 grams of sodium xanthate and 18 grams of water. That is not sufficient to make it really wet.

MR. GOWLING: 96. Q.—What do you mean, that is not really sufficient water? A.—That is not sufficient water to make it really wet, and it will not dissolve a great deal of the sodium xanthate.

97. Q.—In what form does the xanthate appear? A.—As a yellow powder.

98. Q.—Will it be damp as a result of the water? A.—Slightly damp, yes.

For Plaintiff—Arthur Howard Higgins

99. Q.—Below that what have you calculated, below the formula which you have just given us? A.—The quantities for making potassium xanthate.

HIS LORDSHIP: 100. Q.—You mean percentages of solid and water? A.—Yes, my Lord. The weights differ slightly. You see, we have got the same weight of alcohol, we have got the same weight of carbon disulphide; but potassium being a heavier metal than sodium, we have got rather more weight of caustic potash than we had of sodium hydrate or caustic soda. Instead of having 40 grams  
10 of caustic soda we have got 56 grams of potassium hydrate.

MR. GOWLING: 101. Q.—Before you proceed with that, perhaps you would explain the line marked “per cent” on the chart? A.—The column line marked “per cent” reduces the weight in grams so that you have 100 grams of the three mixed together in the proper proportions, and you finish up on the other side of the equation where you have made the reaction with 100 grams, and you have got 88.9 grams of xanthate and 11.1 grams of water.

HIS LORDSHIP: 102. Q.—What kind of xanthate have you got then? A.—If you use caustic alkali sodium you get sodium xan-  
20 thate, and if you use potassium you get potassium xanthate.

MR. GOWLING: 103. Q.—What is the formula for the potassium alkali? A.—KOH.

104. W.—The K standing for the potassium? A.—Yes.

105. Q.—And Na stands for sodium? A.—Yes.

106. Q.—The resulting product of this last analysis on this sheet is what? A.—Potassium xanthate.

107. Q.—Is it possible to vary the percentages of those products to form xanthate? A.—It is quite useless to vary the proportions, because as you see from the formula the four bonds of the carbon  
30 are all satisfied. Each sulphur has two bonds; they are both satisfied. The oxygen has got two; that is satisfied. And the alkyl radical has only got one; that is also satisfied. So it would be useless to try and increase the amount of sulphur, for instance, by doubling the amount of carbon disulphide. It would be equally useless trying to put in twice as much alkyl radical by doubling the quantity of alcohol. But there is some use in using an excess of alcohol. It makes the reaction more easy to control, and it is easy to deal with the xanthate as soon as it forms if you have an excess of alcohol there. In practice they do not use any excess  
40 of alcohol; they have machinery which overcomes the difficulties we have in the laboratory.

108. Q.—Is the xanthate soluble in alcohol? A.—Yes.

109. Q.—Is it possible to use so much alcohol that the xanthate would not be recognized physically? A.—Oh, yes. You could easily put in enough alcohol to dissolve the whole of your potassium

For Plaintiff—Arthur Howard Higgins

xanthate, and then instead of getting nice yellowish crystals you would have a liquid.

MR. BIGGAR: I think the witness used a word there that he did not intend to use. He said you could put in enough alcohol to dissolve potassium xanthate.

MR. GOWLING: 110. Q.—Did you want to say you could put in enough alcohol to dissolve potassium xanthate? A.—Yes.

111. Q.—Is there any difference in physical appearance between potassium and sodium xanthate? A.—Yes. The potassium xanthate has a nice crystalline body, very fine, small, needle-shaped crystals; but the sodium xanthate is more of a powder, it is rather more difficult to get it in a crystalline form, and it usually appears more as a powder and looks as if it has not got any crystals in it.

112. Q.—Does the term “sulphur derivatives of carbonic acid” embrace any other products than those that you have mentioned? A.—I think I have mentioned all of them in this chart, except the particular ones where the alkyl group is substituted by some other group.

113. Q.—Would it be possible that some of these derivatives would not form anions and cations if they were dissolved in water? What I have in mind is that you should explain the term “anions and cations” as used by the inventor to describe the salts to which he refers in his specification. A.—To say that the sulphur derivative or the salt of the sulphur derivative of thio carbonic acid when dissolved in water makes anions and cations, simply means that it is a solution which will react in the same way that many other salts will. There are solutions which do not form anions and cations, like sugar. That dissolves in water very readily, but it does not form anions and cations.

114. Q.—Would you explain what anions and cations are? A.—When a salt is dissolved in water a certain physical splitting takes place; particles are formed from both sides of the molecule, the acid side and the metal side, which carry a charge of electricity. The whole salt does not usually split up except in very dilute solutions, and it is not a chemical disunion, but simply physical. They cannot be separated by chemical means; but because of their carrying an electric charge they can be separated by the influence of an electric current, the anion going to one of the poles where the electric current is introduced, and the cation going to the opposite one. The cation is the metallic part which appears at the cathode, and this is the basis of the silver-plating industry or any other metal-plating industry.

115. Q.—Do those words in this patent specify a certain type of sulphur derivative of carbonic acid? A.—Yes.

116. Q.—Now, I am going on with the specification at the part where I was reading before, at line 34 of the United States patent,

For Plaintiff—Arthur Howard Higgins

where it says: "Excellent results were also obtained by agitating ore pulps with the complex mixture produced when  $33\frac{1}{3}\%$  of pine oil was incorporated with an alcoholic solution of potassium hydrate, and xanthates or analogous substances were produced by adding carbon disulphide to this mixture." What substances are analogous to those? A.—They are sulphur derivatives which are salts and form anions and cations in solution. It just means similar substances.

10 117. Q.—Are they xanthates? A.—Not necessarily xanthates. In my opinion it includes all the di-thio carbonates shown in the first chart, Exhibit P-54.

HIS LORDSHIP: 118. Q.—What is meant by "xanthates or analogous substances"? A.—To me it means that they are similar substances, not exactly xanthates. Your Lordship will see, if you refer to the chart P-54, a similarity in the composition of the sulphur derivatives of carbonic acid.

MR. GOWLING: 119. Q.—Are they sulphur derivatives of carbonic acid? A.—Yes; they all contain carbon, they contain sulphur and they contain hydrogen. They are similar substances.

20 120. Q.—You explained on this chart P-54 that the sulphur derivatives of carbonic acid were as stated on the chart. I think you should name those which are not xanthates. A.—The two mono-thio carbonic acids and their salts are not xanthates.

121. Q.—They are sulphur derivatives, but not xanthates? A.—Yes. One of the di-thio carbonic acids, the first one, where the two sulphurs are connected with both a carbon and a hydrogen, those are not xanthates, the salts of that acid are not xanthates; and the third one, in which all the oxygen is replaced by sulphur, is not.

30 HIS LORDSHIP: Q.—The tri-thio carbonic acid? A.—The tri-thio carbonic acid. Those are not xanthates.

122. Q.—What about potassium tri-thio carbonate? A.—That is not a xanthate.

MR. GOWLING: 123. Q.—But again they are sulphur derivatives of carbonic acid? A.—Yes, certainly.

124. Q.—The next paragraph in the patent, I think, is probably clear. It says:

40 "The galena-bearing froth obtained with xanthates or analogous substances used at the rate of 0.2 pounds per ton of ore had a characteristic bright sheen, like a "plumbago-bearing froth, and seemed to make a more coherent froth than when other materials were used on the same ore."

What is a galena-bearing froth? What is galena? A.—Galena is a metalliferous mineral composed of lead and sulphur in chemical combination.

For Plaintiff—Arthur Howard Higgins

125. Q.—What would account for the plumbago-bearing froth?  
A.—Plumbago is graphite.

126. Q.—Is it also a colour, Mr. Higgins? Q.—Yes. The colour of galena is bluish. It has a high metallic lustre.

127. Q.—In the next paragraph of the patent he states:

10 “In general the substances referred to are not mineral-frothing agents, — producing only a slight scum, and some evanescent frothy bubbles, when subjected to agitation which would produce mineral-bearing froth in an ore pulp in the presence of a mineral-frothing agent. The substances are effective in enabling a selective flotation of lead and zinc, and cause uncombined silver, if present, to tend to go into the lead concentrate rather than with the zinc, where these are separated in separate concentrates.”

Would you explain that experiment in selective flotation? A.—The example on the next page says:

20 “A pulp of San Francisco Mines of Mexico ore was agitated for ten minutes with potassium xanthate 0.15 pounds per ton and the same amount of coal tar creosote to yield a lead concentrate.”

30 That was done in very much the same way that the machine agitated the pulp this afternoon. It was put into a machine and stirred up thoroughly and air let in. Then the lead concentrate was removed. Then what was left afterwards contained the zinc with the gangue. He put in 0.2 pounds per ton of copper sulphate. That is what many people call an activator. It makes the zinc mineral float very readily. Then he put in 1.2 pounds per ton of water-gas tar, which is a mineral frothing agent of poor quality, and 0.05 pounds per ton of steam-distilled pine oil, which is a very good frothing agent. Then he agitated the pulp again and let some air in, and then he took off a zinc concentrate, his concentrate running to 64 per cent of lead, and 83 per cent of the lead originally in the ore. The first figure, 64 per cent of lead, is the ratio of the lead to sulphur in his concentrate, neglecting the small amount of gangue stuff there would be in that concentrate. The second figure, 83.2 per cent, represents the proportion of the lead originally in the ore.

HIS LORDSHIP: What are you describing now?

40 MR. GOWLING: The witness is referring to the United States patent which is identical with the patent in suit. It is convenient to refer to the United States copy because the lines are numbered. I see a copy on your Lordship's desk. I had intended to have the witness read passages from the patent and give explanations, but somehow or other I have got into reading and letting the witness do the explaining. It seems to me it would be more logical

For Plaintiff—Arthur Howard Higgins

to let him do the reading and to make any explanations as he goes along. He has just been explaining the experiment mentioned at lines 45 to 48 on page 2, but it is not much good to do that without reading the patent. As I mentioned this morning, ordinarily I would have read the patent and made explanations, but on a technical subject of this kind I do not think that is proper.

MR. BIGGAR: It is quite easy to define selective flotation. There will not be any dispute about that. If my friend wants an explanation of that, why not ask for it?

10 MR. GOWLING: The witness has explained this particular experiment in selective flotation. I think something will turn on that.

THE WITNESS: That is an example of selective flotation. There is another one beginning at line 4 on page 2.

MR. BIGGAR: If your Lordship numbers the paragraphs, beginning with "This invention relates" as No. 2, because that is the way it is in the Canadian patent, and then number on down, this paragraph with which my friend was dealing will be paragraph 6.

20 MR. GOWLING: Yes, my Lord. I am quite prepared to continue reading the patent, which I am entitled to do, but I do not want to be suggesting the interpretation that should be placed on it.

HIS LORDSHIP: Is there anything wrong with your referring to a paragraph by its number?

MR. GOWLING: That is quite all right, my Lord. I have been following the United States copy.

HIS LORDSHIP: The Canadian one is in separate paragraphs. If you start by numbering the paragraph beginning "This invention relates" as paragraph 2, then you are at paragraph 6.

30 MR. GOWLING: I have read about half of that paragraph, and the witness has explained the experiment in selective flotation. I mentioned that in opening, without giving any details. Now I would like to proceed and read the balance of that paragraph, and have the witness explain the rest of this experiment.

HIS LORDSHIP: That seems to be all right.

MR. GOWLING: It says:

"Usually pre-agitation is unnecessary, the brightening and other effects seeming to be practically instantaneous."

Then this starts another part:

40 "The pulps may be either acid, alkaline or neutral according to circumstances."

Now, Mr. Higgins, would you explain those three classes of pulps? You mentioned them incidentally in making your experiment. A.—At the time of the invention or the issue of the patent, in 1925, all three pulps were used — acid, alkaline and neutral. In

For Plaintiff—Arthur Howard Higgins

certain ores it was an advantage to use acid, and with certain mineral frothing agents it was an advantage to use acid. The frothing agent selected by a mining company frequently depends on its price and the supply they can obtain. For instance, Anaconda was using a hardwood creosote with acid sludge, and that required an acid circuit, so they put in a small amount of sulphuric acid to make an acid circuit. There are some oils and some frothing agents that behave better in an alkaline circuit. Then you put in either a small quantity of caustic soda or a little soda ash, which  
 10 is sodium carbonate, or sometimes lime. For a neutral pulp of course you do not add anything, unless it happens to be a slightly acid ore and you want it neutral, then you neutralize it with a little alkali.

128. Q.—Is there any advantage in using one type of circuit over another? A.—Sometimes with an ore it is an advantage to use acid; sometimes it is an advantage to use alkali.

129. Q.—What are the guiding factors in determining which type of circuit you should use? A.—I have just stated that sometimes it is the nature of the mineral frothing agent or the nature of the  
 20 ore itself.

130. Q.—Then the patent goes on to explain another experiment:

“Two sticks of caustic potash weighing perhaps 15 grams were partly immersed in about 80 cc. of commercial carbon disulphide and kept for about ten days in a closed bottle containing some air in the warm region of the laboratory where were the hot plates used for drying. These eventually yielded a yellow or orange salt which was used with pine oil at the rate of approximately half a pound to a ton of ore in concentrating Hibernia ore from Timber Butte Mining Company.”

30 What would that yellow or orange salt be, Mr. Higgins? A.—That would be a mixture of potassium tri-thio carbonate, with some potassium carbonate.

131. Q.—Would that be a xanthate? A.—No, it would not.

132. Q.—Would it be a sulphur derivative of carbonic acid? A.—Yes, it would.

133. Q.—What is Hibernia ore? A.—Hibernia ore was a lead zinc ore.

134. Q.—Is that an ore commonly known to metallurgists? A.—I do not know. Many metallurgists may know it, but it is doubtful  
 40 whether everyone does.

135. Q.—Where is the Timber Butte Mining Company? A.—In Butte, Montana, U.S.A.

200. Q.—It states here: “The test was with a neutral pulp, and the concentrates were seen to be clean with brightened lead sulphide particles.” Have you ever performed an experiment of this nature



For Plaintiff—Arthur Howard Higgins

yourself? A.—Yes, I have, with lead-zinc ore. I had not any Hibernia ore, but I had one something like it.

201. Q.—What was the result of your experiment? A.—I found that the patentee was correct. The concentrates that I got off first were brightened, and chiefly lead sulphide not anything like as good a concentrate as he got from the San Francisco mines in Mexico, but it did show a distinct selection of lead from zinc.

202. Q.—Would you say that the experiment recorded here would produce the results stated? A.—Yes, I would.

10 203. Q.—In the next paragraph, which will be 8, which is followed by a description—

MR. ROBINSON: I think the two lines should be in the same paragraph as what follows.

HIS LORDSHIP: I beg your pardon?

MR. GOWLING: The next paragraph is No. 8, my Lord. Here the inventor states: "For laboratory purposes potassium xanthate was prepared as follows:"

HIS LORDSHIP: That will be all the same paragraph.

MR. GOWLING: That is all the same paragraph.

20 HIS LORDSHIP: I suppose it would be.

MR. ROBINSON: Yes, although it does not carry on.

MR. GOWLING: 204. Q.—Have you read this paragraph, Mr. Higgins? A.—Yes, I have.

205. Q.—And does that set forth the proper method of preparing xanthate? A.—It does, for the laboratory; quite a good method.

HIS LORDSHIP: I was wondering whether you were going to read that into the record.

MR. GOWLING: Yes. I think I should read it in, to have a  
30 coherent story of the patent.

HIS LORDSHIP: Yes.

MR. GOWLING: The paragraph reads:

"For laboratory purposes potassium xanthate was prepared as follows: 19.48 grams of 88.5% caustic potash was dissolved in 524 grams ethyl alcohol (denatured No. 5 formula)—"

206. Q.—Is that a recognized formula, Mr. Higgins? A.—Yes.

207. Q.—Continuing the paragraph, "—at a temperature of 124° F., in a reflux condenser." What is a reflux condenser? A.—A reflux condenser is a straight tube, somewhat wide, perhaps half an inch,  
40 or it may be a curly tube. At any rate, the tube is surrounded by a water jacket through which water runs and keeps it cold, so that any volatile substance escaping from the vessel over which this condenser is placed comes out into the straight tube or curly tube, whichever it is, is cooled and condensed and drops back again into

For Plaintiff—Arthur Howard Higgins

the vessel over which it is placed. It is a method of conserving anything volatile, so that it can act for a long time on anything.

208. Q.—Continuing with the specification: “The solution was cooled to 58° F. It contained a large excess of alcohol over the theoretical amount needed for the subsequent reactions.” Just what excess of alcohol would be produced by using the proportions mentioned by Mr. Keller? A.—Well, he used there about 3.6 times as much as he needed. He got 2.6 over and above what the reaction required. That is done for convenience in making the xanthate. When you  
 10 get caustic soda mixed with the alcohol dissolved in it, you add carbon disulphide. The reaction takes place immediately. It is necessary to add the carbon disulphide very slowly and keep it well stirred up. As you see from the equation, we have 160 grams of xanthate and only 18 grams of water. That makes a very solid paste which it is most inconvenient to stir up in a glass beaker with a stirring rod. As I say, in practice they have other ways of doing it. But in the laboratory it is easier to add a little more alcohol and get a nice, smooth paste which you can stir up thoroughly and keep cold at the same time.

20 209. Q.—Why would this mixture be cooled? A.—Because it gives out heat during the reaction, and heat is really bad for the reaction.

210. Q.—The patentee goes on as follows: “To this was added, while stirring, and in a cooling bath, the theoretical amount of carbon disulphide. The reaction was substantially instantaneous, producing a thick pulp of potassium xanthate.” Would you say that potassium xanthate would be produced at that stage? A.—Yes.

211. Q.—What would be the form of such potassium xanthate? A.—It would come down as a yellow solid; and seeing that he has  
 30 more alcohol than he really needed for the reaction, it would make rather a thick paste, yellowish in colour.

212. Q.—Continuing: “The pulp was cooled and centrifuged in a laboratory machine, yielding crystals containing about 20 per cent moisture. The yield thus obtained was 74.7 per cent. Another 17.5 per cent was obtained by evaporation of the mother liquor.” Would you explain how this pulp was centrifuged in the laboratory?

MR. BIGGAR: Oh, I object to that.

MR. GOWLING: Perhaps he could explain what is meant by “centrifuged”.

40 MR. BIGGAR: My friend cannot ask how this man centrifuged the material.

HIS LORDSHIP: He can explain how you centrifuge.

MR. BIGGAR: If he means to ask what is meant by centrifuging, by all means. I am sorry to have interrupted.

HIS LORDSHIP: He is watching you very carefully, Mr. Gowling.

For Plaintiff—Arthur Howard Higgins

MR. GOWLING: I notice that, my Lord. I will have to be a little more careful. I will re-read the court decision tonight.

213. Q.—Would you explain the operation of the centrifuging machine? A.—Yes. The centrifuge varies a great deal in construction, but the principle there is that the material to be treated must be whirled around rapidly so that the centrifugal force squeezes the water out of it. You get sometimes a wall made from fine wire screen in a cylindrical fashion.

HIS LORDSHIP: 214. Q.—It is the water that is thrown out?  
 10 A.—The water comes through the screen in that case. Sometimes the wall is solid. The liquid builds up on the inner side; the solid, being heavier, is thrown out onto the wall, and as more pulp comes in, the thing overflows on the top and the bottom. That is an inconvenient sort of machine to use. You have to keep watching it too much. The machines are used a great deal in drying clothes, where they simply go into a rotating basket which is whirled around at great speed and all the water is squeezed out of them. It is the same with these crystals when put into some machine which was revolving at a good speed; and the mother liquor, which is the  
 20 liquor from which the crystals are separated, would be forced out and the crystals retained on the fine screen.

MR. GOWLING: 214. Q.—Would the mother liquor retain some of the xanthate, some of the crystals, in solution? A.—Yes; because as I said a little while ago, alcohol does dissolve xanthate. This would be expected to carry xanthate, because of its solubility in the alcohol.

215. Q.—It goes on to state: “Both the centrifuged crystals and the residue from the mother liquor gave excellent results in flotation. It was found in cases where sulphuric acid was used that the  
 30 centrifuged material yielded better results than the uncentrifuged.” Was that a common practice, to use sulphuric acid in flotation, at that time? A.—Yes. It was also common practice to use neutral and alkaline circuits, particularly alkaline circuits.

HIS LORDSHIP: It has been suggested to me that, in view of the fact that daily copy takes time to run off, the court might adjourn from day to day at 4 o'clock rather than 4.15.

MR. GOWLING: Yes, my Lord. I think that, in the long run, time is saved by doing that.

HIS LORDSHIP: This might be a convenient place at which  
 40 to break off, them.

MR. GOWLING: Yes, my Lord; it would be.

HIS LORDSHIP: Then we will adjourn until tomorrow morning at 10.30 a.m.

—Court adjourned at 4 o'clock p.m. until Tuesday, November 14th, at 10.30 a.m.

For Plaintiff—Arthur Howard Higgins

OTTAWA, NOVEMBER 14TH, 1944

MORNING SESSION

MR. GOWLING: My Lord, at the close of Court yesterday we were discussing the patent, and I think we had stopped at the end of paragraph 8.

HIS LORDSHIP: Yes.

MR. GOWLING: The next paragraph, paragraph 9, commences "A pulp of Anaconda slimes—

HIS LORDSHIP: Had you dealt with the concluding sentence of  
10 paragraph 8?

MR. GOWLING: I doubt if I read that into the record, my Lord.

HIS LORDSHIP: I do not think you did.

MR. GOWLING: No, I did not. I think I will just commence with the last sentence in paragraph 8. I see no necessity for reviewing any of it unless your Lordship particularly wishes it.

HIS LORDSHIP: No. But my recollection is that you had not read that last part of paragraph 8.

MR. GOWLING: That is quite right, my Lord.

20 MR. A. H. HIGGINS. Examination by Mr. Gowling, resumed.

MR. GOWLING: 216. Q.—Mr. Higgins, I shall now read you the last sentence in paragraph 8 of the patent in suit. It reads: "It was found in cases where sulphuric acid was used that the centrifuged material yielded better results than the uncentrifuged." Was it common practice to use sulphuric acid in the carrying out of this process? A.—Yes. At this time there were one or two companies left who still used acid, but the majority of them had changed from acid to alkali at this time, 1925.

217. Q.—Would the sulphuric acid be used alone or along with  
30 other agents? A.—It would be used with a mineral frothing agent and any other agent that might assist; a heavier oil like hardwood creosote might be used.

HIS LORDSHIP: 218. Q.—When you speak of centrifuged material and uncentrifuged material, does that mean the substance that is left after it has been subjected to being centrifuged? A.—Yes. The centrifuged material is the solid that is separated from the liquor.

219. Q.—After centrifuging? A.—Yes. The liquor is the mother liquor that contains a lot of xanthate, and it is evaporated so as  
40 to get out the crystals which the mother liquor dissolved; that is, it was subjected to some kind of heating process which removes all

For Plaintiff—Arthur Howard Higgins

the alcohol left in the mother liquor, leaving only the solids, potassium xanthate there. The heating to evaporate the mother liquor might have some deleterious effect in decomposing the xanthate, but not a great deal of decomposition would go on. But undoubtedly it would not be such a pure product as the material he had removed by the centrifugal machines.

220. Q.—Was it the purpose of the centrifugal machine to separate the liquor from the solids, from the minerals? A.—I would rather put it the other way round, my Lord, that it was the purpose to  
10 separate the solids from the liquor, the solids being the most valuable parts.

221. Q.—Then as far as the evaporation of the alcohol from the mother liquid is concerned, was it for the purpose of salvaging the xanthate? A.—The residue of xanthate that was dissolved in the liquor. It was for that purpose.

222. Q.—It was for the purpose of salvaging that again? A.—Yes, my Lord.

MR. GOWLING: 223. Q.—And would the xanthate which you salvaged from the mother liquid be exactly the same as the xanthate  
20 which you obtained through the centrifuging machine? A.—Except for the impurities that you probably form in evaporation, but in my opinion those would be very small.

MR. GOWLING: The point, my lord, is that the xanthate recovered in the centrifuging machine was just a little purer than the xanthate which is recovered by the evaporation of the mother liquid.

HIS LORDSHIP: Oh, I see.

MR. GOWLING: That was the point which was covered here, my Lord. Is there any further explanation of that sentence needed,  
30 Mr. Higgins?

HIS LORDSHIP: I was not sure whether this last sentence had to do with the recovery of the xanthate or whether it had to do with the better separation of the solids from the liquor.

MR. GOWLING: 224. Q.—It seems that it has to do with the use of one particular xanthate, my Lord. He says: "It was found in cases where sulphuric acid was used that the centrifuged material yielded better results than the uncentrifuged." In other words, I take it that he is suggesting there that if you are using a process in which sulphuric acid is one of the agents, he suggests the use of the centri-  
40 fuged material rather than the xanthate recovery by evaporation of the mother liquid. Perhaps Mr. Higgins could suggest why the centrifuged xanthate would yield better results in a circuit where sulphuric acid is used? A.—Yes. In my opinion, the better results were entirely due to the purer xanthate obtained by centrifuging the paste which he first had. Any impurity that was in the mother liquid would be removed from that first batch of xanthate. But he

For Plaintiff—Arthur Howard Higgins

did not want to leave the xanthate in the mother liquor. To recover that, if he evaporated the liquid and left with the xanthate any impurity which the liquid was carrying, that would undoubtedly give him a little worse xanthate than what he separated by the centrifugal machine.

225. Q.—Is there any reason why the inventor should have called particular attention to the process in which sulphuric acid is used? A.—Yes; because one of the biggest mining companies in the United States was using sulphuric acid in their pulp.

10 226. Q.—In paragraph 9 there is a description of a test made on Anaconda slimes which is in rather technical language. Would you mind explaining to his Lordship the meaning of the technical terms in that paragraph? A.—Pulp has already been explained. It is a mixture of the very finest parts of the ore with water. Anaconda is the name of the mining company who own these slimes, the Anaconda Mining Company. “Slimes which had been stored for several days”—the storing would be likely to make the copper pyrites which is contained in the slimes oxydize slightly, especially when they are  
20 stored out in the open, exposed to the atmosphere.

227. Q.—Would that increase the problem of recovering the valuable mineral from the slimes? A.—Yes. The slimes which are oxydized in that way are more difficult to recover than nice, clean slimes having nothing but clean copper pyrite in them.

228. Q.—The inventor goes on to state that these slimes were treated with cresylic acid as a frothing agent. A.—May I continue?

229. Q.—Oh, yes, I am sorry to have interrupted you. A.—These slimes “assaying 2.95% copper” — that does not mean to say that the copper was there as a metal, but it was there as a sulphide,  
30 copper pyrites or a little chalcocite, both copper sulphide minerals. It is not stated whether the oxydation of the copper mineral is due to this storing, but the storing would undoubtedly cause oxydation. “— was treated with cresylic acid as a frothing agent” — cresylic acid is a relation of carboic acid.

230. HIS LORDSHIP: Q.—It is a relation of what? A.—Carboic acid.

231. Q.—Carbonic acid? A.—Carboic acid.

232. Q.—Oh, carboic acid? A.—Yes; the well-known disinfectant.

40 233. Q.—Oh, yes. A.—Cresylic acid is a well-known and much used mineral frothing agent. Potassium xanthate was also added “at the rate of half a pound to a ton of the slimes. With no pre-agitation” — the pre-agitation is a process that is frequently carried out immediately before the froth flotation process. It merely consists in agitating the pulp with some flotation agent for some period of time. It may vary from twenty minutes in some cases to much longer, with the object of giving the agent every

For Plaintiff—Arthur Howard Higgins

possible chance of doing its work on the mineral before it goes into the machine and is separated. "With no pre-agitation and fifteen minutes agitation in a laboratory subaeration machine"—the laboratory subaeration machines differ in construction, but they are all of a general type such as the machine that your Lordship saw yesterday, where the air is admitted into the bottom of the agitating cell and makes a froth on the top during the agitation." — These slimes yielded a concentrate containing 15.6% copper, a middling containing 0.48% copper and a tailing containing 0.082% copper." There we have three products. In the operation of the process on the practical scale it is usual to submit the ore to preliminary treatment in which a concentrate is taken off which is of insufficient grade to send direct to the smelter, the object being to reduce the tailings to the lowest possible content of the metal which is being treated. That concentrate is a rougher concentrate. The concentrate is then re-treated. It is taken bodily off the top of the pulp into a separate machine, and the process goes on again. It is not always necessary to add any more agents of any kind. Very frequently the operation takes place without the addition of any further agents, but it is done in a separate machine. From that machine you can get a cleaner concentrate, a finished concentrate or a concentrate which is satisfactory to send to the smelter. The tailings from that machine are not as clean by any means as the tailings you get from the first machine. They still contain a lot of copper and they are called middlings. They are returned to the rougher machine for the second treatment, sometimes with an intermediate crushing stage, but not always.

"The small proportion of silver present was recovered in about the same proportions. Similar results were obtained with the use of sodium xanthate and General Naval Stores No. 5 flotation oil, a steam distilled pine oil."

That is a well-known and generally used pine oil such as was used yesterday in the test that I showed your Lordship.

HIS LORDSHIP: Q.—Is there any date at which this experiment was carried on? A.—I do not know the date, my Lord, but I think it was somewhere about the early part of 1923.

241. Q.—What I am getting at is, was this before the date of the patent?

MR. GOWLING: Yes, my Lord, it must have been.

THE WITNESS: Undoubtedly.

HIS LORDSHIP: It must have been on a date before the date of the patent in suit?

MR. GOWLING: Yes, my Lord. In fact, an experiment of this nature which is recorded in the patent in suit must have been made before the filing date of the application.

For Plaintiff—Arthur Howard Higgins

HIS LORDSHIP: Yes, of course; that is obvious.

MR. GOWLING: In England you can file a complete specification after some experimentation. That is perhaps what your Lordship had in mind. In England they can file a provisional specification and then, after making some experiments, can file a complete specification, but in Canada we cannot do that.

HIS LORDSHIP: In Canada the specification is part of the application for the patent.

MR. GOWLING: That is right, my Lord.

10 HIS LORDSHIP: So this experiment must have been conducted prior to the date of the patent in suit.

MR. GOWLING: That is right, my Lord.

HIS LORDSHIP: Was it conducted by the patentee?

MR. GOWLING: I think Mr. Higgins is familiar with what took place and can perhaps state who conducted this experiment.

THE WITNESS: As I recollect it, this experiment was carried on by one of the metallurgists of the San Francisco laboratory.

HIS LORDSHIP: 242. Q.—Of the Anaconda mine? A.—No; the Minerals Separation North American Corporation.

20 243. Q.—The plaintiff company? A.—Yes, my Lord.

MR. GOWLING: 244. Q.—Was that metallurgist an assistant of the inventor? A.—Not exactly. The inventor was the assayer and had little experience in making flotation tests, so he asked Mr. Lewis to make the test for him.

HIS LORDSHIP: 245. Q.—The metallurgist was Mr. Lewis? A.—Yes.

246. Q.—He made this experiment? A.—To the best of my recollection it was Mr. Lewis who did this experiment.

247. Q.—At the request of the patentee? A.—At the request of Mr. Keller, yes, my Lord.

30 MR. GOWLING: At the request of Mr. Keller, the inventor.

248. Q.—Do you regard the result of the test recorded in the specification as satisfactory? A.—Yes.

249. Q.—Would it justify treating the Anaconda slimes if the same results could be produced in commercial practice? A.—Yes.

250. Q.—I find there are some further tests recorded here, and in view of the fact that there are some new technical terms used I would ask you to explain them.

HIS LORDSHIP: Is this another paragraph?

40 MR. GOWLING: I was going on to the next paragraph, my Lord.

HIS LORDSHIP: That will be paragraph 10. I am taking the liberty of marking the paragraph numbers on the patent.

MR. GOWLING: I will ask the witness to explain the test recorded in paragraph 10.



For Plaintiff—Arthur Howard Higgins

THE WITNESS: There is nothing new in that paragraph until we come to a solution of naphthalene in xylene.

MR. GOWLING: 251. Q.—Perhaps you had better read it, to make it clear how that term is used. A.—“A pulp of Cash Mine ore subjected first to agitation. . .”

HIS LORDSHIP: 252. Q.—What is Cash Mine ore? A.—Cash Mine is simply the name of the mine from which the ore was received.

MR. GOWLING: 253. Q.—What type of ore would that be? A.—It was a lead zinc ore containing some copper, some gold and some  
10 silver, together with a little iron. It was subjected first to agitation for ten minutes with a mixture of 0.3 pounds per ton of potassium xanthate with a small proportion of a 10 per cent or a saturated solution of naphthalene in xylene.

254. Q.—What is that? A.—The mixture of naphthalene in xylene is a mineral frothing agent. Naphthalene is a coal tar product which is commonly used for killing moths or getting them out of clothes. Xylene is a relation of benzene, and it is a solvent, a little heavier than benzene. It was a better solvent for the naphthalene than the benzene. The mixture was a mineral frothing agent.  
20 At the end of the 10 minutes the lead concentrate was removed.

HIS LORDSHIP: 255. Q.—The lead concentrate was removed by itself? A.—Yes, my Lord. That lead concentrate shows up in the table underneath. The “Pb. concentrate,” that is the lead concentrate. It gives the weight of it, the percentage weight in the first column, then the assay of gold in it and the assay of silver in it, and then follows the copper and the lead and the iron. That is the composition of the concentrate. When that concentrate had been removed, the remaining part was subjected to agitation for ten minutes with copper sulphate. Copper sulphate is commonly used to assist the  
30 floatation of the zinc mineral. Barrett No. 4 floatation oil, that is a rather poor quality mineral frothing agent, but a good agent to use to assist the mineral frothing agent. General Naval Stores No. 5 floatation oil is a mineral frothing agent of good quality, at the rate of 0.1 pounds per ton yielded the results shown in the following table. This indicates the Pb concentrate—

HIS LORDSHIP: 256. Q.—Pb concentrate is lead? A.—Yes, my Lord. Underneath that, the next line is Zn concentrate, that is zinc concentrate. As to the letters up at the head of that table, the Au. is gold; the Ag. is silver; the Cu. is copper; the Pb. is  
40 lead; the Zn. is zinc, and the Fe. is iron. A recovery of 95 per cent of the lead in the concentrate was obtained containing 87 per cent of the silver, but containing only 5 per cent of the zinc, while 70 per cent of the zinc was recovered in the zinc concentrate.

That evidence is set out in the table. The second table is marked percentage recoveries. In each line you see how much of the different metalliferous minerals carrying these particular metals

For Plaintiff—Arthur Howard Higgins

was obtained. It is the ratio of what you feed into the plant and what you take out as lead concentrate or zinc concentrate or what is left in the tailings.

HIS LORDSHIP: I do not quite understand that table.

MR. GOWLING: 265. Q.—Would you explain that table again? A.—The first table is what we call the grade of the concentrates. That is its value in any proportion of metal in the mineral it carries.

266. Q.—What does the term “Heads” mean? A.—That is a term generally used for the feed ore, the ore you put in that is concentrated at the moment. The second table is marked “Percentage Recoveries”.

267. Q.—May I stop you there? When you refer to “Heads” being the ore as put in—the top line in the table running straight across—that is the assay of that ore which is being sent to the floatation processing machine? A.—Yes, exactly.

HIS LORDSHIP: 268. Q.—That is the assay of the ore? A.—That they are going to treat, yes.

MR. GOWLING: 269. Q.—In other words, it is .154 ounces of gold and so forth as indicated in that first line?

20 HIS LORDSHIP: And 10.7 ounces of silver.

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: 3.18 percent of copper, and so on.

MR. GOWLING: 270. Q.—Then, would you explain what the second line is?

HIS LORDSHIP: Lead concentrate.

THE WITNESS: That is the assay of the lead concentrate.

MR. GOWLING: 271. Q.—What does it indicate? A.—It shows that the gold has been increased to some extent.

HIS LORDSHIP: 272. Q.—What does 38 per cent mean? A.—That 30 is the weight. For every 100 pounds or tons you put into the machine you get 38 pounds or tons as lead concentrate.

273. Q.—It is 38 per cent of the total ore? A.—Yes, my Lord.

274. Q.—What do the remaining figures in that line mean? A.—Gold .24, .24 ounces of gold in that 38 pounds of concentrates. It has gone up slightly from .154 ounces to .24 ounces, not a very material increase. The next one is silver, 24.6 ounces. That has gone up considerably from 10.7 to 24.6. The next column is copper. Copper has increased from 3.18 to 7.12. Lead has increased from 14.9 to 37.4. That shows we are getting the 40 lead out.

275. Q.—What relationship does that have to the 38? A.—That means that out of every 100 pounds of lead concentrate you find 37.4 pounds as lead and the smelter does his best to get that 37.4 pounds out.

For Plaintiff—Arthur Howard Higgins

MR. GOWLING: 275. Q.—But it also has something else mixed with the lead? A.—Yes, other things.

HIS LORDSHIP: 276. Q.—It has all these things mixed with the lead? A.—Yes.

MR. GOWLING: 277. Q.—Before sending it to the smelter do you attempt to extract gold, silver, copper and so forth from that 38 per cent?

HIS LORDSHIP: 38 pounds.

MR. GOWLING: No, I think it is per cent.

10 THE WITNESS: Well, 38 per cent or you can take it as pounds.

MR. GOWLING: 278. Q.—Do you attempt to remove the gold, silver and other metals before sending that concentrate to the smelter? A.—Usually, no; there are cases in which the gold might be removed before it was sent to the smelter.

279. Q.—Would the amounts of these other metals in that 38 pounds be in quantities sufficient to make it worth while recovering them? A.—The smelter recovers them and he pays you for the amount of gold in the concentrate. He pays you for the amount  
20 of silver. He will pay you for the amount of copper. He will pay you for the amount of lead but he will not pay for zinc in this case. He probably will not pay you much for the iron.

280. Q.—In other words, what you are trying to do primarily is to recover first your lead? A.—Yes.

281. Q.—By this flotation process? A.—Yes, lead mineral.

282. Q.—And with the lead you obtain these other minerals as you go along? A.—Yes.

283. Q.—And they are separated from the lead in the smelter? A.—Yes.

30 284. Q.—Then, would you explain what you are after next, Mr. Higgins, as indicated by this table? A.—Zinc concentrate, that is the third line. Out of 100 pounds we should get 15.4 pounds of zinc concentrate and that would contain .36 ounces per ton of gold.

HIS LORDSHIP: 285. Q.—.36? A.—.36 ounces.

286. Q.—Of gold? A.—Yes, and 6.3 ounces of silver, most of the silver having already gone into the lead concentrate. Then there is 2.56 per cent of copper. There again the bulk of the copper has gone into the lead concentrate. There is only 3 per cent of lead. Of course, we got the bulk of it in the lead concentrate, but 35.2  
40 per cent of the zinc goes with the zinc concentrate and 12 per cent of iron. That is zinc concentrate and would be sold to some smelter who handles zinc mineral.

287. Q.—The smelter that handles the zinc concentrate would separate these other minerals from the zinc? A.—As far as he can he separates all metals that are in the concentrate. If he cannot

For Plaintiff—Arthur Howard Higgins

do it he won't pay you for them but if he can do it he charges you a certain fee for doing it, but he will pay you for the metal.

MR. GOWLING: 288. Q.—How does he do that, Mr. Higgins?  
A.—Smelting the zinc?

289. Q.—In smelting lead how would he recover the gold and silver from the lead? A.—When they smelt it they run it all down into a liquid form by intense heat using some agent which will take off the silver. They get the gold and silver that will be found in that lead, and then the separation of the silver and gold from the lead  
10 is a rather difficult process. Several processes are carried on. Sometimes the lead is kept molten and allowed to crystallize very slightly, and the crystals coming to the surface are scraped off with a skimming dish much the same as is used in skimming off cream from milk. These crystals are gathered together and put into a separate pot and re-heated again until they melt. Then they are allowed to crystallize a little bit on the surface and you get a little bit richer silver, and so on, until he is satisfied he has got all the silver. There is another way of doing it. You can put  
20 the lead containing the gold and silver into a solution and then pass an electric current through it and get your lead off at one pole. The gold and silver will drop down to the bottom of the bath as slime which is cleaned up periodically and treated to separate the gold and the silver.

290. Q.—You do not attempt to take the gold and the silver out of the lead and concentrate by a further flotation process?  
A.—Oh no.

HIS LORDSHIP: 291. Q.—You can take the lead concentrate off by a flotation process, can you? A.—That is exactly what we do.

292. Q.—And then take the zinc concentrate off? A.—A little  
30 more frothing agent and two or three other agents.

293. Q.—For instance, in your lead concentrate you do not continue the flotation process to take other minerals out of the lead.

MR. GOWLING: 294. Q.—That is the gold and silver? A.—At the present time we are unable to do that.

HIS LORDSHIP: 295. Q.—By the flotation method? A.—By the flotation method.

296. Q.—Similarly with regard to the zinc concentrate you cannot take off other metals by the flotation process? A.—Sometimes we can get off a little of the iron if it is there as iron pyrite. We can  
40 leave that behind as tailings, but if it is there as part of the zinc mineral or in some other form you cannot separate it by flotation at the present time.

297. Q.—These processes of separation of the metals in the concentrates where the concentrates are lead concentrates or zinc concentrates are done at the smelter? A.—Yes.

For Plaintiff—Arthur Howard Higgins

MR. GOWLING: 298. Q.—Then there is another table underneath that which relates to the same test. Oh, I am sorry; you did not explain the tailings, Mr. Higgins? A.—There were 46.6 per cent by weight of tailings. That is roughly one-half of the ore we treated. They contained .015 ounces of gold.

299. Q.—Is that very much from a commercial standpoint? A.—It is not much in this ore.

300. Q.—Just proceed? A.—It contained 0.9 of an ounce of silver. You see most of the silver has been taken out. We had 10 10.7 originally and we have reduced our residue to 0.9 of an ounce. It contains .26 per cent of copper which is quite low, 0.5 per cent of lead which is quite low, 0.8 per cent of zinc which is quite low, and 4.2 per cent of iron. That is a satisfactory tailing. It can now be thrown away as useless.

HIS LORDSHIP: 301. Q.—That tailing would be thrown away? It would not be subject to a further flotation process? A.—No, my lord.

MR. GOWLING: 302. Q.—Are you ready to proceed with the next table, Mr. Higgins? A.—The next table shows the recovery.

20 303. Q.—I notice it says “Per Cent Recoveries”? A.—The recoveries are put in percentage, yes. They are usually expressed that way. That is to say, if you start with 14.9 per cent of lead in the ore you are treating—

HIS LORDSHIP: 304. Q.—If you start with what? A.—14.9 per cent of lead ore in the ore we were treating. That is in the upper table. Of that 14.9 per cent we have recovered 95.3 per cent as lead concentrate.

MR. GOWLING: 304. Q.—Is that a good recovery? A.—Yes, that is a very good recovery. The other metals do not concern us so 30 much, but in the zinc concentrate we have recovered 70.5 per cent of the zinc. That is not quite so good. We should like that to be up to 90 too but it is not a bad result on that ore which is a very difficult ore to treat.

305. Q.—There are a number of other tests reported in the specification.

HIS LORDSHIP: Then I suppose the next test could be described as relating to pulp of the San Francisco Mines. Would that be paragraph 10?

MR. GOWLING: That would be paragraph 11, my Lord. I 40 don't know whether your Lordship wishes a detailed explanation of these further tests.

HIS LORDSHIP: I don't know myself.

MR. GOWLING: I don't think it is necessary to go through it except to explain a few of the new terms which have been introduced in these tests.

*For Plaintiff—Arthur Howard Higgins*

MR. GOWLING: 306. Q.—Mr. Higgins, you might explain what type of ore the San Francisco Mines is? A.—That is a lead, zinc, silver ore, from Mexico.

307. Q.—In this paragraph it refers to the fact that a coal tar creosote has been used? A.—Coal tar creosote is a mineral frothing agent and it is obtained from coal tar by distillation. It is one of the distillation products of coal tar.

308. Q.—And the remaining pulp is agitated for fifteen minutes with copper sulphate and water-gas tar. I do not believe water-gas tar has been mentioned before. Would you explain what that is? A.—Water-gas tar is also a mineral-frothing agent but is not very good. It is not anything like as good as steam distilled pine oil. It is obtained from the manufacture of water-gas for illumination purposes.

309. Q.—Does the table for the San Francisco Mine ore give the same information as the two tables shown above for the Cash Mine ore? A.—Yes. There the table is condensed. There are not so many items to put in so it is written out in one line, or you might say one table.

20 310. Q.—I notice with this ore the patent emphasizes sodium xanthate was used and in the Cash Mine ores potassium xanthate was used? A.—Potassium xanthate was used in this.

311. Q.—Oh, I am sorry.

HIS LORDSHIP: It is the other way around, is it not?

MR. GOWLING: I made a mistake there.

THE WITNESS: These are both potassium.

HIS LORDSHIP: With the Cash Mine ore potassium xanthate was used and with the San Francisco Mine ore potassium xanthate was used. We start with the words "Similar results were obtained",  
30 in paragraph 12.

MR. GOWLING: 312. Q.—In paragraph 12 sodium xanthate is mentioned as the agent. Would that produce any different results from potassium xanthate? A.—Not in my opinion, not the least difference.

313. Q.—Can potassium and sodium xanthate be used interchangeably in connection with most of these ores? A.—Yes.

314. Q.—Would you just state briefly what is described in the next three paragraphs of the patent? They would be Nos. 13, 14 and 15. Do not go into the details.

40 HIS LORDSHIP: 13, 14 and 15.

MR. GOWLING: I think I will add 16 to that, my Lord.

HIS LORDSHIP: 13, 14, 15 and 16. Paragraph 13 is "Current Anaconda slimes".

MR. BIGGAR: Is there any difficulty about that?

For Plaintiff—Arthur Howard Higgins

MR. GOWLING: I was going to have the witness state they refer to similar tests and similar terminology has been used.

MR. BIGGAR: I agree.

HIS LORDSHIP: You are now speaking of paragraphs 13, 14, 15 and 16.

MR. GOWLING: Yes, my Lord, and my friend has been kind enough to agree.

MR. BIGGAR: Is "current Anaconda slimes" any different from "Anaconda slimes and metal" and "Anaconda old gravity concentration tailings"?

MR. GOWLING: Would you deal with those terms?

HIS LORDSHIP: Mr. Biggar referred first to paragraph 13 which deals with current Anaconda slimes.

THE WITNESS: Current Anaconda slimes were slimes that were being freshly produced at the mill in distinction to slimes that had been stored in paragraph 9 on the dump somewhere. They were fresh slimes from the mill. The oxidized copper in that slime was oxidized copper they had dug out of the mine. It was not oxidized by its exposure to the atmosphere. That is why they used  
 20 the word "current" so that you will know it was not dump tailings which had been oxidized by exposure to the atmosphere. "Mineral separation standard machine" was a machine used at that time in the Anaconda Copper Company for flotation treatment. It consisted of a number of cells in which agitation took place, each one connected at the front with a Spitzkasten. A Spitzkasten is a pointed box very much like a wedge of cheese only larger, with the narrow edge of the cheese going downwards and the broad end upwards to the atmosphere where it was open. Each one of these agitating cells discharged into one of these Spitzkasten. Then the  
 30 froth came off the top of the Spitzkasten and what did not come off at the top fell to the bottom into the narrow wedge at the bottom and was sucked up into the next agitating cell, and so on through the series. There were a number of them, fourteen of those in a row, as far as I remember.

MR. GOWLING: 315. Q.—Did you deal with the term "kerosene acid sludge"? A.—That was a mineral frothing agent which was obtained in the treatment or refining of kerosene. You treat kerosene with strong sulphuric acid getting it thoroughly mixed up and the clean kerosene is removed at the top and at the bottom is some  
 40 tarry matter and the acid which has not been thoroughly used up by the refining process sinks to the bottom and is called sludge. There was very little use for it but it had an extensive use at Anaconda as a mineral frothing agent. Usually they add to that some hardwood creosote. That was to assist the kerosene sludge to make a good froth which they could handle nicely and facilitate the operation. In addition to that some chamber sulphuric acid

For Plaintiff—Arthur Howard Higgins

was used. Chamber sulphuric acid is the first manufacture of sulphuric acid before it is concentrated and it runs about 60 per cent of acid instead of about 100. It is cheaper than the purer acid so that is why it was used.

316. Q.—The term “gravitation concentration tailings” was mentioned a few moments ago. Would you explain what that means? That is at the beginning of paragraph 14.

HIS LORDSHIP: “Old gravity concentration tailings.”

MR. GOWLING: Yes, I am sorry, my Lord.

10 THE WITNESS: Those were tailings that had been treated at some time or other in the processes that preceded the froth-flotation process. They were to some extent running side by side. The gravity concentrator would take out everything it could get and then the flotation would continue the process of cleaning up what the gravity concentration or concentrator had left in. The term “gravity” was given to it because the separation depended on the difference in specific gravity of the mineral and the gangue. The mixture was put into water and, either by shaking vertically or horizontally, the mineral was made to take up a different position in the apparatus where it could be separated from the gangue stuff.

20

HIS LORDSHIP: 350. Q.—This is the process that was used before the flotation process? A.—Yes; and it was used not only before in time, but also in plant. Plants frequently contain some gravity apparatus at the present time.

351. Q.—They use both processes? A.—Yes, both.

MR. GOWLING: 352. Q.—Do you wish to say anything more about that, Mr. Higgins? A.—Yes. “Porous bottom in the spitzkasten through which air was admitted.” That simply means that at 30 the bottom of this wedge-shaped box they put in a piece of canvas or something of that kind, made an air chest, and blow air in in that manner to assist in the formation of froth. There is nothing else new in that paragraph.

352. Q.—On what size scale were these tests conducted, that are mentioned in paragraphs 10 to 16?

HIS LORDSHIP: 353. Q.—Is there nothing in the remaining paragraphs, 15 and 16, as far as explanation of the meaning of the terms and so on is concerned? A.—There is the Brown aerator.

353. Q.—The which? A.—In paragraph 16, “The Brown aerator and circulating device” in one of the mineral separation machines, containing fourteen spitzkastens. In front of the machine, instead of an ordinary spitzkasten, they put a special one. In fact, they closed up the opening so that the agitating box did not discharge into the spitzkasten. It went first of all through the fourteen agitating cells, and then was sent through fourteen spitzkastens.

40



For Plaintiff—Arthur Howard Higgins

The spitzkastens being there, it was easy to block up the opening and to put down a couple of boards and make a trough through which the pulp descended, put a pipe at the bottom of the front compartment through which air was blown, and then the pulp was made to pass by the air coming in at the bottom, up to the top of the channel into the spitzkasten. In other words, it went down a narrow chamber or channel, and then up again, before it got into the spitzkasten.

MR. GOWLING: 354. Q.—Were the tests mentioned in paragraphs 13 to 16 large scale or small scale tests? A.—13, 14, 15 and 16 were all large scale tests.

Q.—Would they be run in a laboratory or would they be run in a mine? A.—They are much too big to run in a laboratory.

355. Q.—Do you know where they were run? A.—Yes. They were run at the Anaconda Mine.

HIS LORDSHIP: 356. Q.—And by whom? A.—The Anaconda Copper Company.

357. Q.—No. They were run by whom? I mean, who conducted the tests? A.—Mr. Lewis.

20 358. Q.—The same Mr. Lewis? A.—And I believe Mr. Quigley was helping. The same Mr. Lewis, but I believe he had an assistant there called Quigley.

359. Q.—Were these tests done for Mr. Keller? A.—Well, they were done primarily for the Anaconda Copper Company, to show them that it was a useful thing to adopt in their mill.

360. Q.—Oh. A.—It had got a little bit past the invention stage. This was putting it onto a commercial footing.

361. Q.—These tests were in the nature of demonstration tests? A.—Yes.

30 362. Q.—But done by persons who were working under the instructions of Mr. Keller? A.—Yes, they were. Mr. Keller sent them the xanthate, and he saw that they got the pure xanthate, which was sufficiently pure to work properly. I think we could say that Mr. Keller really did direct the tests to be done.

363. Q.—Mr. Keller directed the tests to be done? A.—Yes.

MR. GOWLING: 364. Q.—Were the results satisfactory from a commercial standpoint? A.—Yes, they were.

365. Q.—To summarize the situation, Mr. Higgins, would you state what is the significant difference between the process used before 40 Keller and the process disclosed in the Keller patent?

HIS LORDSHIP: The difference between what?

MR. GOWLING: The process used before Keller and the process disclosed in the Keller patent.

366. Q.—Would you state that, Mr. Higgins? A.—The process disclosed in the Keller patent differs from the prior processes in the use of a salt—

For Plaintiff—Arthur Howard Higgins

HIS LORDSHIP: 366. Q.—In the use of what? A.—Of a salt of an organic thiocarbonate.

367. Q.—Of an organic what? A.—An organic thiocarbonate, the commonest example of which is xanthate.

MR. GOWLING: 368. Q.—What are the advantages derived from the use of the Keller process? A.—First, in making better recoveries of the desired minerals.

HIS LORDSHIP: 369. Q.—First, better recoveries of the desired minerals? A.—Yes. Secondly, in effecting in some cases the same  
10 recovery with the use of less mineral frothing agents.

370. Q.—I beg your pardon? A.—By the use of less mineral frothing agents. That is a saving of cost in the mineral frothing agent. Sometimes in reducing the time needed.

371. Q.—I beg your pardon? A.—Sometimes in reducing the time needed for agitation. That means less machinery. It gives better working conditions.

MR. GOWLING: 372. Q.—What do you mean by that, Mr. Higgins? A.—That is to say, the froth is easier to handle. It is more uniform. It needs much less looking after. It greatly facilitates  
20 the filtration of the concentrates.

373. Q.—That requires some further explanation, Mr. Higgins? A.—Filtration of the concentrates is always necessary, because you must send them to the smelter in nearly dry condition. So it is necessary to remove all the water you can from the concentrates as you run them off the machine. Some of it is done by syphoning, and then the thick part of the concentrate is run into a filter and the water is sucked off it; a vacuum is put onto the filter and the water is sucked through the filter, leaving you a cake almost dry which you can handle and ship.

30 374. Q.—Is the filtration apparatus complicated or expensive? A.—It is a little bit complicated and it is expensive; and if you can reduce the time of filtration by a half—which in my opinion, xanthate did—it was in itself a valuable thing. It was also more effective in selective flotation than the prior process is.

375. Q.—What about the treatment of slimes? Would there be any difference in the treatment of slimes? A.—Generally speaking, there would not be. It was effective on the slimes equally with what we call the sandy portion.

376. Q.—To what extent has the Keller process been adopted by  
40 the mining industry? A.—It has been very extensively used; I think I might say universally used all over the world.

HIS LORDSHIP: 377. Q.—Extensively used? A.—Extensively used all over the world. Many millions of tons have been treated by this process.

For Plaintiff—Arthur Howard Higgins

MR. GOWLING: 378. Q.—Have you seen this in operation in any Canadian mines? A.—Yes, I have. I have seen it in operation at the Sullivan concentrator.

HIS LORDSHIP: 379. Q.—You have seen it in operation where? A.—At the Sullivan concentrator.

380. Q.—Where is that? A.—That is at Kimberley.

381. Q.—Kimberley? A.—Yes. It is the property of The Consolidated Mining & Smelting Company of Canada.

382. Q.—Kimberley is in British Columbia? A.—In British Columbia, yes. I believe it is the biggest lead-zinc mine in this country—I mean, in the whole of the Western Hemisphere. I saw it in another of their mines, but I have forgotten the name of it. The first one, the Sullivan, was treating about 30,000 tons a day. I should imagine and the smaller one perhaps 250 tons a day. I have also seen it running in plants in the United States.

MR. GOWLING: I am now going to turn to the evidence relating to the Defence.

MR. BIGGAR: I beg your pardon?

MR. GOWLING: I say I am now going to turn to the evidence relating to the Defence.

HIS LORDSHIP: For the time being you are not continuing any further with the paragraphs of the specification?

MR. GOWLING: No. They deal just with reports of these tests which, with the evidence given by Mr. Higgins, I do not think there will be any difficulty in reading. To save the time of the Court I was going to just leave those.

383. Q.—There is nothing new in that? A.—There is only one new thing.

384. Q.—What is that? A.—That is native copper.

HIS LORDSHIP: That is in paragraph 18?

MR. GOWLING: Yes, paragraph 18.

HIS LORDSHIP: Native copper.

MR. GOWLING: 385. Q.—What is that? A.—Native copper is the term we use for copper occurring in the ore body as copper; if it is there as copper metal, we call it native copper.

MR. BIGGAR: 386. Q.—It is not in a compound? A.—No, it is not a compound. Also, when silver occurs in metallic form, we call that native silver.

HIS LORDSHIP: 387. Q.—That is, chunks of copper, pure copper? A.—Yes.

388. Q.—Without any admixture of any other materials? A.—That is correct.

The graphite in paragraph 19 is the same as the plumbago in the previous part of the specification. Carbon in a crystalline form

For Plaintiff—Arthur Howard Higgins

is used for making pencils, in lubrication and other things. “Chiefly in amorphous state” — that is, without shape — means to say that it has not got a crystalline structure. In my opinion, it probably was not graphite, but simply carbon.

MR. GOWLING: My Lord, I am now going to introduce evidence relating to the question of infringement.

400. Q.—Have you read those portions of Mr. Murdoch’s examination for discovery which you heard me read into the record yesterday? A.—I have.

10 401. Q.—Are you familiar with Exhibits M-1 and M-2? A.—I am.

HIS LORDSHIP: Exhibits M-1 and M-2 are the McLachlan article and the memorandum?

MR. GOWLING: That is right, my Lord.

402. Q.—I will refer you now to those two exhibits M-1 and M-2, Mr. Higgins. Are you familiar with those? A.—I am.

403. Q.—Will you indicate by reference to those exhibits the characteristic features of the defendant’s process? A.—Page 14 of Exhibit M-1 gives a diagrammatic view of the operations at Noranda  
20 Mines Limited. Each part of the machinery used is indicated with a number, and there is a legend showing the use of these parts. No. 7 is primary rougher cells; No. 8 is secondary rougher cells; No. 9 is tertiary rougher cells. Those are cells in which agitation is carried on. Under the heading “Addition of Reagents” it shows that amyl-xanthate is added to aeration tank 5, and pine oil also to aeration tank 5. The pine oil and the amyl-xanthate are mixed together with the ore pulp in that aeration tank and then sent to the cells where the froth concentrate is taken off and the tailings finally go away to a dam for waste.

30 HIS LORDSHIP: 404. Q.—This shows that amyl-xanthate was used as an agent? A.—Yes.

MR. GOWLING: Yes, my Lord. I think that Exhibit M-2 deals in greater detail with the agents that have been used. The McLachlan article is a general description of the process and part of the plant, and this Exhibit M-2 was filed to show the agents which were used at various times at the defendant’s plant.

40 405. Q.—In dealing with this exhibit I would ask the witness if he would indicate any differences between the process carried on at the defendant’s plant and the process disclosed in the Keller specifications. You are looking now at Exhibit M-2, Mr. Higgins? A.—Exhibit M-2 shows that during the period 1929 to February 1943 the defendant was using potassium amyl-xanthate. That is the top table, in the eighth column.

HIS LORDSHIP: It says there, “These circuits were not placed in operation until 1934.”

For Plaintiff—Arthur Howard Higgins

MR. GOWLING: As a matter of fact, my Lord, we are not concerned with anything that took place prior to 1934, one reason being that the statute of limitations would prevent us from recovering beyond a certain period.

THE WITNESS: That, my Lord, refers to three separate circuits. There are really four circuits in this table: the copper circuit, the pyrite flotation circuit, the pyrite regrinding circuit and the pyrrhotite retreatment circuit.

HIS LORDSHIP: 406. Q.—What have you to say as to the copper  
10 circuit? A.—The defendant was using potassium amyl-xanthate throughout the period.

407. Q.—From 1929 to 1943? A.—Yes. In the pyrite flotation circuit, from 1934 until February 1943 the defendant was using sodium ethyl xanthate. In the pyrite regrinding circuit, he was using potassium amyl-xanthate, and also during three years,—1940, 1941 and 1942—he was using potassium hexyl xanthate, that is the one with the six carbon atoms in the alkyl radical. In the  
20 pyrrhotite retreatment circuit—pyrrhotite, I should say, is an iron sulphide of a slightly different chemical composition to iron pyrite—in the pyrrhotite retreatment circuit he was using potassium amyl xanthate. In each of these circuits he was using some distilled pine oil with other flotation agents. I think there was another part to that question.

(The following question was read back:

“Q.—In dealing with this exhibit I would ask the witness if he would indicate any differences between the process carried on at the defendant’s plant and the process disclosed in the Keller specifications.)

THE WITNESS: I do not find any differences.

30 MR. GOWLING: 408. Q.—What type of circuit is used at the defendant’s plant. A.—An alkaline circuit.

HIS LORDSHIP: 409. Q.—You mean, you do not find any differences in the processes? A.—In the processes, my Lord.

MR. GOWLING: 410. Q.—Is there any difference between non-acid and alkaline? A.—Yes. Non-acid is a bit broader than alkaline; it also includes neutral.

HIS LORDSHIP: Is there any dispute between the parties as to whether the defendant was using these xanthates in its process?

MR. BIGGAR: Oh, none, my Lord. This is what we used,  
40 exactly.

MR. GOWLING: There is no dispute as to what was used, my Lord, but in the Statement of Defence the defendant has denied infringement, so I presume the argumnet will be that while there is no dispute as to what was used, the defendant’s use is not an infringement of the claims in suit.

For Plaintiff—Arthur Howard Higgins

For Plaintiff—Arthur Howard Higgins—Cross-Examination

HIS LORDSHIP: But there is no dispute that the defendant used these xanthates?

MR. GOWLING: No dispute at all about that, my Lord. My friends facilitated in the production of this chart, Exhibit M-2.

HIS LORDSHIP: I notice that you spoke of both xanthates and the steam distilled pine oil. Is there any claim of the plaintiff relating to the use of steam distilled pine oil?

MR. GOWLING: No, my Lord.

HIS LORDSHIP: The claim is exclusively related to the use of  
10 the xanthates in the process.

MR. GOWLING: Yes, my Lord. Your Lordship may remember it was mentioned yesterday that the xanthate is used along with other agents; so where you find a xanthate referred to in the patent and also in the defendant's process, you will also find other agents used. Pine oil is a frothing agent.

HIS LORDSHIP: Pine oil is one of many frothing agents.

MR. GOWLING: That is right, my Lord.

HIS LORDSHIP: The witness referred to a number of them in  
the course of his evidence.

20 MR. GOWLING: Yes. I understand that pine oil is a very common one. And, as was indicated yesterday, a frothing agent must be used. The xanthate itself is not a frothing agent, according to the patent.

(The Court recessed for ten minutes).

#### CROSS-EXAMINED BY MR. BIGGAR

411. Q.—Mr. Higgins, there are still some expressions in the patent about which I would like to ask you, in order that we may not have any difference of opinion. I do not think they are troublesome. Agitation, I understand, has two purposes: one is to mix  
30 the reagents thoroughly into the pulp, and the other is to introduce into the pulp enough air to make the froth? A.—Yes, that is so; but at the same time there is an agitation which the introduction of the air can make without any mechanical agitation at the same time.

412. Q.—You are anticipating. I understand that that agitation can take two forms. It can either be mechanical, as it is in this test machine, or it can take the form of blowing or pumping or drawing air through a — generally canvas, I think — bottom to a tank? A.—Yes.

40 413. Q.—A pachuca is a tank, is it not? A.—Yes, but that has not got anything porous through it.

414. Q.—But an air basket has something porous. That expression is used, not in the patent but in some of the correspondence, I

For Plaintiff—Arthur Howard Higgins—Cross-Examination

think. Do you know that expression? A.—Yes. One Hyde, I think, made an air basket which he could take in and out of the cell.

415. Q.—It has not to do with those tanks with canvas bottoms to admit air? A.—No. It is a special kind of a tank, in which you can take the basket out bodily. Usually the canvas is fixed in some way.

416. Q.—Oh, I see. But it has the same purpose, to permit the introduction of air bubbles into the mixture of the pulp? A.—Yes.

10 417. Q.—Then the patent uses the expression “pre-agitation.” That is in paragraph 6. That, I understand, is sometimes done in either one of these ways? A.—It is usually done, I think invariably done, without the admission of air.

418. Q.—The pre-agitation is generally done at all events, if not universally, without the admission of air? A.—Yes.

419. Q.—But is there any reason why it should not include the admission of air? A.—There is in some cases.

420. Q.—But not invariably? A.—If you admit air you tend to remove in the froth something which you may want to mix up.

20 421. Q.—Pre-agitation does not mean before the introduction of the agents? A.—No. Pre-agitation has some agent there. There is some advantage in getting the agent well mixed up with the ore pulp.

422. Q.—Can you give me an example of that? With what kind of agent or what agent would you want to use pre-agitation? A.—There is one in the patent, at paragraph 16:

30 “The lime was mixed with water and fed as a watery pasto with the slimes to the first agitator of a series of nine standard minerals separation agitators or mixing compartments. . . .”

That is without any air going in.

“through which the pulp passed in series at the rate of 97 tons in 24 hours.”

That was pre-agitation. The mineral frothing agent was not added until it reached the seventh agitator. That pre-agitation would occupy a period of about twenty minutes.

40 423. Q.—The expression “pre-agitation” to which I am directing your attention, or which I have in mind, is the pre-agitation which is described as unnecessary, in paragraph 6 of the patent, in the last sentence but one. I suppose you would agree that pre-agitation is usually unnecessary, but therefore sometimes necessary? A.—Yes, it has that meaning. It is sometimes necessary and sometimes unnecessary.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

435. Q.—Now, at the beginning of that paragraph it stated—  
HIS LORDSHIP: The beginning of paragraph 6.

MR. BIGGAR: Yes, my Lord.

436. Q.—At the beginning of that paragraph it is stated that the substances referred to — which are all up to that point sulphur derivatives of carbonic acid — are not mineral-frothing agents. What sulphur derivatives of carbonic acid are mineral-frothing agents? A.—I don't know of any at the moment.

437. Q.—Why does the patent say “in general” then? I  
10 thought that meant there must be some obvious exceptions to that that everybody would know because it seems to me if you did not know and do not know now that patent might have just as well said that there were none of them that were? A.—I should say it was excessive caution on the part of the patentee. He had not been able to try every alkyl sulphur derivative of carbonic acid. He says “in general”. That means to say that he has decided there may be some that are.

438. Q.—Well, he has just referred in the latter part of para-  
graph 4 to a complex mixture produced when  $33\frac{1}{3}$  per cent of pine  
20 oil was incorporated with an alcoholic solution of potassium hydrate and that was agitated with pulp. Would that not have frothing properties? A.—Undoubtedly his process there would not succeed in converting pine oil into any kind of xanthate or similar substance. He might get a very small proportion of it made into xanthate but the bulk of it would remain there as pine oil and it would be a mineral-frothing agent.

439. Q.—We will have to determine, but assuming that in the  
expression at the beginning of paragraph 6 the substances referred  
to are to be interpreted as dealing only with the sulphur derivatives  
30 of carbonic acid generally of which certain examples have useful properties. You know of none that have frothing properties? A.—I recollect none at the moment.

HIS LORDSHIP: 440. Q.—That is, you are not speaking of the sulphur derivatives of carbonic acid? A.—As I understand it the question was were there any of these agents that are mineral-frothing agents as well as sulphur derivatives. I say I do not recollect any at the moment.

MR. BIGGAR: Those that were sulphur derivatives, and the witness says as far as he knows none of them had frothing properties.

441. Q.—Turning to paragraph 7 which is not a sulphur derivative of carbonic acid at all, is it — yes, it is.

HIS LORDSHIP: Which?

MR. BIGGAR: Paragraph 7, my Lord.

442. Q.—You have told us, I think, that the product that resulted from following the process described in that paragraph



For Plaintiff—Arthur Howard Higgins—Cross-Examination

yielded you tri thiocarbonate and thio carbonates? A.—Tri-thio carbonates mixed up with ordinary potassium carbonate.

443. Q.—I was leaving out potassium for the moment because potassium is the only metal that is there. If you want to be accurate then it is a mixture of potassium tri-thio carbonate with potassium carbonate? A.—Yes.

444. Q.—Have you any idea of the proportions of these two? A.—Yes. There would be roughly two molecules of the potassium tri-thio carbonate and one molecule of the potassium carbonate.

10 445. Q.—Whereabouts does the potassium carbonate come in your chart, Exhibit P-55?

HIS LORDSHIP: P-54.

MR. BIGGAR: Yes.

THE WITNESS: It really does not come into this chart at all because these are sulphur derivatives of carbonic acid. Underneath the heading "carbonic acid" which is only put in there to make it complete you could substitute two of these hydrogens with potassium and you would have potassium carbonate.

MR. BIGGAR: 446. Q.—When did you make the test of the  
20 material which is produced by following paragraph 7? A.—About a month ago.

447. Q.—Do you know of any test having been made previously with that? Where did you make it? A.—In Forest Hills where I was living.

448. Q.—That is New York, is it not? A.—Yes.

449. Q.—With what ore? A.—It was ore from the Timber Butte property, Orphan Girl.

450. Q.—Have you got the analysis of that ore and of the results of your test? A.—Yes, some of it, at any rate.

30 451. Q.—Pardon? A.—Yes, I have some results.

452. Q.—I suppose you kept careful notes of the tests you made because you were making it for the purpose of this litigation? A.—Yes.

453. Q.—Why did you test that particular ore? A.—It was the only one I could get at the time at my disposal. We could not get any Hibernia ore because the mine is closed.

454. Q.—What did you do? What were the steps you took? What were the successive steps you took? A.—I had the ore ground up into a suitable size. Then I made it into a pulp and  
40 in one case I added some pine oil, mineral-frothing agent and removed the froth.

455. Q.—Yes? A.—I did another one using the same quantities but I added to that some potassium tri-thio carbonate.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

HIS LORDSHIP: 456. Q.—What? A.—Some of the orange thio-carbonate, some of the orange solid or salt talked about in paragraph 7.

MR. BIGGAR: 457. Q.—How had you produced that? A.—That had been produced in the same way with caustic potash left in contact with carbon disulphide.

458. Q.—You describe it as potassium tri-thio carbonate. Was there any potassium carbonate in it? A.—Oh, there would be.

459. Q.—In other words you used potassium tri-thio carbonate  
10 and potassium carbonate? A.—Yes, just as the patentee did.

460. Q.—Have you got the results? A.—Yes, I have the results here.

461. Q.—Of the two tests? A.—Of the two tests.

462. Q.—Before we look at them, as to the material which you used as prepared under paragraph 7, did you prepare that yourself or did you have it prepared for you? A.—I had that prepared for me.

463. Q.—By whom? A.—By one of the chemists connected with the plaintiff corporation.

20 464. Q.—Who was the chemist? A.—A man called Green, as far as I remember.

465. Q.—Did you make any analysis of it yourself? A.—No, but I did certain tests with it to see whether I was satisfied with it. It acted just like tri-thio carbonate in the chemical reactions and it had the same characteristic colour, orange red. There was no reason why I should suspect the chemist of having made me something different and passing it off just to annoy me.

466. Q.—You misled me. I thought you said you were giving evidence this had been made in the way described in paragraph 7.  
30 I now gather you really do not know how it was made? A.—He was instructed to make it that way.

467. Q.—I know, but you do not know whether he carried out your instructions or not. I am only asking. A.—Well, I do not know but I am certain he did.

468. Q.—It is only the fact, is it not? However, we know what the position now was. Going to your results would you give us first the memorandum of your results that you first obtained? That was without any re-agent of any kind, I gather? A.—Oh, no, I had a mineral-frothing agent.

40 469. Q.—I mean without any re-agent except a mineral frothing agent? A.—Before giving you those results I should like to say I had to make the tests in that machine which is now in court, and it is a most unsatisfactory machine for selective flotation. It is not one I should ever choose for that purpose.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

470. Q.—You are apologizing for the results you are about to give us? A.—No, I am not. I want you to understand this is by no means the best result you can get from this ore with that agent.

471. Q.—Have you ever tried it with any other machine? A.—No, I have not. None were available.

472. Q.—Then you cannot say this is not the best result? A.—I can tell you from my experience which is not very small.

473. Q.—But I gather this is the only experience you have had with this particular re-agent? A.—No, but I have had very  
10 considerable experience in selective flotation.

474. A.—And this is the only experience which you have had with these machines, I gather, these two, the one in court and the one at Forest Hills for this purpose? A.—We did one or two in Forest Hills to see how the machines worked.

475. Q.—Now, will you let us have your first test with no re-agent except a mineral-frothing agent.

MR. GOWLING: We will furnish you with copies of the material as it is used.

MR. BIGGAR: 475. Q.—This is a note of the results in the  
20 same way as those which are contained in the patent, Mr. Higgins? A.—Yes.

476. Q.—That is to say, you took the various— A.—You are referring to the columns?

477. Q.—The various mixtures and then ascertained the quantities of the various minerals in the same way as you have described with regard to the tables in the patent? A.—Yes, they are the same.

HIS LORDSHIP: You are putting that in?

MR. BIGGAR: Yes, I will put it in.

30 478. Q.—I see that not only does it appear there was pine oil used as a re-agent but also beechwood creosote? Both those were used? A.—Yes.

479. Q.—How was that selection made? I mean why did you select pine oil and beechwood creosote? A.—Pine oil is a very good mineral-frothing agent. Beechwood creosote proves itself in this case.

480. Q.—It proved itself what? A.—It improves the action of the mineral-frothing agent. It makes the mineral attach itself more readily or more permanently to the air bubble.

40 481. Q.—Was this the only test you made with re-agents other than mineral-frothing agents with this ore on this machine? A.—No, I think I made other tests.

482. Q.—Have you got the records of the others? A.—Yes.

483. Q.—Is this the best one you have handed me first, or is it the worst? A.—I think that is the worst.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

484. Q.—I suppose then in fairness we ought to see those that are better.

HIS LORDSHIP: You are putting this one in now?

MR. BIGGAR: Yes, my Lord. Perhaps we had better put them all in together because I think we ought to have the others. This will be exhibit what?

HIS LORDSHIP: Exhibit D-50.

MR. BIGGAR: Why not carry on the numerical method just the same? You can separate them afterwards. It seems to me it  
10 would be much more convenient. Most of these exhibits can be referred to by their number alone without any letter.

HIS LORDSHIP: We started marking the exhibits that are not referable to an examination that way.

MR. BIGGAR: Quite so, but this just helps us to identify where they came from at once.

HIS LORDSHIP: You mean mark this as D-56?

MR. BIGGAR: Yes, D-56.

HIS LORDSHIP: Following in the order.

MR. BIGGAR: Following in the numerical order.

20 HIS LORDSHIP: The "D" will indicate you put it in, and it retains the sequence.

MR. BIGGAR: Exactly, my Lord.

HIS LORDSHIP: This will go in as Exhibit D-56.

EXHIBIT No. D-56: Filed by } Results of test conducted  
Mr. Biggar } by the witness.

MR. BIGGAR: 485. Q.—Have you got the others with only mineral-frothing agents? Before putting that document in, my Lord, I should have asked the witness to verify what I assumed, that the figures of the assays are his own.

30 HIS LORDSHIP: Yes.

THE WITNESS: I did not make the assays, you know. The assays were made by an assay firm in New York.

MR. BIGGAR: 486. Q.—What is the assay firm? Are they here? A.—It was Pitkin in New York.

MR. BIGGAR: I am rather amazed that the witness comes here and says he made certain tests under a patent which turned out in a satisfactory way. It appears that the material which he used for the purpose of those tests was prepared by somebody who is not here, and the character of the tests, the effect of them and  
40 the result of them was ascertained by somebody who is also not here. All the witness really knows is that with a substance which he instructed to be prepared he made certain tests, a man having told him presumably that his instructions had been followed. Then

For Plaintiff—Arthur Howard Higgins—Cross-Examination

he sent out somebody else and that somebody else told him that the results of the tests were so and so. I am afraid I will just let it drop where it is.

MR. GOWLING: Except I do not think it is quite right for my friend to put it on the record itself that there is anything unusual about it. We did not introduce the tests because we did not think them necessary.

MR. BIGGAR: My difficulty is not that at all. The witness came here and swore that he had done certain things in accordance  
10 with this patent and got good results. He did not know what he did and he did not know what the results were. However, we will leave it at that.

THE WITNESS: I can say this. I was perfectly satisfied these assays confirmed my judgment as to the quality of the concentrates produced.

HIS LORDSHIP: 487. Q.—Were you able to judge as to the quality of the concentrates? A.—Yes.

488. Q.—How were you able to form that judgment? A.—By  
20 the colour of the concentrate and its general appearance and my experience in the art. I have examined so many of these things and made conclusions on valuable concentrates that have been assayed just to confirm my opinion.

489. Q.—You looked at the report of the assayer? A.—Yes.

490. Q.—How did that report compare with your own judgment of the quality and nature of the concentrate? A.—Oh, it practically confirmed in all cases my judgment, but now and again I should dispute the assay because I thought the tailings, for instance, were returned with too high a percentage of lead, for instance. I would say to him, “You do this over again; I am sure  
30 there was not so much lead in it. I could not see that amount of lead.”

491. Q.—Without an assay could you form any opinion as to the result of the test? A.—Yes.

492. Q.—Without an assay made by someone else? A.—Yes, it is only necessary to get the lead froth in one basin and the zinc froth in another basin, pour the water off and examine them. It is very easy to tell whether one is principally lead and the other is principally zinc or not.

493. With regard to the material that you had prepared,  
40 you said you had that prepared by a chemist? A.—Yes, my Lord.

494. Q.—What sort of chemist? A.—A very well qualified chemist, to the best of my knowledge. It was not material which one could purchase from a chemical house. It had to be made. It does not keep indefinitely. Somebody had to prepare this stuff.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

MR. BIGGAR: 495. Q.—Mr. Higgins, still sticking to paragraph 7, it proposes there caustic potash, and I understand if you use the technical expression for that it is potassium hydroxide.

HIS LORDSHIP: 496. Q.—Caustic potash is — A.—Potassium hydrate or potassium hydroxide; they are both correct descriptions, or names for it.

MR. BIGGAR: 497. Q.—There are other alkali metals that have hydroxides. There is sodium hydroxide? A.—Yes.

498. Q.—Can you say whether that could be substituted for  
10 the caustic potash in preparing the product according to this paragraph with the same consequences? A.—To the best of my recollection Berzelius first formed tri-thio carbonate with caustic soda.

499. Q.—So that you get tri-thio carbonates with sodium and with potassium? A.—Yes.

500. Q.—Would that be true of magnesium hydroxide? A.—I don't know. I have never tried it.

501. Q.—What about ammonium hydroxide? A.—It is my opinion ammonium hydroxide would give you something entirely different.

20 502. Q.—Ammonium has the same reaction generally as those three principal alkali metals, has it not? A.—In inorganic salts it has.

503. Q.—But in organic, no? A.—It very frequently breaks up into  $\text{NH}$ ,  $\text{NH}_2$  and even  $\text{N}$ .

504. Q.—I just want to understand what your statement is, that whereas ammonium reacts in the same way as alkali metals in inorganic reactions it does not do so in organic? A.—It does not do so invariably in organic substances.

505. Q.—Does it generally in organic? A.—No, not generally  
30 although I can give you one instance of where it will not work. You cannot make ammonium xanthate by using ammonium hydrate instead of caustic soda or sodium hydrate.

506. Q.—Is there any other instance in which you know a similar reaction does not occur with ammonium as with sodium, potassium and magnesium? A.—I think if you can give me a little time I can find some for you.

507. Q.—You think you could? A.—Yes.

508. Q.—There are other alkali metals besides those that I  
40 have named, are there not? A.—Yes, but ammonium is not an alkali metal.

509. Q.—I know that. That is the reason I asked you first about ammonium and these common alkali metals. There are a number of other alkali metals besides sodium, potassium and magnesium, are there not? A.—There are five or six of them altogether.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

510. Q.—Are there not more than five or six? What about caesium? A.—That is one.

511. Q.—And rubidium? A.—That is two.

512. Q.—And lithium? A.—That is three of them.

513. Q.—We have got six, anyway. Are there any more? A.—Sodium and potassium.

514. Q.—Those are three we have had: sodium, potassium and magnesium. That makes six with the three we have just mentioned. Are there any more? A.—Magnesium is not an alkali metal.

10 515. Q.—You would exclude magnesium, would you? A.—Oh, certainly.

516. Q.—I am going to direct your attention to paragraph 8. There are two points I want to ask about in paragraph 8. The first is they refer to the use there of ethyl alcohol (denatured No. 5). Do you know anything about the nature of that particular denatured alcohol? A.—Yes, I have the formula, if you wish it.

517. Q.—I am glad you have. A.—100 parts by volume of ethyl alcohol, not less than 160 degrees in proof; two parts by volume of approved wood alcohol; 0.25 parts by volume of approved  
20 pyridine and 0.5 parts by volume of approved benzine (kerosene).

518. Q.—Now, ethyl alcohol not less than 160 degrees proof; if it were all alcohol what would be the proof degree? A.—I don't know.

519. Q.—You don't know? A.—No.

520. Q.—We can easily find out, but my memory is it is about 200, is it not? A.—I am not used to dealing with those proofs, you know.

521. Q.—Even in the form of potable liquors? We are very familiar with that here because we have been reduced in proof,  
30 but the other three ingredients you speak of are for the purpose of making this ethyl alcohol not potable, are they not? A.—Yes.

522. Q.—But you start out with alcohol of a certain degree of proof and the balance of its contents — I mean the degrees of proof that are lacking — are ordinary water, are they not? A.—I should say so.

523. Q.—We can easily find out what is the amount in the way of the proportion of water. Now, in the same paragraph we are told first of all to use caustic potash and ethyl alcohol (denatured No. 5), and then we are told to use a theoretical amount of carbon  
40 disulphide. I gathered from your evidence yesterday that that was calculable and I wondered why the amount was not given? A.—The inventor must have calculated it but as you say he does not give the calculation.

524. Q.—Is there any possible reason you can suggest why this patent when it gives the amount of ethyl alcohol exactly to

For Plaintiff—Arthur Howard Higgins—Cross-Examination

grams and of the caustic potash to fractions of a gram as well as percentage, does not give the theoretical amount of carbon disulphide? A.—I cannot imagine there was any reason for it except he thought anybody would know how to calculate the quantity from the quantity of caustic potash he was putting in.

525. Q.—You mean he thought that fellow could do the work. It did not take you very long, did it? A.—No, I do not think it would take anybody very long.

HIS LORDSHIP: Pardon?

10 THE WITNESS: It would not take anybody very long to calculate the quantity necessary.

526. Q.—You say anybody could calculate the amount of carbon disulphide that was necessary? A.—Yes.

527. Q.—Anybody who was skilled in chemistry? A.—Yes.

MR. BIGGAR: 528. Q.—Any metallurgist in 1923? A.—Yes, I think so. We have only got to refer to Watts dictionary to see exactly the equation. He is making a xanthate. He knows where to look in the dictionary and he would be able to make the calculation in a few minutes.

20 528. Q.—You mean he would just look at Watts and find out how to make the xanthate and disregard this paragraph altogether? A.—No, it does not tell you how to make the xanthate in Watts as far as I can remember. It just gives you the equation for the formation. It does not tell you to cool it or things like that, as far as I recollect. The inventor does, but it gives you the quantities to use.

529. Q.—Do you suggest that potassium ethyl xanthate, which is what this paragraph produces, was a new thing in 1923? A.—No.

30 530. Q.—Then, you mean you do not find it in Watts but you would find how to make it in some other book of authority at the time? A.—Yes, Thorpe's dictionary of chemistry.

531. Q.—And in all these books this would enable you by going through the process of calculation to ascertain what the theoretical amount of carbon disulphide required was for 198.4 grams of 88.5 per cent caustic potash and 524 grams of ethyl alcohol denatured No. 5? A.—It depends on the potash here. He has got an excess of alcohol. He tells you it is an excess. He tells you it is much more so you cannot work from that but from the amount of caustic potash, and in that case you could, as you suggest, easily calculate the quantity of carbon disulphide required.

40 532. Q.—Well, it would rather astonish me that with these exact quantities for the others we do not have the exact quantity for this, but that is the only suggestion you can make on that point? A.—It is. It is a bit curious but I cannot tell you exactly why.



For Plaintiff—Arthur Howard Higgins—Cross-Examination

HIS LORDSHIP: 533. Q.—You say it is a bit curious that he did not specify the exact amount required? A.—Yes, my Lord.

MR. BIGGAR: 534. Q.—Have I been right in understanding—

HIS LORDSHIP: Are you starting with something else?

MR. BIGGAR: Yes, I have left that paragraph, my Lord.

HIS LORDSHIP: It might be a good time to adjourn.

—At 1 o'clock p.m. Court adjourned to 2.30 o'clock p.m.

### AFTERNOON SESSION

2:30 P.M.

10 HIS LORDSHIP: All right, Mr. Biggar.

A. H. HIGGINS, Cross-Examination resumed. By Mr. Biggar.

MR. BIGGAR: 550. Q.—Mr. Higgins, you were speaking about the difference between acid, alkaline and neutral circuits. What I gather, and I want to be sure that I understood, is that the acid circuits were really those to which sulphuric acid or something of that kind had been added? A.—Yes.

551. Q.—And the alkaline circuits were circuits to which some alkali had been added, lime or something else? A.—Yes.

20 552. Q.—And if you just used the ore as it came from the ground, without either acid or alkali addition, you had what you call a neutral circuit? A.—Yes. In addition, I pointed out that if it were only slightly acid as a result of some oxidation of the ore, it could be made neutral by adding the appropriate quantity of alkali.

553. Q.—That is the reason I put it that way, that if you used the ore as it came out of the ground before there had been any change in it by reason of its having been taken out, it would be neutral? A.—Yes; generally speaking.

30 HIS LORDSHIP: 554. Q.—Would it necessarily be neutral if there had been some oxydizing while it was in the ground? A.—No, it would not.

MR. BIGGAR: No.

THE WITNESS: It may even come out in a slightly acid condition.

HIS LORDSHIP: 555. Q.—Yes. So it is not automatically acid merely because the ore has been freshly taken out of the ground? A.—No. It is not automatically neutral either.

556. Q.—That is what I mean. It is not automatically neutral; it might be acid? A.—Yes, your Lordship.

40 557. Q.—Could it be alkaline? A.—There are alkaline deposits in the United States, but I do not know of any ore which is really alkaline when it is dug out of the earth.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

MR. BIGGAR: 558. Q.—But the acidity of the ore that has been oxydized, and when there has been no addition to the circuit, is very slight by comparison with the acidity you get when you have added sulphuric acid, for example? A.—Oh yes; quite slight.

559. Q.—Yes. As a matter of fact, if you use the ore, even if it was slightly acid as it came from the ground, would you still call it a neutral circuit or would you call it a very slightly acid circuit? A.—Well, I might use either. If I wanted to be particularly accurate, I should say a slightly acid circuit.

10 560. Q.—Yes. As a matter of fact, the acidity and alkalinity of a solution are now referred to by reference to a scale, are they not? A.—Yes.

561. Q.—And the scale runs, does it not, from 1 to 14 in P.H.'s? A.—Yes.

HIS LORDSHIP: 561. Q.—What are P.H.'s? A.—They are hydrogen-ion concentration. It is a convenient method for the chemist to determine the exact quantity of alkali or acid in any substance or liquid. It is usually done by putting in some dye of some kind and getting a colour. That makes it a very easy and  
20 simple thing to do in the mill. But there was no measurements of that kind at the time the patent was taken out. It had been proposed for use, but the dyes were not available to the mining industry until several years later. It was done before the production of P.H. indicators by a simple test with litmus paper. If you put red litmus paper into a solution and it turned blue, you said it was alkaline. If you put blue litmus into a solution and it turned red, you said it was acid. That was the only distinction we used to make. If you put them both in, and neither of them changed, you said it was neutral.

30 MR. BIGGAR: 562. Q.—Before I come back to one or two other points, you had something yourself to do with the preparation of this specification, did you not? A.—Yes.

563. Q.—At the time that Keller did his work and Lewis did his work, you were Chief Metallurgist of the Company? A.—Yes.

564. Q.—What was your relation to Mr. Nutter who appears from the correspondence to have had a good deal of discussion on the subject? A.—Mr. Nutter was Chief Engineer of the Company. I was Chief Metallurgist.

40 565. Q.—You were on a level, as it were? A.—Yes, I think so. Neither of us interfered with each other's duties, but if we wanted any assistance, one from the other, we applied for it and got it.

566. Q.—There were two separate departments or branches, as it were? A.—Yes.

567. Q.—And in relation to either of you, where did Keller come in? A.—Keller was an assayer attached to Mr. Nutter's laboratory in San Francisco.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

568. Q.—And where did Lewis come in? A.—Lewis?

569. Q.—Yes. A.—Lewis was a metallurgist attached to Mr. Nutter. He was in Mr. Nutter's office.

570. Q.—Was he under your jurisdiction or under Mr. Nutter's? A.—Under Mr. Nutter's.

571. Q.—What was the relation between Keller and Lewis? Did they each report directly to Mr. Nutter and was one of them subordinate to the other? A.—As far as I know, they used to report to the man in charge of the laboratory, which was Mr. Littleford, I think, at that time; and then either one or the other  
10 of them would send in a report, and he would initial it or sign it as being approved. I do not think that either of them was above the other.

572. Q.—No. That is what I gather, that they were both reporting, as it were, to Mr. Nutter? A.—No; to the man in charge of the laboratory.

573. Q.—To the man in charge of the laboratory, who in turn reported to Mr. Nutter? A.—Yes.

574. Q.—Now I follow you. When you were consulted about  
20 it, was that consultation oral or in writing? A.—The disclosure was made to me in writing.

575. Q.—You mean that you saw the patent specification or that there was some other communication? A.—No. I saw letters that Keller had written.

576. Q.—To whom? A.—Well, either to Mr. Nutter or to New York; I forget which they were.

577. Q.—At all events, it was in the form of letters addressed either to the Company or to Mr. Nutter? A.—Yes.

578. Q.—That you got familiar with the thing? A.—Yes.

579. Q.—And as I gathered, it was in March of 1923, that  
30 there was something brewing, as it were, in San Francisco? A.—I believe it was that date, yes.

580. Q.—Then were any tests carried out in New York? A.—Yes; I think a little later.

581. Q.—When was it? A.—Probably about July or August 1923.

582. Q.—And by whom were those tests carried out? A.—I made some of them myself, and I believe two assistants of mine made some also.

583. Q.—Anyone else? A.—I do not think so.

584. Q.—Who were the two assistants? A.—A man called R. B. Martin and Mr. W. Trotter.

585. Q.—Did Keller and Lewis come at any time to New  
40 York? A.—Yes.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

586. Q.—Keller or Lewis, I ought to say.

HIS LORDSHIP: Or who?

MR. BIGGAR: A man named Lewis, about whom your Lordship will hear something more.

HIS LORDSHIP: Would you mind spelling that name for me?

MR. BIGGAR: I asked if Keller or Lewis came to New York.

THE WITNESS: Yes, they did.

HIS LORDSHIP: 587. Q.—What is the name? A.—Lewis; L-e-w-i-s.

10 MR. BIGGAR: 588. Q.—Did they come to New York in the course of the summer of 1923? A.—That I do not recollect, whether it was 1923 or 1924.

589. Q.—Did Mr. Trotter do any work for you in connection with tests of these proposals of Keller's? A.—Mr. Trotter, yes.

590. Q.—I find that at some time, according to the evidence that you gave in an earlier proceeding, Keller and Lewis came to make some tests, to New York. Perhaps I can recall that to you. You have not any memory of that now, apart from what I may recall to you? A.—I remember they came, and I remember it was  
20 some time either in 1923 or 1924.

591. Q.—Well, this is the way you put it in the print of some evidence that you are purported to have given in an interference between a man named Martin and Keller. I think in 1929. You were asked: "Did you or anyone else in the laboratory do anything by way of testing xanthate and determining its real value, and what was done? Your answer was, "Yes. Both Mr. Lewis and Mr. Keller came over from San Francisco and made some tests with xanthate. I had Mr. Trotter working on it for a long time, and I made tests myself." Does that recall anything to you? A.—With  
30 regard to the date?

592. Q.—With regard to the time at which Keller and Lewis came from San Francisco and made tests with xanthate? A.—Not other than it was either late in 1923 or early in 1924.

593. Q.—Was it before or after the patent application was filed? A.—That I do not remember.

594. Q.—Well, on the next page you were asked this question: "Do you happen to know why the application was not filed until October, although the first communication to New York was in March, 1923"? Your answer was "The application would not be  
40 made until we were satisfied that there was some commercial use in the invention. That necessarily takes a few months. After that it was also necessary to determine exactly what the invention is. It was necessary to procure pure xanthate free from any impurities. That I had Mr. Trotter do, so as to make quite sure that the invention was the use of xanthate and not some impurity carried along with

For Plaintiff—Arthur Howard Higgins—Cross-Examination

it; and I daresay a little time was taken up in considering what claims to make.” Does that recall anything to you? It is asking quite a lot of you, of course, to remember twenty odd years ago. This was not quite so long. This was 1929, which was fifteen years ago. A.—Is the question, “Did I so testify”?

595. Q.—Yes. A.—I did, yes.

596. Q.—And is that according to your present memory? A.—Yes, it is.

600. Q.—And does it help you to identify the time when  
10 Mr. Lewis and Mr. Keller came over from San Francisco and made some tests with xanthate? A.—No, it does not help me to identify the exact date.

601. Q.—No, but does it help you to determine whether those tests that Mr. Lewis and Mr. Keller came all the way from San Francisco to make were the tests that it was necessary to make in order to determine exactly what the invention was? A.—I think that as far as I recollect the tests that Lewis and Keller did there were with the object of expanding the breadth of the invention.

602. Q.—Expanding the what of the invention? A.—The  
20 breadth.

603. Q.—That would be, then, before the application was made? A.—Probably.

604. Q.—You spoke of some work at Anaconda. Would this occasion when tests were being made in New York be before of after that work at Anaconda? A.—To the best of my recollection, it was after the work at Anaconda.

605. Q.—You knew when that was, the work at Anaconda? I mean, you were kept in touch with the progress of what was being done at Anaconda? A.—Yes.

30 606. Q.—You were not there yourself? A.—No, I was not.

607. Q.—At that time what was the common way in which metallurgists approached these problems? Were they organic chemists or chiefly inorganic chemists? I think I mentioned the matter to you this morning. A.—They were chiefly inorganic chemists.

608. Q.—As a matter of fact it appears that Keller, for example, did not know much organic chemistry? A.—Not as much as I should have liked him to have known or should have liked to have known myself.

609. Q.—As a matter of fact your work had chiefly been  
40 inorganic chemistry, I suppose, up to that time? A.—Inorganic, yes.

610. Q.—And to inorganic chemists, when they were directed to evaporate something, that would mean normally boiling it, would it not? A.—Not necessarily, but usually.

611. Q.—I left one or two things that I ought to go back to. With regard to selective flotation, when had that begun? A.—To the best of my recollection, about 1910.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

612. Q.—As early as that? A.—Yes.

613. Q.—In the form of successive flotations, with a view to recovering in each a different metal? A.—Yes.

614. Q.—And had it been widely practised up till the twenties? A.—I don't think I should say it was widely practised. It was probably in use in half a dozen mills throughout the world.

615. Q.—In how many in the United States? A.—That I don't recollect.

616. Q.—Would it be more than one or two? A.—It may  
10 have been two or three.

617. Q.—As a matter of fact it became common in the middle twenties, did it not? A.—Well, I think it would, yes.

618. Q.—And was there much extension of it from, we will say, 1923 or 1925 on? I understand that it is very widely practised now? A.—Yes.

619. Q.—But that development has been since, we will say, 1925, chiefly, hasn't it? A.—Yes, I think so.

620. Q.—There is one other thing with regard to the patent that I forgot to ask you. It has to do with paragraph 8 again.  
20 I observe that the centrifuged material there described is said to contain 20 per cent moisture. I understand that is not the moisture of crystallization? A.—No, it is not.

621. Q.—That would be the mother liquor which had been centrifuged and had not been extracted from the crystals? A.—That is what I understand it to mean.

622. Q.—Then that mother liquor would contain a smaller quantity or proportion of xanthate — of potassium ethyl xanthate, in this case — but that potassium ethyl xanthate would, after the centrifuging, be in solution in the denatured alcohol, would it not?  
30 A.—Yes, it would.

623. Q.—Do you know what the residue from the mother liquor would be, physically? Would it be a pulp or would it be a thick liquid or would it be crystals, the residue after evaporation? A.—In my opinion it would be mostly crystals.

624. Q.—With, do you mean, a larger quantity of moisture either surrounding or included in them than the 20 per cent, or what? Would there be moisture surrounding them? Perhaps I had better ask that question first. A.—I think there might have been a little moisture, but if the evaporation was carried on to  
40 completion there would not be any moisture either.

625. Q.—You mean that they would actually be drier than the centrifuged crystals themselves? A.—It is quite possible they were.

626. Q.—They might be? You mean that is all you can say? The evaporation might be carried to a point that they were drier than the centrifuged crystals? A.—Yes.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

627. Q.—But what was left of that residue would contain some of these potassium trio-thio carbonates that would not be evaporated, I suppose? A.—It might contain a little potassium tri-thio carbonate, but if you heat that it will break up and disappear.

628. Q.—To what degree would you heat, boiling? A.—in evaporation?

629. Q.—Yes. A.—If you wanted to get it done quickly you would take it up till it boiled the alcohol, about 76.

10 630. Q.—I gathered that you said this morning that heat was disadvantageous? A.—In the formation of xanthate, yes.

631. Q.—You mean, in the reaction itself? A.—Yes.

632. Q.—But not subsequently? A.—As long as you do not heat too much. You can decompose xanthate by heating it, but I do not think there would be much decomposition at the boiling point of alcohol.

633. Q.—What about the water contained in the denatured alcohol? A.—That would go off with the alcohol.

20 634. Q.—What is the difference between the boiling point of alcohol — we are speaking of ethyl alcohol, of course — and water? A.—The difference between 76 and 212.

635. Q.—76, that is what I did not know. I knew 212. My friend Mr. Robinson says that you are giving those figures in two different thermometric scales, and that they should really be 76 and 100. Is that right? If you put them both in the Centigrade scale, the figures are 76 and 100, not 76 and 212? The 76 is Centigrade and the 212 is Fahrenheit? A.—Yes. It should have been 76 and 100.

30 HIS LORDSHIP: 636. Q.—Both Centigrade? A.—Yes, Centigrade.

MR. BIGGAR: 637. Q.—There is another expression that I do not understand. It is an expression that occurs in one of the claims, and it is alkaline xanthate. I have understood that xanthate as such was neutral. Am I right? A.—Yes.

638. Q.—So that an alkaline xanthate is really a contradiction in terms? A.—No, I do not think it is. I think it is rather incomplete. If he had wanted to say alkali, he should have said alkali metal, or alkali, and not use the word alkaline. I think it was a slip of the tongue, you might say.

40 639. Q.—Oh, I see, the expression is incomplete? A.—Well, it is not the best expression to use.

640. Q.—Is it an intelligible expression? I gathered that it is in itself, taking it as having been intended, a contradiction in terms, and that there is no such animal. A.—I don't think any metallurgist would misunderstand it.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

641. Q.—That is really not an answer to my question, is it?  
A.—Well, it is comprehensible, if it is understood by the art.

642. Q.—I am putting it to you that as it stands it is a contradiction in terms. There is not any such animal? A.—I do not think it is a contradiction in terms.

643. Q.—I thought you agreed with me that all xanthates were neutral? A.—Yes.

644. Q.—And that there was not any such animal as an alkaline xanthate as such? A.—Yes.

10 645. Q.—That is what I understood. Do you know what the expression which occurs in another claim — “a suitable pulp of an ore” — means? A.—Yes. It means that the ore is ground to a proper degree of fineness and mixed up with the proper quantity of water.

646. Q.—That is what I was not sure about, whether it was capable of that interpretation; but that is the interpretation that you would put on that expression? A.—Yes.

20 HIS LORDSHIP: 647. Q.—Would that be known to metallurgists generally, what is meant by a suitable pulp? A.—Oh, yes, my Lord.

MR. BIGGAR: 648. Q.—In connection with your part in the preparation of this specification, are you able now to identify the records of these tests? A.—I do not remember having seen the records of the tests except in reports.

649. Q.—You mean in letters and that kind of thing? A.—Yes. I do not think I have seen any other records of the tests.

30 650. Q.—You do not remember having had any specific laboratory records or anything of that kind submitted to you which contains these examples that are given in the patent? A.—I know there were laboratory note-books kept, but I have not examined them, and I do not think I have seen them.

651. Q.—So you cannot help me in identifying the tests? A.—Only by comparison of the figures.

652. Q.—But you have not got any special information about them? A.—No.

40 653. Q.—There was an expression that you used in your examination in chief this morning, about which I wanted to ask you. You told us that the purer the xanthate, the better the results obtainable with it. You remember making that observation? A.—Yes. That was in agreement with the statement in the patent that the centrifuged xanthate did better in an acid circuit than the evaporated.

654. Q.—You meant not that there was any contaminant—that is not quite the term I want—you meant not that there was something else than there should be contained in xanthate



For Plaintiff—Arthur Howard Higgins—Cross-Examination

crystals, but that the xanthate crystals should be mechanically separated from some other material which might be deleterious, I suppose? A.—Yes, but not necessarily limited to mechanical separation — any separation.

655. Q.—That is what I want to get. How would you get a contaminant — call it that for our present purposes — that formed part of the xanthate crystals? A.—There is not anything there that would form part of the crystals, particularly in the case of the potassium xanthate.

10 656. Q.—That is what I thought, that when you took potassium ethyl xanthate and you got crystals, so far as the crystals themselves were concerned they would as such be pure xanthate? A.—Yes, but you might have some other crystals or some other body, some little liquid, mixed up with them.

657. Q.—That is exactly as I put it, that it is a mechanical mixture, not a chemical compound? A.—Yes.

658. Q.—Now, what are those impurities that you would like to avoid? A.—Well, I have never identified them. I know they are there.

20 659. Q.—Do you know any of them? A.—I know them by the smell. They are horrible.

660. Q.—Well, perhaps you can describe the smell to us? A.—Except that it is an exceedingly nasty smell, I cannot describe it any further than that.

661. Q.—Do you know any of the chemical names of those contaminants that are deleterious? A.—Well, the tri-thio carbonate might be a contaminant, but as to whether it is a deleterious one or not—

30 662. Q.—I am not asking for anything which is not deleterious. You told my friend Mr. Gowling that the purer the xanthate, the better the results obtainable. Now I am asking what it is desirable to see is not mixed with the xanthate; I am asking you to name some of the things that it is desirable to see are not so mixed. A.—It is my experience that the purer the xanthate, the better it works and the longer it keeps. I have not determined the impurities in the xanthate when it was not pure. The simple purification would correct the matter, and I had not sufficient time or interest to determine the impurities.

40 663. Q.—Can you name any of the impurities that it is desirable to exclude from being mixed with xanthate in order to get the best results? A.—I have already told you that I have not determined them and I do not know their names, and I cannot give you the names.

664. Q.—Can you give me any names? A.—No.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

665. Q.—Now, that is very curious, Mr. Higgins. I go back to your answer of fifteen years ago:

10 “The application would not be made until we were satisfied that there was some commercial use in the invention. That necessarily takes a few months. After that it is also necessary to determine exactly what the invention is. It was necessary to prepare pure xanthate free from any impurities. That I had Mr. Trotter do, so as to make quite sure that the invention was the use of xanthate and not some impurity carried along with it.”

Now, do you mean to tell me that although you separated the xanthates and the impurities to find out what the invention was, you omitted to determine what those impurities were? A.—Yes. We took off the pure stuff and we found that did the work. The impurities had no longer any interest for us.

666. Q.—Even though they did the work too? A.—They would not.

667. Q.—You are quite sure that no impurity would do the work? A.—In my opinion it would not.

20 668. Q.—My friend Mr. Robinson reminds me that your chart, Exhibit P-54, deals with the theoretical properties of the ingredients of xanthate; but it is based upon the use of pure ethyl alcohol, is it not? A.—Yes.

669. Q.—What would be the effect of using a denatured alcohol which had included in it of the order of 10 per cent of water? A.—I should expect that you would get rather less xanthate, but in my opinion the 10 per cent would not be enough to stop the reaction altogether.

30 670. Q.—How much would be necessary to stop the reaction altogether? A.—That I have not determined.

671. Q.—Would the presence of that water in the denatured alcohol increase or affect in any way the amount or character of the impurities in the resulting product? A.—I do not know.

672. Q.—It might or might not? A.—I do not know.

673. Q.—Well, I am putting it to you that “I do not know” means that you are not able to say whether it might or might not? A.—Exactly.

40 674. Q.—I sent over to your solicitors last night some charts dealing with some purely scientific points that I thought I would like to ask you about. I wanted to give you an opportunity to look at them before I did ask you about them. One of them is a large chart, a blue-print, with a memorandum attached. It is the same sort of thing as your chart to which I referred a moment or two ago, except that it is a little more elaborate.

(The Court recessed for ten minutes.)

For Plaintiff—Arthur Howard Higgins—Cross-Examination

MR. BIGGAR: 680. Q.—Mr. Higgins, you have that chart of the sulphur derivatives of carbonic acid with the memoranda attached to it? A.—I have.

681. Q.—Have you any criticism of those things shown on the chart as being sulphur derivatives of carbonic acid? A.—Yes.

682. Q.—Which do you not think are sulphur derivatives of carbonic acid? A.—Line C.

MR. BIGGAR: Your Lordship ought to have a copy of this.

HIS LORDSHIP: I should like to have one.

10 MR. BIGGAR: Unfortunately they were not brought down but they are coming and will be here any moment.

HIS LORDSHIP: All right.

MR. BIGGAR: Have you got an extra one you could let his Lordship have?

MR. GOWLING: This has a few markings which are not of any particular significance. We can substitute a clear copy later.

HIS LORDSHIP: This chart is described as “Sulphur Derivatives of Carbonic Acid.”

20 MR. BIGGAR: Yes, my Lord. I suppose it will be Exhibit D-57.

HIS LORDSHIP: Is that going in as an exhibit?

MR. BIGGAR: It will have to go in in order to make the criticisms of it intelligible.

HIS LORDSHIP: Who proves it?

MR. BIGGAR: We will see how far the witness goes in proving it.

HIS LORDSHIP: It is not proved yet.

MR. BIGGAR: No.

30 683. Q.—You were going to say that in line C you thought some of the sulphur derivatives or some of the compounds shown as sulphur derivatives were not properly to be described as sulphur derivatives of carbonic acid? A.—The whole of the C line.

684. Q.—The whole of the C line; you think that none of them are sulphur derivatives of carbonic acid? A.—Not to me.

MR. BIGGAR: Your Lordship will see that the top line, the grandfather of them all, the ancestor, is called A, and then of a consequence on the next line—

HIS LORDSHIP: Just a moment. I see the one at the top is called A-1.

40 MR. BIGGAR: All the ones of the next generation are called B.

HIS LORDSHIP: Where S is substituted for O, where sulphur is substituted for oxygen, is it?

MR. BIGGAR: Sulphur is substituted for oxygen.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

HIS LORDSHIP: Then, in line C?

MR. BIGGAR: In line C there is a further substitution.

HIS LORDSHIP: Of  $\text{NH}_2$ ?

MR. BIGGAR: C1.

HIS LORDSHIP: C1 substituted for the oxygen; that is the one we are discussing now.

MR. ROBINSON: The numbers are underneath the boxes.

HIS LORDSHIP: 685. Q.—Which of the C's are not sulphur derivatives starting from — A—C-1 up to C-8.

10 686. Q.—In your opinion C-1 up to C-8 are not sulphur derivatives? A.—No, they are derivatives of some other substance, or else by a stretch of the imagination they are derivatives of sulphur with some other derivative, sulphur chloride derivative or —

687. Q.—Do I understand you to say they are not sulphur derivatives of carbonic acid? A.—No, they are something else in addition.

MR. BIGGAR: 688. Q.—I should like to make that clear. You say they are something else in addition to being sulphur derivatives of carbonic acid?

20 HIS LORDSHIP: 689. Q.—They are sulphur plus something else? A.—Sulphur nitrogen derivatives, sulphur chlorine derivatives.

690. Q.—They are sulphur plus something else derivatives of carbonic acid? A.—Yes, my Lord.

MR. BIGGAR: 691. Q.—They have the form of carbonic acid, have they not, the form of the carbonic acid formula, the constitution? A.—By a stretch of the imagination they have, but it has to be stretched.

692. Q.—And they all have sulphur in them? A.—Yes.

30 693. Q.—Now, does your criticism of the inclusion of any of these derivatives extend to any others than those of the C line? A.—Yes, to many of the derivatives in the D line, the one below.

694. Q.—Which of the derivatives of the D line, those that have any nitrogen or any chlorine in them? A.—Yes, those are the ones that are not sulphur derivatives but sulphur nitrogen or sulphur chlorine derivatives.

40 695. Q.—So that the same remark applies, that they have the constitution or form of carbonic acid in them and they also have sulphur, but you say that because they also have nitrogen or chlorine they are not to be described as sulphur derivatives of carbonic acid? A.—Exactly; take thio-urea which is C-4. That is not a sulphur derivative of carbonic acid. That is a sulphur derivative of urea, always known that way.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

HIS LORDSHIP: 696. Q.—Is it your view in order to be a sulphur derivative of carbonic acid there should be sulphur substituted for one of the oxygen elements? A.—Yes.

697. Q.—But nothing else? A.—Nothing else, no nitrogen or no chlorine.

698. Q.—No other substitution for any of the other elements that go to make up carbonic acid? A.—Except, of course, the alkyl groups.

699. Q.—Except an alkyl radical? A.—Yes, my Lord.

10 MR. BIGGAR: 700. Q.—I don't know whether I followed that. You say there is not such a thing really as a sulphur derivative of carbonic acid which contains anything but sulphur and an organic radical? A.—Substituted for oxygen or hydrogen.

HIS LORDSHIP: 701. Q.—There must be sulphur substituted for one of the elements in carbonic acid? That would be a sulphur derivative? A.—Yes.

702. Q.—But if an alkyl radical was added to carbonic acid would that also be a sulphur derivative? A.—Yes, if it were substituted for—

20 703. Q.—If it were substituted for an element in carbonic acid that would also be a sulphur derivative? A.—Yes, it would.

704. Q.—So that it is really a matter of definition of what you mean by a sulphur derivative of carbonic acid? A.—Usually they are called sulphur derivatives when they do not contain anything except sulphur. If you have nitrogen you call them a sulphur nitrogen derivative or you refer them to some other parent, like thio-urea or thio-carbamate. They are referred to urea, not carbonic acid.

705. Q.—That would be a sulphur derivative of urea? A.—Yes.

30 MR. BIGGAR: 706. Q.—I think I understand your point of view. Which of the D line would you exclude, those that contain either nitrogen or chlorine or some others? A.—Only those that include some nitrogen or some chlorine.

707. Q.—What about the E line?

HIS LORDSHIP: What does R stand for?

MR. BIGGAR: R stands for any organic radical, with certain exceptions. In cases where two R's appear in a given formula they may or may not represent the same radical.

40 708. Q.—What about the E line? Have you any criticism of the inclusion of all of those in the E line as being sulphur derivatives of carbonic acid in the sense of the definition of that expression that you have given? A.—Yes, I take exception to E-4.

709. Q.—Any others? A.—No.

HIS LORDSHIP: What does M stand for?

For Plaintiff—Arthur Howard Higgins—Cross-Examination

MR. BIGGAR: Metal; it is under the words, "Line E" in the middle of the chart.

710. Q.—Turning to the memorandum attached have you any criticism of the nomenclature of the compounds that are listed there? A.—It is most unusual to call B-1 Alpha-thiocarbonic acid.

HIS LORDSHIP: 711. Q.—Which one? A.—B-1 on the second line.

MR. BIGGAR: 712. Q.—Those are referred to for convenience. I think this follows Watts. There are other names for these?  
10 A.—Yes.

713. Q.—But, as a matter of fact, these names as attributed to these compounds would suffice, would they not, even though they are not the only names? A.—Yes.

714. Q.—Now, with regard to the note to line C would you agree that those might have been extended to four additional formula corresponding to C-2, C-5, C-6 and C-8 in which the chlorine was replaced by bromine and four more in which it was replaced by iodine? A.—I agree with that but it requires a stretching of the imagination.

20 715. Q.—You would not regard that addition as being proper any more than the addition to include chlorine? A.—Exactly; I should think that was improper.

716. Q.—Then, with regard to line D there are other compounds that might have been included but have been omitted for simplicity, and your criticism with regard to the present D's would apply to those additions, I imagine? A.—Yes.

720. Q.—In this D, I mean — I said B, I am afraid, but it is D— A.—I understood you to say D.

721. Q.—It is D. That is right. Then you would agree,  
30 would you not, that the symbol R, when representing any organic radical, might represent any one of many thousands of possible organic radicals? A.—Well, I will admit many hundreds, but I really do not know whether there are many thousands.

722. Q.—However, it is a large number? A.—Yes, it is a large number.

723. Q.—Have you any complaints about the last sentence of the note about line D?

HIS LORDSHIP: What is the last sentence?

MR. BIGGAR: Has your Lordship not got the note?

40 HIS LORDSHIP: No.

MR. BIGGAR: It is there. It is quite a long sentence. That is the reason I did not give it.

HIS LORDSHIP: Oh, yes; starting with the words, "Of the compounds represented by the formulae D-1 and D-5—" and  
30 on.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

MR. BIGGAR: Yes.

THE WITNESS: I am unable to say whether it would be a small fraction or just a fraction.

MR. BIGGAR: 724. Q.—I see. Coming now to the note with regard to line E, there are four notes. You would agree that each formula in line E represents about fifty times as many compounds as are represented by the formula in line D from which it is derived, would you not? A.—If they can all be made, yes. I am not sure whether they can or not.

10 725. Q.—No. I think that is covered by one other note. Then the second sentence of note (1): “When ammonium and similar ions are added the multiplier would be substantially increased.” A.—I should imagine it would be.

726. Q.—Yes. And then note (2), “Compounds within each of the formulae have been made and the number within each of the formulae E-1 to E-5” — which includes the E-4 which you do not think ought to be included — “which could be made is believed to be indefinitely large. You agree with that? A.—I agree it would be indefinite, but I do not know how large, or what  
20 “large” means.

727. Q.—And note (3), “Formula E-3 covers all possible xanthates and only the xanthates.” A.—Yes.

728. Q.—And note (4), “Formula E-6 covers the principal ingredient of the product obtained by following paragraph 7 of Keller’s Patent”? A.—Well, it is two-thirds of the product.

HIS LORDSHIP: 729. Q.—Two-thirds of what? A.—Two-thirds of the product.

MR. BIGGAR: The note says the principal ingredient, and two-thirds is a good figure or fraction. A.—Well, it is the useful  
30 ingredient.

730. Q.—Right. Thank you. Now, turning to the other chart, Mr. Higgins.

HIS LORDSHIP: Are you going to put this one in now?

MR. BIGGAR: Yes. I will mark that.

HIS LORDSHIP: It will be D-57, I think.

MR. BIGGAR: My Lord, the chart I am now referring to is intended merely to show the relation, as it is hoped, to one another of the classes of compounds referred to in the patent, and all I need trouble to ask Mr. Higgins is if he has any criticism to  
40 make of those relations as shown on this chart.

THE WITNESS: Well, P-2, certainly, to start with; it should be limited there by certain organic compounds.

HIS LORDSHIP: On the note I have it, it is so limited.

For Plaintiff—Arthur Howard Higgins—Cross-Examination

MR. GOWLING: I must have handed your Lordship my copy of the chart. The others were missing. There were some notes of my own on it.

MR. GOWLING: Perhaps we had better change it for his Lordship.

HIS LORDSHIP: You say that P-2 should have the word "certain" before it?

MR. BIGGAR: No, it was not intended to.

HIS LORDSHIP: No. I mean, he is just making that comment.

10 MR. BIGGAR: Yes, quite.

731. Q.—This is nothing but the relation, you know, Mr. Higgins. A.—"Compounds referred to in Patent No. 247576.

732. Q.—It refers to organic compound containing sulphur.

HIS LORDSHIP: It refers to what?

MR. BIGGAR: It refers to organic compounds, and it says that the patent relates to the use of certain of them. What I want to know is whether the widest class is properly described, or whether a wider class of compound is described by the words "organic compounds containing sulphur" than by "sulphur derivatives or carbonic acid."

20 THE WITNESS: Yes. I agree with that.

MR. BIGGAR: 733. Q.—Yes. Then in the next generation, do you agree that there are these three sets of compounds, of which two overlap the third; that is, the two to the right overlap that shown to the left? A.—Oh, I want to object to "sulphur derivatives of carbonic acid" in P-3, generally. I think that ought to have the same limitation, "certain".

734. Q.—Very good. I understand that. I was directing your attention to the next generation. A.—Yes.

30 HIS LORDSHIP: Are these in the claim — C.10, C.2 and so on?

MR. BIGGAR: These are referring to paragraphs of the specification of the claim.

HIS LORDSHIP: Yes.

MR. BIGGAR: 735. Q.—Is there any comment to be made on the third generation, Mr. Higgins? A.—I do not think there is any comment to make on that except, of course, the two off-shoots are really a limitation of C.10.

736. Q.—Yes, exactly.

40 HIS LORDSHIP: 737. Q.—The two off-shoots marked C.1 and C.2 are what? A.—Further limitations of C.10.

737. Q.—They are limitations of C.10? A.—C.1 is described as "sulphur derivative of carbonic acid adapted to form in solution anions and cations"; and C.2 is described as "salts of a sulphur derivative of carbonic acid adapted to form in solution anions and



For Plaintiff—Arthur Howard Higgins—Cross-Examination

cations.” The claim refers to the singular, but I do not suppose that makes any difference. That is Claim 2.

MR. BIGGAR: As a matter of fact, this is simply to get their relations with one another in generality; that is all.

738. Q.—And the fourth generation, Mr. Higgins? A.—Oh, yes, I agree with the rest of it.

739. Q.—You agree with the rest of it. That is all right. Going back for a moment now that we have got that, and looking at C.1, “sulphur derivative of carbonic acid adapted to form in  
10 solution anions and cations,” would you go back to the former chart, Exhibit D-57, and state whether you would agree that the only ones shown on that chart which would not form anions and cations in solution are — and you had better tick them — are C.4, C.6; then on line D, D.2, D.3, D.4, D.6, D.7, D.8, D.10 and D.11; then D.13 and D.14; then D.16 and D.17; and then D.19. Are there any others that do not form anions and cations in solution? A.—It is impossible to answer that question because several of these are not known. C.1, C.2 and C.3 are not known. C.5 is not known. At any rate, they are not known to me. Also  
20 C.8. I cannot find any of these in chemical catalogues.

740. Q.—I see. Apart from those that you have mentioned, are there any others that would not form anions and cations in solution theoretically, then? A.—I had not time last night to go through the whole lot. I have not had time to go through line D. or line E.

741. Q.—Well, if you have any comment on that afterwards, adding to this, perhaps you might hand in a memorandum indicating what others you think would not form anions and cations in addition to those that I have indicated? A.—Yes.

742. Q.—Now I am going to show you—

30 HIS LORDSHIP: Then the chart you have been referring to will be marked as an Exhibit.

MR. BIGGAR: Exhibit D.58.

EXHIBIT No. D-58: Filed by Mr. Biggar	}	Chart showing the relation to one another of the classes of compounds referred to in Patent No. 247576.
--	---	--

MR. BIGGAR: 743. Q.—I am going to show you the results that are said to have been obtained on some tests that were made between the parties, tests numbers 12 to 20.

40 HIS LORDSHIP: Tests. How are they described? “Results of flotation tests made at Noranda, Quebec.”

MR. BIGGAR: August 29 to Sept. 2, 1944.

HIS LORDSHIP: By R. L. Bennett.

MR. BIGGAR: Yes.

For Plaintiff—Arthur Howard Higgins—Cross-Examination  
 For Plaintiff—Arthur Howard Higgins—Re-Examination

744. Q.—You were not present at those tests because I think you had not arrived in Canada, Mr. Higgins? A.—That is so.

745. Q.—I wanted to know whether you had any comment to make on the results made by those tests, because the representatives of the Plaintiff, with whom you have been in touch, no doubt, were supplied with all the notes leading up to these tests, and were supplied with samples and that sort of thing. Have you any comment on the results shown in this table? A.—No, I have no comment on the results.

10 746. Q.—Right. That table will be Exhibit D-59.

HIS LORDSHIP: 747. Q.—Mr. Higgins, you say you have no comment? A.—On the results.

748. Q.—On the results? A.—On the results.

HIS LORDSHIP: That will be Exhibit D-59.

EXHIBIT No. D-59:	Filed by Mr. Biggar	{	Results of flotation tests made at Noranda, Quebec, August 29 — Sept. 2, 1944, by R. L. Bennett.
-------------------	------------------------	---	---

MR. BIGGAR: Thank you.

20 RE-EXAMINED BY MR. GOWLING:

MR. GOWLING: 749. Q.—Mr. Higgins, is there any difference between Hibernia ore and Orphan Girl ore? A.—Yes, there is a little difference.

HIS LORDSHIP: A difference between what?

MR. GOWLING: Hibernia ore and Orphan Girl ore.

HIS LORDSHIP: Yes?

MR. GOWLING: 750. Q.—What difference would there be? A.—I think the Orphan Girl carries a little more lead than the Hibernia ore.

30 751. Q.—What are the similarities between the two ores? A.—They both contain galena; they both contain blende.

HIS LORDSHIP: Galena, did you say? A.—Galena, which is the lead sulphide; and blende, which is the zinc sulphide; and they have a similar gangue stuff.

752. Q.—Did you find the term “alkaline xanthate” in claim 6 confusing to you in any way? A.—No, I did not.

HIS LORDSHIP: In claim 6, alkaline what?

MR. GOWLING: Alkaline xanthate.

40 753. Q.—What does that term mean to you? A.—That it is synonymous with alkali xanthate.

For Plaintiff—Arthur Howard Higgins—Re-Examination

HIS LORDSHIP: 754. Q.—It is synonymous with what?  
A.—Alkali xanthate.

755. Q.—It is synonymous with or equal to alkali xanthate.

MR. GOWLING: I refer you again to Exhibit D-57. Do all of the compounds shown on this chart, or are some of them theoretical combinations? A.—Many of them are not known to exist. I had not completed my study—

HIS LORDSHIP: Many of them are what?

MR. GOWLING: 756. Q.—What is that again? A.—Many of  
10 them are not known to exist, or are known not to exist.

HIS LORDSHIP: 757. Q.—Are not known to exist? A.—Yes.

758. Q.—Or are known not to exist. Which is it? A.—Well, they are not known to exist. I should prefer to use that description.

MR. BIGGAR: That is exactly the way it is put in the note, my Lord.

HIS LORDSHIP: Yes.

THE WITNESS: But I have not had time to go through the greater part of it.

MR. GOWLING: I understand, my Lord, that we will be per-  
20 mitted to analyze this chart very carefully.

HIS LORDSHIP: I would think that would be a reasonable request.

MR. GOWLING: Perhaps the first thing tomorrow we could state our further comments.

HIS LORDSHIP: I think that would be a reasonable request, perhaps, under the circumstances.

MR. GOWLING: The main part of my re-examination is dealing with this chart.

HIS LORDSHIP: That was the new chart introduced by Mr.  
30 Biggar?

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: That seems to be a reasonable request. Then perhaps we might as well adjourn now.

MR. BIGGAR: I think perhaps we had better finish everything but the chart.

HIS LORDSHIP: Unless, Mr. Gowling, you would deal with any other portion of your re-examination apart from the chart.

MR. GOWLING: Yes, my Lord. I am limited to the subject  
40 which my friend dealt with in opening, which is of a rather re-  
stricted scope.

HIS LORDSHIP: Yes. I think perhaps it might be fair that you conclude your re-examination except in respect of material which it would be only fair to give the expert witness a chance to consider.

MR. GOWLING: Yes, my Lord.

For Plaintiff—Arthur Howard Higgins—Re-Examination

759. Q.—I was not too clear about your answer to the question as to what constitutes a suitable pulp of an ore. Would you explain that again, please? A.—A suitable pulp of an ore is an ore which is ground to the appropriate degree of fineness. It is mixed up with the appropriate quantity of water to make a freely flowing pulp. It may even include an ore that is amenable to flotation and not an ore which will not treat by flotation. It might even include that. So that we have three things: The size of the particles, the water and the amenability of the ore to be treated by flotation.

10 HIS LORDSHIP: 750. Q.—Could the fineness or otherwise of the pulp be specifically defined by the mesh? Mesh is the term that you use? A.—Yes, my Lord.

751. Q.—Or would you have to define the fineness to a certain degree? A.—Yes, but that degree will vary according to the ore. In some ores you must crush a good deal finer than in other ores, so you could not very well state it must be crushed to 80 mesh, because it might be crushed a lot finer.

752. Q.—Then the suitability of the ore is related to the kind of ore? A.—Yes, my Lord, and the grinding and the mixing  
20 up with water so as to make the pulp thin enough to be treated by flotation.

MR. GOWLING: 752. Q.—Mr. Higgins, you were asked a question concerning this chart or statement which was filed as Exhibit D-59. I would like to be sure of the confines of your answer. You expressed approval only of certain parts of that statement?

HIS LORDSHIP: With regard to D-59 his answer was, ‘I have no comment to make on the results.’

MR. GOWLING: 753. Q.—Your answer was confined to the results, and nothing else? A.—Yes. The question was so limited.

30 MR. GOWLING: My questions in the morning, my Lord, will be restricted entirely to the charts, and I will have very few of those.

MR. BIGGAR: My Lord, may I say a few words with regard to the last question asked by my learned friend? I pointed out to the witness, with regard to Exhibit D-59, that representatives of the plaintiff had been supplied with the laboratory records of the preparation of the materials and everything that was done, and with samples of the material used, and then I asked: ‘‘Have you any criticism to make of the results as shown in the table?’’  
40 Now I do not want my learned friend to suggest that because I put the question that way the witness’ evidence is confined.

HIS LORDSHIP: The witness replied to that: ‘‘I have no comment to make on the results.’’

MR. BIGGAR: Quite so, my Lord. That includes everything that went into those results which were communicated to the

For Plaintiff—Arthur Howard Higgins—Re-Examination

plaintiff. You see, the plaintiff's representatives were present during the actual tests and the preparation of the material and everything else.

MR. GOWLING: But my friend did not ask the witness, nor did I, whether those results proved anything.

MR. BIGGAR: No, I was not asking him that.

HIS LORDSHIP: The answer is confined to the witness' statement that he had no comment on the results.

MR. GOWLING: We are not going to quarrel about the method  
10 of computation nor the materials used nor anything like that.

MR. BIGGAR: That is all right. I just did not want any misunderstanding about that.

MR. GOWLING: This is perhaps a difficult point, but I am sure my friend and I understand each other now.

MR. BIGGAR: Quite.

HIS LORDSHIP: We shall adjourn now, and you may further re-examine Mr. Higgins in respect of the charts. I suppose that would extend to all the charts?

MR. BIGGAR: Yes. My Lord, may I put a question with  
20 regard to another point on which my friend re-examined, in connection with the expression "alkaline xanthate," which the witness now says is equivalent to "alkali xanthate".

HIS LORDSHIP: He said: "It is not confusing to me. I regard it as the equivalent of alkali xanthate."

MR. BIGGAR: The question I wanted to put to the witness, with your Lordship's permission, was this:

754. Q.—Is there any difference in the way you are using the words "alkali xanthate" and the words "alkali metal xanthate"?

A.—No, I do not think there is any difference in those two  
30 expressions.

MR. BIGGAR: I thought not.

—Court adjourned at 4.10 o'clock p.m. until Wednesday, November 15th, at 10.30 a.m.

---

OTTAWA, NOVEMBER 15TH, 1944

MORNING SESSION

MR. A. H. HIGGINS, Re-examination by Mr. Gowling resumed.

755. Q.—Mr. Higgins, I understand that during the adjournment you have made a further study of Exhibit D-57? A.—Yes, I have.

40 756. Q.—I would now ask you to state the basis of your statement yesterday that the chemical compounds in line C and

For Plaintiff—Arthur Howard Higgins—Re-Examination

their derivatives in lines D and E are not sulphur derivatives of carbonic acid? A.—The basis of that statement is the fact that the derivatives so objected to contain elements other than sulphur and should really be described as sulphur-nitrogen or sulphur-chlorine derivatives. Richter generally adopts this classification. His book is the best book and the most common one on organic chemistry in English.

757. Q.—You might refer to the passages in Richter now or whenever you are ready, Mr. Higgins. A.—On page 431 of volume 10 1 of Richter's Organic Chemistry, second edition, he deals with the sulphur derivatives of ordinary carbonic acid, and the five acids set out in chart P-54 are set out in the text-book. On page 434 he passes to the chlorides of the sulphur carbonic acids. Those are the things containing both sulphur and chlorine. On page 435 he deals with the amide derivatives of carbonic acid. Those contain the nitrogen or the nitrogen-hydrogen group, the amide group, as it is called. On page 448 he deals with the substances containing both the  $\text{NH}_2$  and the sulphur under the heading "Sulphur-containing derivatives of carbamic acid and of urea."

20 758. Q.—Is that word "carbamic" related to carbonic in any way? A.—It is a derivative which is shown in C-4, for example, on Exhibit D-57.

759. Q.—Does that complete your explanation, Mr. Higgins? A.—I think so.

760. Q.—Which of these compounds on D-57 are known to exist and which are not known to exist? A.—That is a very difficult question for me. I have not had time to search the whole of chemical literature, which is most extensive. The opportunity I have had to find out which are known and which are not known has been rather 30 limited. C-1 and C-2 are not known. C-3 and C-5 are not known, and C-8 is not known. When we come to the next group, the D line, there are so many possible substitutions of the R radical that it is impossible to state whether each one is unknown, but of the simple ones in which the R is represented by an alkyl group  $\text{C}_2\text{H}_5$ , D-4 is not known, D-11 is not known, D-14 is not known, and D-17 is not known.

761. Q.—Which of these compounds do not form anions and cations in solution?

HIS LORDSHIP: Are you referring to any particular line?

40 MR. GOWLING: That would only apply in lines C, D and E, my Lord.

THE WITNESS: I have already answered that as to C.

HIS LORDSHIP: What is the question now?

MR. GOWLING: I have asked him to state which of the other compounds on this chart will not form anions and cations in solution.

For Plaintiff—Arthur Howard Higgins—Re-Examination

Some information was given on this yesterday, my Lord, but in view of the fact that the witness has had an opportunity of further study of the chart I would like him to confirm or vary the answer which he gave yesterday.

MR. BIGGAR: I read him a list which in our opinion would not form anions and cations in solution and asked him whether he had any to add to that.

MR. GOWLING: Perhaps he will state, then, whether there are any others than those which were mentioned in the list yesterday.

10 MR. BIGGAR: I can give them to him again.

MR. GOWLING: They are in the record, on page 204.

HIS LORDSHIP: The question asked yesterday was whether there are any others than the ones specified by Mr. Biggar that do not form anions and cations in solution.

THE WITNESS: In my opinion D-9 and D-15 should be added to this list.

HIS LORDSHIP: D-9 and D-15 should be added to the list Mr. Biggar read to you.

20 MR. BIGGAR: D-9 was in my list. D-15 is the only one that is not.

THE WITNESS: It is not in the record.

HIS LORDSHIP: It is not in the record.

MR. BIGGAR: It ought to have been. I read it. I am reading from the note I had before me.

HIS LORDSHIP: It is not in the record.

775. Q.—D-9 and D-15 should be added? A.—Yes, my Lord.

30 MR. GOWLING: 776. Q.—Would you now compare chart p-54 with chart D-57 explaining where the sulphur derivatives of carbonic acid on P-54 will be found on chart D-57? A.—Carbonic acid itself is shown in D-57 as A-1. The mono-thio derivatives are shown as B-1 and B-2 and the di-thio—

HIS LORDSHIP: 777. Q.—You are starting from chart No. P-54 and then showing where the material on chart P-54 is to be found on D-57? Is that it? A.—Yes, my lord; I was taking the broad headings as to what we have on this chart and tracing them on the other chart.

MR. GOWLING: 778. Q.—The first chart you mentioned is P-54? A.—Yes.

40 HIS LORDSHIP: I thought your question was put the other way, where does the material shown on D-57 appear on chart P-54?

MR. GOWLING: It should have been the other way around. I want him to take the material from P-54 and show where it is found on D-57.

HIS LORDSHIP: That is right.

For Plaintiff—Arthur Howard Higgins—Re-Examination

779. Q.—Is that what you are doing now, Mr. Higgins? A.—Yes, my Lord. The di-thio derivatives are shown under B-3 and B-4 and the tri-thio derivatives under B-5. Chart P-54 only shows one substitution by an alkyl radical which is xanthic acid. That one is shown in exhibit D-57 under D-12. The potassium xanthate which is shown on chart No. P-54 is shown under E-3 where M is K instead of any metal.

780. Q.—That is under E-3? A.—Yes, my Lord. The tri-thio potassium carbonate shown on chart P-54 is shown under E-6  
10 where M is replaced by the metal potassium.

MR. GOWLING: 781. Q.—Would you identify R, Mr. Higgins? Is that any organic compound? A.—In chart No. D-57 R is any organic radical with certain exceptions. It does not say what those exceptions are.

782. Q.—Would you look at E-3, Mr. Higgins? A.—Yes.

783. Q.—Tell me what R is, or must be, in order to have that compound be a xanthate? A.—R must be  $C_2H_5$ .

784. Q.—What is  $C_2H_5$ ?

HIS LORDSHIP: That is in order to be potassium ethyl xanthate?

20 MR. GOWLING: Yes, my Lord. I was putting it generally as to what R would have to be as a class in order to make any xanthate, I think the answer being —

THE WITNESS: One of the alkyl radicals.

HIS LORDSHIP: It must be one of the alkyl radicals.

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: It need not necessarily be  $C_2H_5$ ?

MR. GOWLING: That is right, my Lord.

HIS LORDSHIP: It could be, for example, propyl, amyl, methyl.

30 MR. GOWLING: It is because any alkyl radical is distinguished from any organic compound or any organic radical.

HIS LORDSHIP: Or any organic radical. It has to be an alkyl radical.

MR. GOWLING: That is what the witness has stated, my Lord.

HIS LORDSHIP: 785. Q.—It could be methyl; it could be any one of the alkyl radicals mentioned in P-54? A.—Yes, my Lord.

MR. GOWLING: 786. Q.—Would you refer to line E on chart D-57, Mr. Higgins? Have you any comment with respect to the letter M in that line? A.—Yes, I should not include ammonium. Very few of these acids would have an ammonium salt. For instance,  
40 it is impossible to make an ammonium xanthate.

HIS LORDSHIP: 787. Q.—It is impossible to make an ammonium xanthate? A.—Yes, my Lord.

MR. GOWLING: 788. Q.—Mr. Higgins, can you state broadly which of the compounds on D-57 you would exclude from your



For Plaintiff—Arthur Howard Higgins—Re-Examination

chart P-54, that is, giving a broad classification as to how you would exclude them? A.—The majority of it must be excluded. Only the A-1, B-1, B-2, B-3, B-4, B-5—

MR. BIGGAR: Just a little more slowly.

MR. GOWLING: I think if you follow each one through from line A to line E it would simplify matters.

HIS LORDSHIP: You say —

MR. GOWLING: I think what the witness is telling is which would be left in rather than those which would be excluded.

10 HIS LORDSHIP: I took it the other way.

MR. GOWLING: It might simplify matters if the witness would simply state what would be left in, my Lord.

HIS LORDSHIP: What would be left in.

MR. GOWLING: Tracing them from line A through to line E on each case.

HIS LORDSHIP: I understood him to say that the majority of the compounds would be excluded.

MR. GOWLING: That is right, my Lord. In order to identify these it would simplify matters if he states what would be left in.

20 HIS LORDSHIP: Now he is going to state what would be left in on exhibit D-57?

MR. GOWLING: Yes, my Lord.

THE WITNESS: It would simplify matters very much if I were allowed to ring around the exclusions with a red pencil. Then you could easily see what is left in.

MR. BIGGAR: If you will just read the symbols that indicate them that will do.

MR. GOWLING: If the witness could put a red pencil ring around them on the exhibit I think it would simplify matters.

30 HIS LORDSHIP: Yes, I think it would, but on this one there are rings. There are some rings around this exhibit.

MR. GOWLING: I think that yesterday, my Lord, when we were short of copies your Lordship must have been given that one.

HIS LORDSHIP: This is the exhibit that is marked.

MR. GOWLING: That must have been one which was picked up which I had in my brief before the others arrived.

HIS LORDSHIP: There are rings around certain things here.

MR. GOWLING: Perhaps the witness could examine that.

MR. BIGGAR: We had better substitute an unmarked one.

40 HIS LORDSHIP: I think it would be better to substitute an unmarked copy for this exhibit.

MR. GOWLING: Yes, my Lord, and then he could mark it on a fresh copy and have the fresh copy identified.

For Plaintiff—Arthur Howard Higgins—Re-Examination

MR. BIGGAR: Are there any marks on the notes, my Lord?

HIS LORDSHIP: Just a minute until I see.

MR. BIGGAR: The notes will be retained with the new exhibit.

HIS LORDSHIP: No. There are no marks on the notes, but the notes are bradded together.

MR. BIGGAR: They can easily be attached to the new copy.

HIS LORDSHIP: There are no marks on the notes. I think it would be better to leave the exhibit unmarked.

MR. GOWLING: Yes, my Lord.

10 HIS LORDSHIP: And then put in as a fresh exhibit his marked copy.

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: Then the unmarked copy becomes D.57.

MR. GOWLING: This copy which the witness is about to mark will have a new number?

HIS LORDSHIP: Yes.

THE WITNESS: Do you wish to see this as it is marked?

MR. BIGGAR: Would you mind reading the symbols of those you have marked?

20 HIS LORDSHIP: I think it would be well to mark it, and then perhaps you could read the various numbers that are enclosed in your circles.

MR. GOWLING: Yes, my Lord.

THE WITNESS: I have four circles.

HIS LORDSHIP: 795. Q.—You have four circles? A.—Yes. In the first one, I include in that red ring—

796. Q.—Just so that I may be clear on the matter, what are the circles for? A.—The circles enclosing these different groups exclude those from the chart we have in P.54.

30 797. Q.—Yes. A.—There is in the first one, C.1, C.2, D.3, D.4—

MR. BIGGAR: 798. Q.—Would you mind saying that again, please. Is C.1 to be excluded? A.—Yes. These are all exclusions.

799. Q.—C.1? A.—C.1, C.2.

800. Q.—C.1? A.—D.2, D.3.

801. Q.—D.2? A.—D.3, D.4.

802. Q.—D.2 and D.4.

MR. GOWLING: D.2, D.3 and D.4.

MR. BIGGAR: Yes.

40 HIS LORDSHIP: Q.—You have put a circle around that group of compounds? A.—Yes. In the second group there is C.3, C.4, C.5, C.6.

For Plaintiff—Arthur Howard Higgins—Re-Examination

MR. BIGGAR: 803. Q.—You say “in the second group”. What is the second group? A.—That I have ringed around.

804. Q.—I thought we had a list of the ones that ought to be excluded? A.—These are exclusions.

MR. BIGGAR: I thought that he had given the list, C.1, C.2 and so on.

HIS LORDSHIP: C.1, C.2, D.2, D.3 and D.4. He has one circle around all those.

10 THE WITNESS: I think it would help Mr. Biggar if he saw the rings.

MR. BIGGAR: It is put alternatively so often that it is hard to follow.

HIS LORDSHIP: Now he is putting another circle around another group.

THE WITNESS: Yes, my Lord.

MR. BIGGAR: Oh, yes, I see. Thank you, my Lord.

MR. GOWLING: Now the witness is about to read those enclosed in the second circle?

HIS LORDSHIP: Yes.

20 MR. GOWLING: 805. Q.—Go ahead, Mr. Higgins. A.—C.3, C.4, C.5, C.6; D.6, D.7, D.8, D.9, D.10, D.11.

HIS LORDSHIP: 806. Q.—And you have put another circle around that group of compounds? A.—Yes, I have.

807. Q.—Indicating that that group of compounds is to be excluded? A.—Yes, my Lord.

808. Q.—From chart D.57? A.—Yes, my Lord.

809. Q.—Or is to be excluded from the list of sulphur derivatives.

30 810. Q.—Yes. That is the second circle that you have put on the chart? A.—In the third circle are C.7, C.8, D.13, D.14, D.15, D.16, D.17 and E.4.

811. Q.—And have you put another circle around that group of compounds? A.—Yes. I have put a circle around those.

MR. GOWLING: 812. Q.—E.4 was the last? A.—Yes, E.4. In the last group, there is only one to be excluded there, D.19, and that has a red circle around it also.

HIS LORDSHIP: Yes.

MR. GOWLING: And the number of that exhibit will be what?

THE REGISTRAR: Exhibit P.60.

40 HIS LORDSHIP: And that exhibit with the circle drawn on it to show the exclusions of compounds becomes Exhibit P.60.

EXHIBIT No. P-60: Filed by Mr. Gowling { Chart of sulphur derivatives of carbonic acid showing exclusions of compounds.

For Plaintiff—Arthur Howard Higgins—Re-Examination

MR. GOWLING: 812. Q.—You do not leave anything except the direct derivatives of carbonic acid, or is that the proper way to describe them? A.—May I have your question again?

813. Q.—I would ask the reporter to read it.

—Reporter reads question 812.

A.—Yes. That is correct.

814. Q.—Will you now refer to Exhibit D.58 and tell me where on that chart you will find claim 6? A.—I cannot find claim 6 on this chart.

10 MR. GOWLING: I am through with this witness, my Lord.

HIS LORDSHIP: He cannot find claim 6 on it.

MR. BIGGAR: What was that?

MR. GOWLING: The witness said he did not find claim 6 on the chart.

HIS LORDSHIP: I will just have a look at it.

MR. GOWLING: It is D.58, my Lord.

HIS LORDSHIP: May I have the patent, please?

THE REGISTRAR: Yes, my Lord.

MR. BIGGAR: That is alkaline xanthate, I suppose?

20 HIS LORDSHIP: Yes. Well, that at any rate is the paragraph in which the term “alkaline xanthate” is used.

MR. BIGGAR: Yes. We could not put it on because we did not understand it. The witness says it ought to mean something, and it means something else.

HIS LORDSHIP: My understanding is that he said it was synonymous with alkali.

MR. BIGGAR: Alkali metals.

HIS LORDSHIP: Alkali xanthate.

MR. BIGGAR: An alkali metal xanthate means a xanthate  
30 made with alkali metal in which the metal in the xanthate is an alkali metal.

HIS LORDSHIP: Yes.

815. Q.—Is that what you mean? A.—Yes. That is correct, my Lord.

HIS LORDSHIP: Then that finishes your re-examination, does it, Mr. Gowling?

MR. GOWLING: I am finished with this witness, my Lord.

MR. BIGGAR: I have two points on which the witness’s re-examination evidence contradicts directly what he said in cross-  
40 examination. I do not know whether your Lordship thinks it would be proper to clear up possible misunderstandings there, or not. It seems to me that this would be a helpful place to make sure of the two statements the witness really adheres to.

For Plaintiff—Arthur Howard Higgins—Re-Examination  
For Plaintiff—Arthur Howard Higgins—Re-Cross-Examination

MR. GOWLING: I am willing that the witness be re-cross-examined if there is any misunderstanding. I do not want any misunderstanding.

HIS LORDSHIP: If there is any misunderstanding, I think it would be desirable.

MR. BIGGAR: It would seem to me to be desirable, my Lord.

HIS LORDSHIP: I think it would be desirable.

MR. BIGGAR: The first one is that the witness said yesterday that his objection to the inclusion of some things in Exhibit D-57  
10 was the inclusion of those compounds containing chlorine and nitrogen.

HIS LORDSHIP: I thought he made it a little broader than that—that contained anything in addition to sulphur.

MR. BIGGAR: Well, he could not have meant that, my Lord.

HIS LORDSHIP: Except for radicals.

MR. BIGGAR: Well, he has now included in his exclusion in re-examination I think three things which, as far as I can tell, except organic radicals.

HIS LORDSHIP: Oh, I see.

20 MR. BIGGAR: The first that he included is D-6, which I cannot infer as including anything but sulphur.

HIS LORDSHIP: I have not Exhibit D-57 before me now. Which is it you refer to?

MR. BIGGAR: D.6, my Lord.

HIS LORDSHIP: And that was excluded?

MR. BIGGAR: And that was excluded in re-examination.

HIS LORDSHIP: Yes.

MR. BIGGAR: There may be some misunderstanding there which the witness can now clear up.

30 HIS LORDSHIP: Yes.

#### RE-CROSS-EXAMINATION BY MR. BIGGAR:

THE WITNESS: I have excluded in D.57 those compounds which do not make anions and cations about which you were asking me.

MR. BIGGAR: 816. Q.—It is on that ground that D-6 is excluded? A.—Yes.

817. Q.—It is a sulphur derivative of carbonic acid, but one that does not make anions and cations in solution? A.—Yes. That is the object of excluding it.

40 818. Q.—That is clear enough now. He is excluding it from one particular class but not from the broader class.

For Plaintiff—Arthur Howard Higgins—Re-Cross-Examination

HIS LORDSHIP: Yes. He is not excluding it from the class of sulphur derivatives of carbonic acid?

MR. BIGGAR: No.

HIS LORDSHIP: But he is excluding it from the class of those derivatives that make anions and cations?

MR. BIGGAR: That is quite right.

819. Q.—That is true also, is it not, of D.13 which you excluded this morning? A.—It is true of that too.

820. Q.—And it is also true, is it not of D.17? A.—No.  
10 D.19.

HIS LORDSHIP: Would it not be true of D.17? A.—It is true of D.2, D.6, D.13 and D.19.

MR. BIGGAR: Q.—We are asking about D.17. Will you direct yourself to D.17 and tell me whether you have excluded D.17 on the ground that it does not make anions and cations? A.—Yes.

821. Q.—That is the ground for the exclusion of that.

HIS LORDSHIP: 822. Q.—You are not excluding it as not being a sulphur derivative of carbonic acid? A.—No, my Lord. I think perhaps I should have said that the broad table, D-57, includes  
20 everything in organic chemistry that has sulphur in it, irrespective of any other radical or metal.

MR. BIGGAR: 822. Q.—What about mercaptans, Mr. Higgins? Is that statement also true with regard to mercaptans? A.—No. I beg your pardon. It is not true with regard to every sulphur derivative: I should have said “every sulphur derivative of carbonic acid.

823. Q.—You put it a little more widely. I think possibly it was a slip of the tongue. A.—The other table, P-54 is “certain derivatives.”

824. Q.—Well— A.—It should have been labelled “certain  
30 derivatives.”

825. Q.—By directing your mind to them we have cleared up these misunderstandings. D.2, D.6, D.13, D.17 and D.19 are now excluded from the class of sulphur derivatives of carbonic acid which in solution produce anions and cations? A.—Yes.

HIS LORDSHIP: 826. Q.—On the ground that they do not? A.—On that ground, yes.

MR. BIGGAR: 827. Q.—That is true of D.2, is it, because that will be added to the list that I noted? A.—Yes, That is true  
40 of D.2.

828. Q.—Very well. The next point is that you told me yesterday that you agreed that the formula E.3 covered all xanthates and only xanthates. I gather that you are saying this morning that it does not? A.—I never intended to say this morning that it was not.

For Plaintiff—Arthur Howard Higgins—Re-Cross-Examination

829. Q.—You did not. That is all right. It does.

HIS LORDSHIP: 830. Q.—The comment that you made this morning was that you could not make a xanthate with ammonium?  
A.—Yes, my Lord.

MR. BIGGAR: 831. Q.—I should like to know on what basis you put that. In the first place, are you saying that when you substitute ammonium for a metal, with the other ingredients necessary to react so as to produce a xanthate, you do not get xanthate? A.—You do not.

10 832. Q.—Under no circumstances? A.—Not known to me. I found it impossible to make one.

833. Q.—I see.

HIS LORDSHIP: 834. Q.—So that if the formula E.3, M. has the meaning of metal, including ammonium, it is too broadly stated. Is that your opinion. A.—That is my opinion.

MR. BIGGAR: 835. Q.—The next point is this: You agreed yesterday, as I understand it, with the note attached to exhibit D-57 that of the compounds represented by the formulae D.1 and D.5, none have so far as is known, been made; and of those represented  
20 by each of the remaining formulae, the number of which have been made is a small fraction of those that might be. Now this morning you have included among those of which there are no examples, as I understood your evidence, not only D.1. and D.5, but also D.9, D.11, D.14 and D.17. I just want to clear up that possible contradiction between those two answers.

MR. GOWLING: Do you know the number of that question, Mr. Biggar?

MR. BIGGAR: I do not know. I went through the whole of the note to D-57 with him, and he agreed, subject to some qualifica-  
30 tion and particularly with that note I remember there was no qualifica-  
tion.

836. Q.—Well, what is the fact. You have before you, Mr. Higgins, yesterday's notes of evidence, but that is not the point. We are not concerned with what anybody really said. We are concerned with what they meant to say with regard to the facts. What is the fact? A.—The fact is that, if you remember, I told you I had not time to examine line D.

837. Q.—I know that. A.—I had only got as far as that. So anything I said with regard to D was naturally subject to investi-  
40 gation.

838. Q.—Quite so. I only want to clear the facts up. You say now that not only D.1 and D.5, but also D.9, D.11, D.14 and D.17 represent compounds of which there have never been any samples made, as far as you know? A.—I do not think I said D.9.

839. Q.—Oh. Well, I may have misunderstood you, then. But it is true of the remaining ones? A.—Yes.

For Plaintiff—Arthur Howard Higgins—Re-Cross-Examination  
Remarks of Counsel

840. Q.—And it would not matter what the radical was?  
A.—No. That is as far as my search went. I could not find them.

841. Q.—As far as your information carries you then, those four—to keep them right, taking D.1 and D.5 from the note you add some—which was it you said you did not add, 11 or 9? A.—No. D.9.

842. Q.—You add then 11, 14 and 17? A.—Yes.

843. Q.—Right. Coming back to the ammonium xanthate, I have and I am going to show you a document—

10 HIS LORDSHIP: Coming back to the ammonium what?

MR. BIGGAR: Ammonium xanthate.

HIS LORDSHIP: Which this witness says cannot be made.

MR. BIGGAR: Which he says cannot be made.

844. Q.—I am going to show you, and I think it is fair that I should, a document which summarizes a very large number of publications that are listed in the Defence, my Lord, in schedule 2. They are very hard to go through individually, and my friend and I have agree to a summary of them that is convenient and easy to refer to. It is agreed that it shall go in subject to the following  
20 conditions which I will attach to it but which I might let your Lordship know now, so that we will have it in our minds: First, that the list constitutes all the references to xanthate prior to 1923 which could be found in the scientific literature; second, that none of the references are to metallurgical publications but all of them are in the chemical field; and third, that all of the references are to laboratory experiments, with the exception of cellulose xanthate in rayon, and all are reports either of success in preparing the type of xanthate disclosed or of laboratory exploration of one or more of its properties. None of the references are to preparation or use outside the laboratory.  
30 We accept those conditions.

MR. GOWLING: I should like to be sure that my friend is going to confine his questions to something that I brought up in my re-examination.

MR. BIGGAR: Yes.

845. Q.—I am putting to the witness the point that on that list, which I will show him, ammonium xanthate occurs under Number 2 as ammonium amyl xanthate and also under Number 9, ethyl xanthates, ammonium ethyl xanthate, as having been made in 1835?  
A.—I have not seen the publications.

40 846. Q.—You have not seen the publications? A.—No.

847. Q.—Very good. I was assuming that you were familiar with what had been pleaded and so on, and that you were speaking with full knowledge of what was in the documents referred to in the pleadings? A.—Most of them are in German, and I cannot read German.



## Remarks of Counsel

848. Q.—I beg your pardon? A.—I say that most of them are in German, and I cannot read German.

849. Q.—Yes. Very well.

MR. GOWLING: I do not want to be restricted in any way about calling evidence in reply to this list, as to what these documents are or as to whether ammonium amyl xanthate was produced or whether this document simply says it was produced. I just do not want my Reply evidence to be hampered by the introduction of this chart at this stage.

10 HIS LORDSHIP: No.

MR. BIGGAR: I only did it in fairness to this witness.

MR. GOWLING: The witness has seen the list before.

HIS LORDSHIP: The witness, as I understand it, says that so far as he knows you cannot make xanthate with ammonium.

MR. GOWLING: Yes. The witness has seen this list before but he had not seen the publication.

EXHIBIT D-61.	Filed by	{	List of xanthates in printed publications, with attached admissions.
	Mr. Biggar		

20 The Court recessed for ten minutes.

MR. GOWLING: My Lord, Mr. Higgins is the only witness being called by the plaintiff in the opening of this case. Before closing our case, I would like to have the commission evidence considered as having been read into the record, and I would like to include with the commission evidence the examination on discovery of Dr. Gregory. That is being treated as commission evidence through the kindness of my friends.

HIS LORDSHIP: Will you give me a list of the witnesses who were examined on commission?

30 MR. GOWLING: Perhaps I could just explain to your Lordship the general nature of the commission evidence and identify the witnesses for your Lordship. The inventor, Mr. Keller, was examined in California. He traced the development of his invention, explained how it was made and gave some technical evidence relating to the facts of the case. Mr. Keller also explained his relationship with Mr. Lewis, who has been mentioned in opening, and in addition he dealt with the successful introduction of the patented process at the Anaconda mill; that would be in 1923. During the course of the evidence your Lordship will hear about a man named Martin. I do  
40 not know whether my friends propose to call Mr. Martin, but in any event considerable of the evidence of Mr. Keller is directed to the work of Martin, who was at one time an employee of the plaintiff company.

HIS LORDSHIP: Mr. Biggar referred to Mr. Martin in the cross-examination of Mr. Higgins.

## Remarks of Counsel

MR. GOWLING: Yes, my Lord. We have to be prepared for the possible appearance of Mr. Martin, and considerable of our commission evidence was taken to meet any evidence that might be introduced through him. That is, a substantial part of the commission evidence in reply, so it does not seem appropriate to read it at this moment.

Another witness examined in California was Mr. Wilkinson, He is an engineer, and he confirms to a substantial extent the story of Mr. Keller. Mr. Wilkinson was qualified as an expert and gave  
10 considerable evidence relating to the flotation art. His testimony is likewise directed to the work of Mr. Martin.

Then in New York Dr. Gregory, an officer of the plaintiff company, was examined for discovery by the late Mr. Smart.

MR. BIGGAR: We have agreed that the plaintiff may use that as commission evidence, my Lord, as if it had been taken by the plaintiff.

HIS LORDSHIP: It is agreed that Dr. Gregory's evidence can be regarded as commission evidence taken by the plaintiff.

MR. GOWLING: Yes, my Lord. Dr. Gregory traces the history  
20 of the company, and while he does not add very much to the technical side of the case he does refer to the success of the patented invention and identifies a number of relevant documents. Dr. Gregory also gave some evidence relating to the defence of laches which has been set up by my friends, and he had some knowledge of Mr. Martin's situation in this picture.

The last witness that I should mention is Mr. Williams. He was examined in New York. Mr. Williams was the patent attorney for the plaintiff company.

HIS LORDSHIP: He was one of the plaintiff's witnesses?

MR. GOWLING: Yes, my Lord. Mr. Williams was intimately  
30 associated with the development of the invention and gave evidence concerning Martin's situation. He was able to identify the various files and he gave considerable evidence relating to what Martin did.

My friends and I have agreed that it would be unnecessary and perhaps somewhat confusing for us to interrupt the trial for the purpose of reading all of this evidence. As the case has developed it now becomes apparent that a portion of this, at least, may be unnecessary, and if your Lordship will permit us we will  
40 not read the evidence during the course of the trial, but each of us will read those portions which we regard as relevant to our respective cases when we are arguing the case.

HIS LORDSHIP: You will read this in the course of the argument after the other evidence has been given?

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: But it is all put in now as evidence?

## Remarks of Counsel

MR. GOWLING: That is right, my Lord.

HIS LORDSHIP: It is difficult to separate what relates to the plaintiff's case in opening and what may properly be rebuttal by the plaintiff.

MR. GOWLING: Yes. In fact, it is virtually impossible to do that, my Lord.

HIS LORDSHIP: I suppose that would be true of any commission evidence?

MR. GOWLING: Yes; that is the problem we almost invariably  
10 encounter, because in taking evidence of this nature we must endeavour to anticipate what the opposite side will do. I think from our experience here that this has proven the wise way to deal with these matters. So, if your Lordship approves, my suggestion would be that the defence now proceed.

HIS LORDSHIP: I suppose there were a number of exhibits filed on the commission evidence?

MR. GOWLING: Yes, my Lord.

HIS LORDSHIP: They would have to be given a number or identification of some kind.

20 MR. GOWLING: Yes. Your Lordship will remember that at the opening my friend Mr. Biggar suggested that we give the exhibits the numbers that they were given on commission.

HIS LORDSHIP: The exhibits filed on the commission evidence of Mr. Keller could be marked K-1, K-2, and so on? And Mr. Wilkinson's exhibits could be numbered W-1 and so on?

MR. GOWLING: Mr. Wilkinson and Mr. Keller were examined one after the other at San Francisco, Mr. Wilkinson having been called first. My friend Mr. Robinson has just mentioned one point.  
30 We have agreed that all the exhibits in the California testimony will be identified as K-1 to K-47. That will enable us to apply the initial W to the exhibits filed on the evidence of Mr. Williams.

HIS LORDSHIP: The letter K will precede the number of every exhibit filed on the commission evidence of Mr. Wilkinson as well as of Mr. Keller?

MR. GOWLING: Yes. The California exhibits will be numbered in sequence from K-1 to K-47. The exhibits filed on the evidence of Mr. Williams, who was examined at New York, will be numbered W-1 to W-22. Dr. Gregory's exhibits, twenty-one in  
40 all, will be preceded by the letter G; that is, they will be numbered G-1 to G-21.

Your Lordship will remember that we started numbering the exhibits filed here at No. 50, so there cannot be any confusion.

HIS LORDSHIP: The Registrar points out to me that in the California commission evidence the defendant put in three exhibits, which were marked A, B and C.

For Plaintiff—E. W. Wilkinson—Direct

MR. GOWLING: Yes, my Lord. They can be identified as K-A, K-B and K-C.

Testimony of ELTOFT WRAY WILKINSON and CORNELIUS H. KELLER, in behalf of the plaintiff, taken under commission issued herein on the 13th day of March, 1944, and pursuant to arrangement and agreement between counsel, at the office of Messrs. Pillsbury, Madison & Sutro, 19th floor Standard Oil Building, No. 225 Bush Street, San Francisco, California, in the United States of America, before Frank L. Owen, of San Francisco, California, the commissioner named in the said commission.

APPEARANCES:

FOR PLAINTIFF:

MR. W. L. SCOTT, K.C., of Ottawa, Canada,  
MR. HENRY COHEN, of 70 Pine Street, New  
York, New York;

FOR DEFENDANT:

MR. RUSSEL S. SMART, K.C.,  
MR. P. C. FINLAY, of Ottawa, Canada.

ELTOFT WRAY WILKINSON, having been first duly sworn  
20 by the commissioner, testified as follows:

DIRECT EXAMINATION BY MR. COHEN

Q. 1.—What is your full name? A.—Eltoft Wray Wilkinson.

Q. 2.—Where do you live? A.—2828 Webster Street, Berkeley,  
California.

Q. 3.—Are you now employed? A.—No.

Q. 4.—Has your health been good? A.—No. I have suffered  
lately from stomach ulcers and I have phlebitis in my leg.

Q. 5.—Will you tell us something about your education? A.—I  
was educated as a boy in public and grammar schools and went to  
30 Leeds University on a scholarship in 1904, graduating in 1907 with  
honors and a degree in electrical engineering, taking mechanical  
engineering simultaneously.

Q. 6.—Do you belong to any professional societies? A.—I am  
a member of the American Institute of Mining and Metallurgical  
Engineers, and have been for about twenty years.

Q. 7.—Will you tell us about your employment and occupation  
since graduating—since being graduated from Leeds? A.—Between  
graduation and my employment by Minerals Separation, Limited, in  
1910, I served time as an apprentice in engineering works, both  
40 mechanical and electrical, and was employed for a short time in the  
drafting office on the latter, electrical work.

Q. 8.—And after that? A.—After that I was employed by  
Minerals Separation, Limited, in London.

For Plaintiff—E. W. Wilkinson—Direct

Q. 9.—When were you there employed? A.—That was in 1910, and from then for about a year I was employed at the testing plant and laboratory at 31 Charlotte Street, London, E.C., and also at a new testing plant set up at King John's Court, London, E.C.

Q. 10.—A testing plant for what? A.—A testing plant for the testing of ore.

Q. 11.—In flotation? A.—Flotation primarily, and there was other work as well.

Q. 12.—When did you come to the United States? A.—In 10 March, I think it was, 1911.

Q. 13.—In whose employ? A.—By the Minerals Separation, and following that its successors in the United States.

Q. 14.—Including the present plaintiff? A.—Including the present plaintiff, the Minerals Separation North American Corporation.

Q. 15.—And where did you work in the United States? A.—At first in New York City in a small testing laboratory at No. 7 Pine Street, until nearly the end of the year, when I came out to San Francisco to join Mr. Nutter, the chief engineer, who had started a 20 testing laboratory in the Merchants Exchange Building, San Francisco.

Q. 16.—And how long did you stay there? A.—I was attached to that office as my headquarters until 1920.

Q. 17.—And what was the nature of your work? A.—I was employed in testing ores for flotation mostly on a small scale, and then I was sent out into the field to start up practical flotation plants on the basis of the results obtained in the testing work.

Q. 18.—Will you mention some of the places at which you worked in the field? A.—I was in Butte—

30 Q. 19.—When were you in Butte? A.—I was in Butte in 1912—I think it was 1912—testing ores for the Elm Orlu Mine. In 1913, I think it was, I was up in Colorado with the Atlas Mine installing and starting up a flotation plant. In 1914 I was at the Engels Mine in Plumas County, California. After that I was down in Mexico for a while on similar work, starting up commercial flotation plants and getting them running properly with the right reagent combinations, and so forth. Shortly after that I was in Michigan at the mines of the Calumet & Hecla Company on similar work; and my work has taken me to Anaconda, New Mexico—in 1914 I think 40 that was—Colorado and other mines, more than I can remember offhand.

Q. 20.—You were in charge of the laboratory in San Francisco? A.—In San Francisco I was in charge of the laboratory testing work.

Q. 21.—Now, you say that you remained in San Francisco until 1920? A.—As my headquarters, with these trips outside. I might add that I was absent also on litigation work for Minerals Separation; that is, the demonstration and testing in connection with that work.

Q. 22.—In court? A.—In court—demonstrations in court.

For Plaintiff—E. W. Wilkinson—Direct

Q. 23.—Have you ever testified as an expert? A.—Yes.

Q. 24.—On flotation? A.—On flotation.

Q. 25.—What did you do after 1920? A.—I was transferred to the New York headquarters, and made my personal headquarters at the—

BY MR. SMART: What year was that?

A.—1920. And made my personal headquarters at Minerals Separation testing laboratory in Long Island City.

BY MR. COHEN: Q. 26.—What was the nature of your work  
10 there? A.—Very much the same as I had been doing while attached to the San Francisco office—perhaps more litigation work; and shortly after my arrival there I did a great deal of work on the flotation of coal.

Q. 27.—How long did you remain in New York? A.—The laboratory there was shut down, and I came to San Francisco in 1929, arriving at the beginning of July.

Q. 28.—And then? A.—Since then I have been attached to the—I was attached to the San Francisco office, in the laboratory largely on research work and very little commercial testing, but a  
20 good deal of litigation work.

Q. 29.—All connected with flotation? A.—All connected with flotation.

Q. 30.—And when did your employment with Minerals Separation cease? A.—At the end of 1942.

Q. 31.—Because—A.—Because the laboratory was closed down.

Q. 32.—Have you kept up with the literature on flotation in the technical press? A.—In my professional work I kept up with the literature in the technical press, to which I have had access wherever I have been working, and of course through the literature of the  
30 Institute of Mining Engineers, its transactions and papers.

Q. 33.—Will you describe, as briefly as you can, what the flotation process consisted of in and around 1915? A.—The process is one for the separation of metalliferous and valuable constituents of an ore from its waste or gangue materials. For flotation, the ore is ground to suitable size and mixed with water in the form of a freely flowing pulp, and violently agitated, in the presence of what are called flotation agents. In the course of this violent agitation a great amount of air is entrained into the ore pulp and finely divided into small bubbles, so that when the pulp is brought to quiescence or  
40 allowed to flow into a quiescent zone the air bubbles rising to the surface carry with them a substantial amount of the valuable and metalliferous particles, where they form a froth which supports the mineral until it can be removed from the pulp by over-flowing or by scraping, or otherwise. This froth constitutes what is called the concentrate, and the remaining pulp carries the gangue particles with it, which constitute the tailings or waste of the operation.

Q. 34.—What is done with the concentrates? A.—The concentrates, after removal from the separating machine, are collected

For Plaintiff—E. W. Wilkinson—Direct

and filtered and dried and smelted for their metal values, as a rule. In cases they may be treated by cyanide or other methods.

Q. 35.—Now, you spoke of reagents used in the process. What is the function of the reagents commonly used? A.—Well, the reagents can be roughly divided into classes.

Q. 36.—I am speaking of 1915. A.—1915. The reagents which caused the formation of a froth, first of all, they are roughly divided—they can be roughly divided into frothing and collecting agents. There is another class of reagent which can be roughly  
10 described as modifying agents. In 1915 and prior to that the most common had been sulphuric acid. Alkalis had also been used to some extent as a modifying agent. Alkalis used were sodium hydrate, sodium carbonate, and I think lime to a certain extent.

Q. 37.—What does a modifier do? A.—I don't know exactly. A modifier makes the—I mean I don't know the mechanical details. It makes the froth better; it enables the flotation agents themselves, those that cause flotation, it makes their work more efficient. It modifies the nature of the froth to give better operating conditions.

Q. 38.—Do modifiers have common characteristics and physical  
20 properties? A.—No, they are not flotation agents; they are not able to cause flotation in themselves, but they are very extreme in their physical and other differences. For instance, sulphuric acid is a very strong acid; sodium carbonate is a very alkaline substance, and sodium hydrate is even more so. They are classed as modifiers. Sodium silicate is another modifier.

Q. 39.—You said before that there were reagents which were classed as frothers and collectors. Will you explain what their function is in flotation? A.—A collector, as I am using the term,  
30 is an oily substance which tends to coat metalliferous particles in the ore pulp. It appears that when so coated, ever so slightly, there is better attachment of air to these particles to float them into the concentrated froth which is desired. That is the essential feature of a collecting agent. Frothing agents are those which, when beaten into the pulp, promote the formation of the right kind of bubble to give a satisfactory froth. The air can be beaten in with no frothing agent, but it is not efficacious in the absence of the frothing agent.

Q. 40.—Do air bubbles have a natural affinity for the metalliferous particles of an ore? A.—Apparently, yes.

Q. 41.—And the function of a collector is what? A.—It en-  
40 hances the affinity—the attraction, rather, of the air to the mineral. The collector appears to have an affinity for the material, and the air seems to have a better affinity for the oiled mineral.

Q. 42.—What were some of the principal reagents in use in flotation for the collectors, frothers and modifiers in 1915, in addition to those you have already mentioned? A.—The first flotation agent—you mean the flotation agents?

Q. 43.—Reagents. A.—Outside of modifiers, the first I knew was oleic acid, and between 1910 and 1915 a great number of other

For Plaintiff—E. W. Wilkinson—Direct

reagents were used or found available, including wood tars and wood tar oils, certain coal tar products, certain essential oils, cresylic acid, and a number of phenols. Certain alcohols have been found useful, such as amyl alcohol, and there are a number more.

Q. 44.—Did Minerals Separation North American Corporation own some important patents in the field of flotation in 1915? A.—Yes, its basic patent, the Canadian number of which I don't know, is United States 835,120.

10 Q. 45.—What did that cover? A.—That covered the use as a flotation agent of oily substances having a preferential affinity for metalliferous matter, used in quantities of less than 1% of the weight of ore treated.

Q. 46.—Soluble or insoluble? A.—They were substantially insoluble. They were oily in nature.

Q. 47.—When did the patent issue? A.—The American patent?

Q. 48.—Yes. A.—1905, I think.

Q. 49.—Could it have been 1906? A.—Yes, easily.

BY MR. SMART: You have a copy, haven't you?

20 BY MR. COHEN: I haven't a copy of that with me. I have the date November 6th, 1906.

BY MR. SMART: I have a copy.

BY MR. COHEN: Q. 50.—Was there another patent? A.—Yes, there was a later patent for the use of what are termed soluble frothing agents, as distinguished from the oily and practically insoluble reagents of the earlier patent.

Q. 51.—Did the patent say anything about the oily or non-oily nature of the substances covered? A.—You mean in the second patent?

30 Q. 52.—In the second patent. A.—I don't remember that they actually differentiated between oily and non-oily, but they were soluble substances, and the examples given would not lead you to oily substances at all.

Q. 53.—What was the principal reagent used under the first patent? A.—May I add to that previous answer?

Q. 54.—Yes. A.—That the general understanding of an oil is that it is insoluble and immiscible with water.

Q. 55.—What substances generally were used under the first patent? A.—Oleic acid was by far the commonest.

40 Q. 56.—And what was its principal function? A.—Its principal function was to make a froth. It was oily in nature, and it coated the mineral in the process of making a froth.

Q. 57.—In other words, to use the definitions you have laid down in a rough way before, it had both collecting and frothing properties? A.—Yes, it had both properties.

BY MR. SMART: Could you give us the number of that second patent?

BY MR. COHEN: Q. 52.—When did the second patent issue? A.—1910.



For Plaintiff—E. W. Wilkinson—Direct

Q. 53.—And what was the number? A.—I don't remember the number. I think that is the correct patent (indicating document).

Q. 54.—962,678? A.—I think so.

BY MR. COHEN: We can correct it if it is not correct.

Q. 55.—What were the reagents commonly used under the second patent? A.—There was no common use that I know of, of the second patent reagents exclusively. It was found that the best results were obtained and easier conditions reached by use of  
10 the reagents of both patents, and it became common practice to use more than one flotation agent.

Q. 56.—You say reagents of both patents. What would the reagents of the second patent be? A.—They would be soluble frothing agents — substantially soluble.

Q. 57.—For example? A.—Amyl alcohol, phenol, amyl acetate, the soluble constituents of a great number of wood distillation products.

Q. 58.—Such as pine oil? A.—Such as pine oil, wood creosotes of varying degrees, and certain coal tar creosotes.

20 Q. 59.—In what direction was research tending in 1915 in the light of these patents?

BY MR. SMART: Just a moment. I will object to a question as broad as that. He can say what his own research was devoted to.

BY MR. COHEN: I will reframe the question.

Q. 60.—Were you familiar with the lines of research which were being conducted in your laboratory and other laboratories in 1915? A.—I was completely familiar with the research done in Minerals Separation laboratory, of which I was in charge when present, and even if absent for a time I was familiar with the work,  
30 because all the work done was entered into a series of lab. books, which I would look over upon returning from a field assignment. As regards other laboratories, there were very few, and I had a good idea as to what they were doing. They published their results, and I would meet research men at the various mines to which I had been sent to install flotation.

BY MR. COHEN: May I ask the question now?

BY MR. SMART: If you can ask it in a way which won't be objectionable. I have no objection to him stating what he knew about these other laboratories.

40 BY MR. COHEN: Q. 61.—What did you know about those lines of research in your laboratory and in the other laboratories that you mentioned? A.—We were experimenting continually on the best flotation agents we had available to us in great number, many of which would give quite pretty results by themselves, but we found it much better to work out combinations for each ore tested. In this work we began to fully understand the workings of certain collecting agents, and how to combine their effects with those of

For Plaintiff—E. W. Wilkinson—Direct

the flotation agents employed. That was the general line on which research work was conducted.

Q. 62.—What do you mean by flotation agents? A.—By flotation agents, I mean in this sense — I mean those causing flotation.

Q. 63.—Causing flotation? A.—Light oils or frothy agents —collecting agents or frothing agents, as distinguished from modifiers, which do not cause flotation.

Q. 64.—And other laboratories? A.—In other laboratories the same kind of thing was being done. In starting up a plant at such  
10 a place as Anaconda, for instance, I was in constant touch with their research laboratory men and frequently made tests in their equipment, so that I knew pretty well what they were doing.

Q. 65.—Do you know of any research which was seeking to avoid the scope of the Minerals Separation patents you have described? A.—I knew that a number of laboratories were trying to find some way of effecting flotation without infringing the two patents we mentioned a short time ago. I have seen some of their attempts.

Q. 66.—I am going to read to you, Mr. Wilkinson, from a  
20 list of reagents which I have in my hand, and I should like you to tell me what the nature of the reagent is, and whether or not it was well-known in flotation in 1922, and thereafter?

By MR. SMART: Well, I suppose the term “reagent” is not quite proper there, if some of these are not reagents. Some chemical compound, I suppose would do.

By MR. COHEN: Some substance. A.—We use the term “reagent” for anything used in flotation; it is the customary term.

By MR. SMART: Well, I don't know; if there were some named compounds that were not usable in flotation, then they wouldn't  
30 be reagents. However—

By MR. COHEN: Well, it depends on how you define it. We define “reagent” as anything— A.—Anything that you put into the pulp.

By MR. SMART: This was after 1915.

By MR. COHEN: 1922.

By MR. SMART: 1922.

By MR. COHEN: Q. 67.—No. 2 Coal Tar Creosote of the Barrett Company. A.—That was a flotation agent. The properties would come mostly under what is described as a collector. It had  
40 some frothing properties, and was quite well known.

Q. 68.—Copper sulphate. A.—Copper sulphate I would classify as a modifying agent. It had no frothing properties and was not a collector. It was very well-known too, particularly in the flotation of zinc ores.

Q. 69.—When you say “well-known”, I assume you mean— A.—It had been used extensively on a practical scale.

For Plaintiff—E. W. Wilkinson—Direct

Q. 70.—Water Gas Tar. A.—Water gas tar was a tarry product from the manufacture of water gas. The sample we used mostly came from Chicago. It was an excellent collecting agent, with some frothing properties. It was quite extensively used.

Q. 71.—No. 100 Pine Oil of the Pensacola T. & T. Company. A.—That was a good steam-distilled pine oil, with excellent frothing properties, and it was used I think in large amounts in practice, and certainly frequently used as a good frother in testing work.

Q. 72.—Hardwood Creosote of the Cleveland Cliff Iron Company. A.—Does it give its number?

Q. 73.—No. A.—Well, I know what it was. It was an excellent flotation agent, with frothing and collecting properties, made from the distillation of hardwood. It was used quite extensively in the field and also in laboratory testing. In the field the largest use was perhaps that of the Anaconda Company.

Q. 74.—No. 5 Pine Oil. A.—No. 5 Pine Oil is perhaps the best known. That is G.N.S.

Q. 75. General Naval Stores. A.—Perhaps the best known of the really good pine oils, and it is used extensively—it was then used extensively, and is now.

BY MR. SMART: Q. 76.—That is steam-distilled? A.—Steam-distilled pine oil. An excellent frother, as I have said about similar reagents.

BY MR. COHEN: Q. 77.—Coal Tar No. 635. A.—Barrett.

Q. 78.—Barrett Company. A.—A very good collecting agent, with some frothing properties. It tended to give a good high-grade froth.

Q. 79.—Would you say whether it was well-known? A.—Quite well-known. I used it successfully on Calumet & Hecla ore.

Q. 80.—Sodium Silicate. A.—Sodium Silicate is a modifying agent, with no frothing properties; unable to make a froth in itself, but well-known for its power of so affecting conditions so as to improve the froth produced by flotation agents.

Q. 81.—Sulphuric Acid. A.—Practically the same answer, though it had practically gone out of use after 1915, or even earlier, except that the Anaconda people carried on the use of sulphuric acid longer than anybody else.

Q. 82.—Kerosene Acid Sludge. A.—Kerosene Acid Sludge was obtained from the refining of crude petroleum, and was practically a waste product until used in flotation. The Anaconda Company used enormous quantities of it. It had frothing and collecting properties.

Q. 83.—Tar Acid Oil. A.—Whose?

Q. 84.—International Coal Products Company. A.—I don't remember that individually, but I know what sort of thing it would

For Plaintiff—E. W. Wilkinson—Direct

be. It was very similar to the Barrett No. 635, which you mentioned before, but it was a lighter distillate and contained more phenolic products.

Q. 85.—Cresylic Acid. A.—Cresylic Acid was an excellent soluble frothing agent, and used quite extensively.

Q. 86.—Hydrated Lime. A.—Hydrated Lime was what I have been calling a modifying agent. It is an alkaline substance, of course, and has no frothing properties of its own.

10 Q. 87.—When was it used? A.—By 1922 it was quite extensively used in the field. Various large operations I know employed quite a bit of lime in their flotation circuit.

Q. 88.—Naphthalene in Xylene? A.—That was a mixture of two organic chemical substances, which was used in flotation testing. Some of the men in the laboratory were very fond of it. It had good collecting properties, though not very strong frothing properties.

Q. 89.—Was it used in the field, that you know of? A.—Not to any extent.

20 Q. 90.—Pine Oil No. 25 of the Pensacola T. & T. Company. A.—It was a pine oil from a distillation of pine wood or pine roots, very like other products. I am not sure whether that was a steam distilled one or not; but the other kind, the destructively distilled pine oils were good frothing agents and were quite extensively used.

Q. 91.—Shale Oil. A.—“Shale Oil” by itself doesn’t define it enough for me to say much, except that it would be a collecting agent, and I would not expect much frothing properties there.

30 Q. 92.—Stove Oil 27°. A.—Stove Oil was an excellent collecting agent. It was a distillation product from petroleum, somewhat heavier—that is, distilled at higher boiling points than kerosene, and brown in color, and used quite extensively.

Q. 93.—Coal Tar Creosote No. 4 of the Barrett Company, A.—A very good reagent. A flotation agent—not a collector; used extensively. It had both frothing and collecting properties.

BY MR. COHEN: May I have that answer, please? (Answer read.) A.—That is Barrett No. 4.

BY MR. COHEN: This is off record. (Unreported discussion.) A.—That is where I was wrong. I meant to say “modifying”—not the word “collecting.” It was a flotation agent. I distinguish between flotation agents and modifying agents all the time.

40 Q. 94.—Crude Solvent Naphtha. A.—That was a flotation agent. It had some frothing and collecting properties.

Q. 95.—Yarmor Pine Oil. A.—That was a very good pine oil. There were a number of Yarmor pine oils, all good, some steam-distilled and some destructively distilled; excellent frothing agents, and used extensively.

For Plaintiff—E. W. Wilkinson—Direct

Q. 96.—How about Crude Solvent Naphtha? I don't know that you said anything as to the extent of its use. A.—It was used to a certain extent, but not in any enormous tonnage.

Q. 97.—Kerosene. A.—Kerosene could be used practically the same way as stove oil. It costs a little more. A good collecting agent; practically no frothing properties at all. None if pure, I think.

Q. 98.—How about use? A.—Oh, it was used quite a good deal as a collecting agent.

10 Q. 99.—Sodium Sulphide. A.—Sodium sulphide was generally used for a chemical effect on the surface of the mineral particles in case they should be oxidized and not so easily floated as they would be otherwise. It would react on oxidized minerals to form a very thin film of sulphide which would then be floated by ordinary methods of the patents then in use.

Q. 100.—Was it used very much? A.—It was used quite a bit in places where the values were almost exclusively in oxidized minerals. It had a certain modifying effect on the pulp too, but it was not employed for that so much as for its chemical effect. It was  
20 not a frothing agent.

Q. 101.—It was— A.—It was not a frothing agent.

Q. 102.—Pine Oil and Resin. A.—Well, that would be used as a frothing agent. It was simply a case of putting back into the pine oil the resin which had been distilled out of it earlier, and the man who made that mixture probably thought he could get a very strong frothing effect with it. I don't think it was used to any very considerable extent anywhere.

Q. 103.—Was there anything novel in it? A.—No.

BY MR. SMART: I think he said it was known at that time.

30 BY MR. COHEN: I didn't hear him say that. He said it was used in the laboratory, I think— A.—It was used in the laboratory. It may have been used outside, but not to any considerable extent.

Q. 104.—No. 750 Pine Oil. A.—That was an excellent frothing agent, with some collecting properties. I don't know how much it was used in practice; to some extent certainly. In an operating mine they will experiment over certain periods of time with shipments of varying reagents from different producers.

Q. 105.—Acme Pine Oil. A.—I don't remember Acme Pine Oil.  
40 That is just a trade name. It is all right, no doubt.

Q. 106.—Georgia P. & T. Co. made it. A.—Well, their reagents were good, but I don't remember that individual specimen.

Q. 107.—Does this list exhaust the list of reagents commonly used in 1922? A.—No, it is a very short list indeed. We had a list at the laboratory or samples of flotation agents or potential agents

For Plaintiff—E. W. Wilkinson—Direct

from a great number of producers of pine — well, I might say wood tar, coal tar products, and various chemicals and assorted substances, and I should imagine that the current list in 1922 was four or five times that size. The reagents were used in the laboratory for use in testing ores as they came in, or as the reagents that we were using at the moment seemed to need a bit of help.

Q. 108.—Were these reagents which you have discussed used alone or in combination? A.—As I said before, we very early came to the use of reagents in combinations. It was extremely seldom  
10 that we thought of getting a result on an ore by the use of only one flotation agent, and we preferred to use combinations such as cresylic acid and fuel oil, or pine oil.

Q. 109.—What was the purpose of the latter combinations? A.—In the latter combination the fuel oil functioned almost exclusively as a collecting agent, the pine oil supplying the frothing power needed to carry on the process.

Q. 110.—Would it be usual to use any other reagent in addition to those two? A.—Yes, we used very widely varying combinations of flotation agents. Those are just two examples. For in-  
20 stance, Anaconda used hardwood creosote and kerosene acid sludge in an enormous tonnage; and then besides the flotation agents in use, it was almost the rule to employ one or more modifying agents. The non-frothing agents I have discussed, and also the non-floating.

Q. 111.—So that you might have as many as three or four that would be used— A.—I have seen eight or ten, where a man was getting a bit fancy in a test.

Q. 112.—Eight or ten different reagents? A.—Different reagents.

Q. 113.—Did you have particular combinations of reagents for  
30 particular ores? A.—Not to any great extent. In testing an ore we had our favorite compounds, which we found by experience to be very useful, and we would start with those, and before we had finished we would make modifications in the combinations, both as regards ingredients and quantities of ingredients, until we found what we thought was the best, so that each ore finally had practically its own reagent combination.

Q. 114.—What would the weight of the reagent combination —what relation would the weight of the reagent combination bear to the tonnage of ore used? A.—Based on the tonnage, the  
40 weight of the reagent — the total weight of the reagent was very often in the neighborhood of one-tenth of one per cent — perhaps two pounds, sometimes as high as four, sometimes lower, not less than one pound per ton of ore treated; with this exception, that where modifying agents were used, that would be in addition to the flotation agents and in somewhat higher proportions—sometimes appreciably higher.

For Plaintiff—E. W. Wilkinson—Direct

Q. 115.—Now, in 1922 was it standard practice to condition the circuit in which the pulp flowed? A.—By “conditioning” is commonly understood pre-mixing of the ore pulp with its reagents, using the word “reagent” in the broad sense, prior to the introduction of air and/or the removal of froth; that is a certain time of agitation which sometimes—which was quite often employed, where the pulp was stirred with its reagents but no flotation took place, to give the reagents a chance to do their work.

10 Q. 116.—My question was not directed to that— A.—It was with regard to conditioning?

Q. 117.—What circuits were generally used— A.—Oh, I thought you meant an entirely different thing. The ore was treated in acid, alkaline and neutral circuits—not the same for all ores; it could be acid, alkaline or neutral.

Q. 118.—And was the use of these circuits normal practice? A.—Yes, it depended on which modifier you used. If you used sulphuric acid as a modifier, the circuit was acid, and if you used lime or sodium carbonate the circuit would be alkaline. As a rule, where no modifier was used, the circuit would be neutral.

20 Q. 119.—Would some ores float better when the circuit was made alkaline? A.—Yes. That was why it was made that way.

Q. 120.—And would some ores float better with an acid circuit? A.—Yes, that was why they used acid. It was a matter of testing to determine that.

Q. 121.—Do you know of any mine which made—any mill which made its circuit alkaline in 1922 with the use of lime? A.—Yes. For one example, the Magma Copper Company in Arizona used lime extensively. I saw its operations.

30 Q. 122.—So far as you remember, how long had the use of alkaline circuits—circuits made alkaline been part of flotation practice? A.—I think since before 1915 it had been found to work in practice, and when put into regular use it developed very fast.

Q. 123.—Its use developed? A.—Its use developed very fast.

40 Q. 124.—Will you please describe, Mr. Wilkinson, the procedure which was followed in your laboratory in making a test on an ore? A.—When an ore came into the laboratory for the ordinary commercial test, with the object of finding out the best conditions to be set up in its practical treatment at the mine, it was received and noted, and the sample of the ore was taken and ground fine, to perhaps 60 mesh or 100 mesh, depending on the case. A certain charge of this, very often between one and two pounds, was weighed out and introduced into a laboratory flotation machine, which was from a third to half full of ordinary tap water. The mixture was stirred and the reagent additions were made in known quantities, and the volume of water increased so that the pulp nearly reached the top of the machine. Air was introduced,

For Plaintiff—E. W. Wilkinson—Direct

and that through the bottom of the machine in the type commonly used. As the air came into the pulp, the level rose and a froth formed on the top of the agitated pulp, and was overflowed or scraped off. This constitutes the concentrates, which were thus separated from the main body of the pulp. The residual pulp, which was by far the larger proportion of the water, was taken out of the machine and constituted the tailings. Where the result appeared to warrant it, both products were filtered and dried and assayed, and the results were worked up, though quite often the  
10 whole test was thrown out if no useful result had been obtained with the conditions in the circuits.

Q. 125.—How did the results of work in your laboratory machine compare with work in a mill? A.—They compared very well—surprisingly well, so that we were able to prescribe very closely the nature and quantity of reagents that would be found best in practice in our operations. We were also able to foretell very closely the metallurgical results, and a great number of plants were installed on the basis of these small laboratory tests.

Q. 126.—Must an experienced operator of a laboratory testing  
20 flotation machine have the products assayed in order to be able to determine whether or not a test gives a good result? A.—An experienced man can tell without assays whether the line he is working on is worth following, and whether the test is going to give a good result, in the light of the chemical assays made of the products.

Q. 127.—He does that merely by inspection? A.—He does that by inspection.

Q. 128.—What does he look for? A.—He looks for a good  
30 working froth, as we call it; that is, one that is mechanically sound and complete, that can be easily removed from the surface, and one that contains enough mineral to assure a chance of a good recovery of the values.

Q. 129.—The presence of a mineral can be determined by eye? A.—By eye. You can tell by the colour, and, knowing the ore, by watching the ore you can tell about how much froth you should have to give a decent result.

Q. 130.—Is that true of flotation operations conducted with xanthate? A.—Yes, that is true of all flotation operations.

Q. 131.—Isn't it particularly true of xanthate? A.—Xanthate  
40 gives a particularly startling effect in the appearance of the froth, which you can't miss. Immediately upon the addition of xanthate to an already frothing pulp, for instance, there is a rather startling brightening of the surface and bringing out the natural colors of the minerals. There is also notable a sort of cleaning up of the slimes in the main pulp body. They also tend to take on the natural color of the gangue minerals, instead of, as they would



For Plaintiff—E. W. Wilkinson—Direct

otherwise, carrying certain coloration from sulphide minerals which had escaped the froth for the time being.

Q. 132.—You say they take on the color of the gangue minerals?

A.—The slimes.

Q. 133.—The slimes take it on? A.—Yes.

Q. 134.—I show you a drawing of what purports to be a Minerals Separation North American Corporation laboratory sub-A machine, and ask you if it fairly represents the laboratory testing machine in use in 1923.

10 BY MR. SMART: '23 or '22?

BY MR. COHEN: '22, I mean.

A.—Yes, this does show it; this is the laboratory machine. That was used to take the place of a commercial sub-aeration flotation machine for which I had a patent.

Q. 135.—By “commercial machine” you mean a machine for doing large-scale work? A.—Large-scale work—commercial work in a plant at the mine.

BY MR. COHEN: I offer that in evidence. This will be plaintiff's exhibit—

20 BY MR. SMART: They will have to be all re-numbered at the trial anyway, so you can start with “1.”

BY MR. COHEN: I offer the drawing as “Plaintiff's Exhibit 1.” (Drawing marked “Plaintiff's Exhibit 1.”)

Q. 136.—Are you familiar with the use of xanthate in flotation?

A.—Yes, I have used it myself and I have seen very many reports of its use by others.

Q. 137.—Have you used it extensively? A.—Quite.

Q. 138.—In your experimental work? A.—Yes.

30 Q. 139.—When did you first start using it? A.—Either late in 1923 or early in 1924 I started to make experiments with xanthate in flotation.

40 Q. 140.—In what respects did it improve results in flotation? A.—Quite a number. Under given conditions the use of a very small amount of xanthate tends to appreciable increases in recovery of mineral; it also tends to the production of better grade concentrates and promotes the rejection of gangue minerals and slime from the concentrates. It gives what are called better working conditions—that is, the attendant or operator of a practical machine is relieved of a good deal of work, in that conditions are steadier and less subject to fluctuations with small variations in the composition of the ore being treated. It is possible in circuits employing xanthate to vastly improve the results of what we call selective flotation; that is, where one valuable constituent is to be floated separately from another similar constituent. I mean there that flotation is effected sometimes in two stages, as in a lead-zinc ore, where it is desired to separate

For Plaintiff—E. W. Wilkinson—Direct

the lead and the zinc concentrates by flotation if possible. This is a very important improvement over previous practice. It has been found that the concentrates from flotation circuits employing xanthate filter very much better in a number of cases than they would if obtained in the absence of xanthate. This is important on account of the high cost of filtering equipment.

10 Q. 141.—How about the characteristics of the froth? A.—Well, that was perhaps touched on in speaking of the ease of operation. An excellent froth is obtained. It is steady and carries its weight well and flows freely, carrying away the values. It is what we might describe as a more fool-proof froth than is often obtainable in the absence of xanthate.

Q. 142.—Has xanthate made possible the working of ores that would otherwise be uneconomic to mine? A.—Yes, I believe it has. There have been a number of cases of ores of border-line value, where only the very highest recovery will glean a grade of concentrate which would make it economically possible to mine and treat the ore. This is particularly the case in very low-grade copper ores.

Q. 143.—Porphyry? A.—The so-called porphyry type of ore.

20 Q. 144.—In what class of reagents, as you have defined the classifications before, would you place xanthate? A.—It is a modifying agent. It is incapable of effecting flotation by itself; it does not froth, and is not a collector in the sense in which I have used that word.

30 Q. 145.—What are its distinguishing characteristics? I mean distinguishing it from other modifiers? A.—Other modifying agents or modifiers. Well, other modifiers I have mentioned have been sulphuric acid for one, which produces an acid circuit. Xanthate does not do that. Sulphuric acid is a soluble liquid. Xanthate is a solid. Sulphuric acid is inorganic. Xanthate is organic. Sulphuric acid affects the surface tension of the water in the pulp. Xanthate does not.

Q. 146.—Isn't that surface tension effect—isn't the absence of the surface tension effect peculiar to xanthate, as distinguished from other modifiers?

BY MR. SMART: You are leading him a little. A.—I beg your pardon?

BY MR. SMART: You are leading the witness a little, I am afraid. A.—Shall I answer?

40 BY MR. COHEN: I will try not to lead him.

Q. 147.—I think you might answer.

BY MR. SMART: I am not pressing my objection at this time. A.—It is a peculiar effect, and I determined that myself in the laboratory here in San Francisco, and was considerably surprised at the result I obtained. Most modifying—all modifying agents used

For Plaintiff—E. W. Wilkinson—Direct

before xanthate—that includes sodium carbonate as well as the sulphuric acid I have talked about—have an effect on the surface tension of the water in the pulp. Xanthate I found had no effect.

BY MR. COHEN: Q. 148.—In what quantities—A.—You are talking about differences. There is this difference in regard to the effect on filtration. That is not an effect on flotation, but there is a difference in the modifying agents; it has that difference outside the flotation circuit, but it is still there—the difference.

Q. 149.—In what quantities is xanthate used? A.—Nowadays  
10 it is used in the most minute quantities, and then it is perhaps one fiftieth of a pound, or possibly even less—one-fiftieth of a pound of xanthate to the ton of ore being treated. Most of the other modifiers hitherto used—all of them were used in very much larger quantities.

Q. 150.—Which, for example? A.—For example, sodium carbonate, four pounds to the ton. Not one-fiftieth, but four pounds per ton, would be a very reasonable amount to use. Lime has been used up to as high as twenty pounds to the ton. Acid was used at probably a minimum of five pounds, and often a great deal more.  
20 I know of no use of lime or sodium carbonate—I have given a lower limit for acid. Lime and sodium carbonate, as I said, I know of no use below a pound or two to the ton at the lower limit. Generally four or five pounds, and that would be considered fairly low.

Q. 151.—What about the effect of xanthate in the re-treating of concentrates? A.—That is rather an interesting thing about xanthate, wherein it differs quite a bit from other modifying agents. The xanthate effect appears to follow the concentrates so that on re-treating them—that is, putting them through flotation again—the xanthate effect and result follow with the concentrates without the addition of further reagent.

30 Q. 152.—And that although most of the xanthate appeared to have gone into the solution? A.—A lot of it goes into the solution; a great deal of it goes into the solution, when it has done its work; it will last for quite a long time, even in further treatment.

Q. 153.—Do you know of any other modifier which does that? A.—No, I think xanthate is unique in that.

Q. 154.—Are there many modifying agents which are organic compounds? A.—There are a few, but not very many besides xanthate, and a number of other organic compounds are known to have modifying properties, but there are very few, if any, in use  
40 today.

Q. 155.—Do you know a man named Rutherford B. Martin? A.—Quite well.

Q. 156.—You knew him sometime before 1920, when you came to the laboratory? A.—Yes, quite some time.

Q. 157.—Did you find him working there when you came to the laboratory? A.—Yes.

For Plaintiff—E. W. Wilkinson—Direct

Q. 158.—What was Martin's position there? A.—He didn't have any title there, but he did a great deal of research work along the lines of trying to develop new flotation agents for flotation treatment of ores. He did a certain amount of flotation work, a little on commercial tests, and more in connection with reagents he was attempting to develop. He also spent a good part of his time in the preparation and collection of materials and apparatus for litigation work, where we would set up laboratories in the town in which court was held, or for demonstration in court.

Q. 159.—You and he were both employed in the Long Island City laboratory from the time you came there in September, 1920, until Martin left? A.—Yes.

Q. 160.—Do you know when it was that he left? A.—1926.

Q. 161.—At the time or shortly after you came to the laboratory did you have a discussion with Martin with respect to some inventions he had made? A.—Yes, ever since I had known Martin he had discussed with me a number of reagents which he had developed or put together and used, and he used to discuss these with me at some length, and seemed rather surprised that I had not used them, and tried to do a little missionary work with me.

Q. 162.—What reagents did he mention to you? A.—Those he mentioned in particular were what he called re-constructed oils of various types, also a sulphidizing agent which he christened by the fancy name of "kotrix." He also used another reagent which he was very fond of and called "calura." They both contained alkaline sulphides and were used for sulphidizing purposes.

BY MR. COHEN: Will you read that answer, please.  
(Answer read.)

A.—Excuse me. I might go on.

Q. 163.—Yes, surely. A.—He mentioned other reagents which he had put together or proposed to put together. One of them I remember was called copper anilide, and I saw him do a great deal of work on this, although I never saw any particularly good results.

Q. 164.—That was something he developed after he came to the laboratory— A.—Yes, I saw the developing of it.

Q. 165.—Were there any others? A.—I don't think so.

Q. 166.—Did he ever mention to you "Stanol"? A.—No, not at any time.

Q. 167.—Did he ever recommend to you— A.—You are referring to when I went to the laboratory in Long Island City, or what date in particular?

Q. 168.—Ever. A.—Ever?

Q. 169.—Did he ever recommend—A.—No, he never recommended "Stanol" to me at any time.

For Plaintiff—E. W. Wilkinson—Direct

Q. 170.—Did he ever recommend to you the use of xanthate in flotation? A.—Only after we were aware of Keller's disclosure of its use.

Q. 171.—Can you fix how long after that was? A.—Fairly shortly after that. There was discussion of xanthate in the laboratory after we had been informed of Keller's invention, and he took part in the discussion. In that sense he mentioned xanthate to me, but in no other at that time.

Q. 172.—He never recommended it to you? A.—He never  
10 recommended it to me at all. I think he was rather hostile to the idea.

Q. 173.—Rather what? A.—Rather hostile to the idea. He wanted to see his own reagents put forward.

Q. 174.—When did you first hear mention of xanthate as a flotation reagent? A.—In April, 1923.

Q. 175.—What was the occasion? A.—I was working in the Long Island City laboratory, among others, and Mr. Chapman, the assistant chief engineer, and Mr. Higgins, chief metallurgist for the company, came over on one of their frequent trips from the head office and informed those of the staff there working of a report from  
20 San Francisco of Keller's discovery of xanthate as a flotation agent. There were the three of us working in the same comparatively small room at two flotation machines, testing machines, when Chapman and Higgins came in and told us of this discovery and claims made for it.

Q. 176.—Is Mr. Chapman dead? A.—Yes. And following this disclosure there was a certain amount of discussion, in which we all took part.

Q. 177.—Did Martin take part in the discussion? A.—Yes. Answering one of your previous questions, I suppose that was the first time he mentioned xanthate or used the word.

Q. 178.—You use the word "mentioned" in that limited sense?  
30 A.—Yes.

Q. 179.—Who else was present at that discussion? A.—Mr. Trotter was present.

Q. 180.—Who is Mr. Trotter? A.—He was—he didn't have any title at the time.

Q. 181.—He was employed by the company? A.—He was employed by the company.

Q. 182.—And worked in that laboratory? A.—And worked in that laboratory steadily. I have already mentioned Martin.

Q. 183.—Did Martin at that time or any subsequent time in  
40 your presence say in substance or in words that he was the discoverer of xanthate in flotation? A.—No.

Q. 184.—Were you shown certain reports concerning the discovery which were made by Mr. Keller and his associate, Mr. Lewis? A.—Yes, I saw several reports by them.

For Plaintiff—E. W. Wilkinson—Direct

Q. 185.—I show you a report dated March 28th, 1923, signed by Cornelius H. Keller and C. P. Lewis, and ask you if you remember being shown that report? A.—Yes, I was shown that report and read it.

Q. 186.—When? A.—Very shortly after the discussion I just mentioned, when Messrs. Chapman and Higgins informed us of the results of the San Francisco xanthate work. Their information was apparently based on this report.

BY MR. COHEN: I offer the report in evidence as "Plaintiff's  
10 Exhibit 2."

(Report marked "Plaintiff's Exhibit 2.")

Q. 187.—I will show you a report dated May 3rd, 1923, signed by the same persons, and ask you whether you were shown that report? A.—Yes, I saw and read this report.

Q. 188.—When? A.—Shortly after its receipt.

BY MR. COHEN: I offer this as "Plaintiff's Exhibit 3."

(Report marked "Plaintiff's Exhibit 3.")

BY MR. SMART: That is the May 3rd one?

BY MR. COHEN: That is the May 3rd one, the Keller and  
20 Lewis report of May 3rd and the covering letter.

Q. 189.—I show you another report of the same two persons, dated May 11th, 1923, and ask you whether you were shown that report at or about the date it was received in New York? A.—Yes, I saw this report too.

BY MR. COHEN: I offer it in evidence as "Plaintiff's Exhibit 4."

(Report marked "Plaintiff's Exhibit 4.")

Q. 190.—Were the reports of the work which was being done in San Francisco on xanthate discussed in the Long Island City laboratory? A.—The information we received was discussed at  
30 length, although we didn't all perhaps see each report, but the information received by us was discussed at some length, and of course continuously extra news came in.

Q. 191.—Did you see a telegram which was sent by Mr. Nutter to the New York office of Minerals Separation on June 15th, 1923, in which he commented on certain work being done at Anaconda with xanthate, and said that the results "created quite a furore"? A.—Yes, I saw that telegram. There was some discussion of that statement—some discussion in the laboratory of that statement in the telegram.

40 Q. 192.—And what was the tenor of that discussion? A.—The tenor of the discussion was to the effect that Mr. Nutter seemed very enthusiastic on rather short notice.

BY MR. COHEN: I will introduce that in evidence. I offer a copy of the telegram as "Plaintiff's Exhibit 5."

For Plaintiff—E. W. Wilkinson—Direct

(Telegram marked "Plaintiff's Exhibit 5.")

Q. 193.—Did you receive any instructions to keep the reports of the xanthate discovery secret in the laboratory? A.—No, none whatever. We were not supposed to talk about it outside.

Q. 194.—Was there any effort made by you to keep it secret? A.—No.

Q. 195.—Was Martin excluded from the discussions about xanthate? A.—No, he was not excluded from any discussions that I know of. We worked together in the laboratory and moved freely  
10 about, and it was the custom to discuss with each other the results we were getting on the work to which we were assigned, and anything else of interest that came up.

Q. 196.—Were relations among the employees in the laboratory friendly? A.—Very friendly. We used to take our lunch together and discuss together anything that came up. We even had a certain amount of association outside of working hours.

Q. 197.—Was it the practice for each of you to follow the progress of the others' work in the laboratory? A.—We all showed  
20 interest in the work that the other fellow was doing, and were generally kept informed as to what it was. We didn't try to be intrusive, but there seemed to be no need whatever under the conditions under which we worked.

Q. 198.—As a matter of fact, your laboratory couldn't have run successfully— A.—You couldn't keep secrets in that laboratory, and it wouldn't have run successfully if we had not had each other's confidence.

Q. 199.—That included Mr. Martin? A.—Pardon me?

Q. 200.—That included Mr. Martin? A.—Oh, yes.

Q. 201.—After a lapse of some months did reports as to the  
30 xanthate discovery and its use in the field appear in the technical press? A.—Reports began to appear as to its use, or experimental use at first, in the practical field, such reports being in the technical press.

Q. 202.—I show you an extract from the Engineering and Mining-Journal Press, dated February 9th, 1924, and ask you whether you remember reading that article? A.—Yes, I particularly remember reading this one, it being in the form of an editorial, and we being very interested in the reaction of the mining public to our new reagent.

Q. 203.—What was the passage in that article which attracted  
40 your attention? A.—Particularly the passage referring to reagent "Z", which stood for xanthate among other reagents they were discussing, and in that passage the peculiar statement that "Z" does not require a frothing agent. The statement is absolutely wrong.

For Plaintiff—E. W. Wilkinson—Direct

Q. 204.—So far as you know, was this the first reference in the press to the use of potassium xanthate as a flotation reagent?

A.—I think it is the first editorial comment, though I wouldn't be certain that some mention by one of the papers may not have appeared which our field representative didn't call our attention to — which didn't call their attention to us so strongly as an article like this, because we were previously aware of what was being done.

Q. 205.—The interest in this would be the editorial? A.—The editorial. It was a sort of official comment on it.

10 BY MR. COHEN: I offer the article from the Engineering and Mining-Journal Press, dated February 9th, 1924, as "Plaintiff's Exhibit 6." That exhibit is from Volume 117, No. 6, pages 233 and 234.

(Said article marked "Plaintiff's Exhibit 6.")

Q. 206.—I show you another editorial from the same journal, Volume 118, No. 5, page 184, and ask you if you remember reading this editorial, which contains the following passage:

"A newer class of reagents, which may be used either with or without those already mentioned, includes—"

20 It mentions among other things potassium xanthate. I ask you do you remember seeing that editorial?

BY MR. SMART: Did you give the date of it? A.—August 2, 1924.

BY MR. COHEN: The date is August 2, 1924. A.—Yes, I have seen this. I don't know whether I subscribed to the content of the matter or not. I don't remember.

BY MR. COHEN: I offer this in evidence as "Plaintiff's Exhibit 7."

(Said editorial marked "Plaintiff's Exhibit 7.")

30 Q. 207.—I show you an abstract from the same publication of October 18, 1924, page 635, and ask you whether you remember seeing that reference to the issuance of a patent to Ludwig Rosenstein for a method of producing alkali metal xanthates — Mr. Rosenstein being mentioned as a former employee of the first producer, "the first plant to make and sell potassium xanthate in large quantities to flotation operators." A.—Yes, I remember seeing this.

BY MR. COHEN: I offer this in evidence as "Plaintiff's Exhibit 8."

(Said abstract marked "Plaintiff's Exhibit 8.")

40 Q. 208.—I show you another editorial from the same journal, Volume 118, No. 21, of November 22nd, 1924, in which, in discussing the flotation situation, it is stated:

"A recent introduction, for which the Minerals Separation research engineers seem to be responsible, is the use of potassium and sodium xanthates as flotation reagents. These salts are now



For Plaintiff—E. W. Wilkinson—Direct

being used by several of the larger companies, with a marked improvement in recoveries; they have proved of value in selective work and in some instances in the flotation of oxidized mineral. The use of xanthate is one of the most important advances made in the technology of the flotation process in recent months."

I ask you whether you remember seeing that editorial?  
A.—Yes, I well remember seeing this. I made it a point to hunt up all references to Minerals Separation in the technical press in any case, and I remember that one particularly.

10 BY MR. COHEN: I will offer that in evidence as "Plaintiff's Exhibit 9."

(Said editorial marked "Plaintiff's Exhibit 9.")

Q. 209.—I show you an extract from the same journal of November 1, 1924, page 713, which carries a reference to the issuance of a patent to Ralph E. Sayre covering the use as a flotation agent of a heavy metal xanthate in a non-acid pulp, and ask you whether you remember seeing that? A.—Yes, I saw that.

BY MR. COHEN: I will offer this in evidence as "Plaintiff's Exhibit 10."

20 (Said extract marked "Plaintiff's Exhibit 10.")

Q. 210.—I show you finally a cover and leading article in the same journal for December 20, 1924, the article being entitled "Analysis of Xanthate, First Published Method of Determining Its Purity," and ask you whether you remember seeing that cover and reading that article? A.—Yes, I saw that cover and I read the article more than once.

BY MR. COHEN: I offer this in evidence as "Plaintiff's Exhibit 11."

(Said cover marked "Plaintiff's Exhibit 11.")

30 Q. 211.—Where did you see all these articles? A.—Most of them I saw at the Long Island City laboratory — perhaps all of them.

Q. 212.—Will you describe the physical layout of that laboratory? A.—Do you want the lower floor as well as the upper floor?

A. 213.—The upper floor. A.—Pardon me?

Q. 214.—The upper floor. A.—On the upper floor were three rooms, one fairly large room, in which were chemical benches around the walls, and in the middle of the room, and a set of shelves on which the apparatus was kept, a sink, and all that sort of thing.  
40 This was at the back of the building. At the front were two small rooms, one leading from the other. In the inner room were two roll-top desks and a set of book shelves, the desks being for the use of Mr. Higgins and Mr. Martin. The other upstairs room, through which this was entered, contained a large flat-top desk, with drawers, in the middle of the room, shelves containing apparatus,

For Plaintiff—E. W. Wilkinson—Direct

a chemical balance, a bullion balance, a calculating machine. At the large desk in the center we used to sit and write up our notes, and Mr. Trotter and I shared the drawers in this desk, usually sitting opposite to each other. On the desk we usually piled a number of copies of technical papers, which we either had read or proposed to read. These papers were received regularly by Mr. Higgins, who was a subscriber to them.

Q. 215.—You mean by “these papers” the Engineering and Mining Journal— A.—They were the Engineering and Mining  
10 Journal and Chemical and Metallurgical Engineer. In his absence from the laboratory we had his permission to open them and read the contents, which we did, and which contents we discussed together frequently over the lunch hour or during it.

Q. 216.—Were copies of these magazines left in this large room that you mentioned, or— A.—No, sir, they were opened and taken away from his desk, and they would be left on the table for quite a period of time, but available to anybody, and frequently open at the page of anything the first reader thought interesting,  
20 such as those editorials and articles which I have recently identified for you as having seen.

Q. 217.—The table you mentioned was in the room which was the common room for— A.—It was a sort of common room for the staff working there—so much so that in bad weather we would send out for sandwiches and eat them at that table, all of us together.

Q. 218.—During the latter part of 1923, and '24, was any work being conducted with xanthate in the Long Island City laboratory?  
A.—Did you say 1923 and '24?

Q. 219.—1923 and '24. A.—Yes, work was being done. I  
30 remember a sample of xanthate was received for analysis and test as a flotation agent. Samples were made in the laboratory. I think Martin worked on some samples of xanthate at that time—I know he did.

Q. 220.—Did he ever say to you that he had discovered the use of xanthate in flotation? A.—No.

Q. 221.—During this period 1923 to '24? A.—No, he never said a word to that effect at all.

Q. 222.—Prior to his retirement from his employment with Minerals Separation in 1926 did you hear from any one of any claim  
40 by Martin to have discovered xanthate in flotation work? A.—Not that I remember.

Q. 223.—There was a considerable amount of interest in xanthate in the Long Island City laboratory, wasn't there? A.—Yes, particularly as time went on and its virtues became better known.

Q. 224.—It had substantial meaning for you men in the Long Island City laboratory? A.—It had great meaning. We looked on

For Plaintiff—E. W. Wilkinson—Direct  
 For Plaintiff—E. W. Wilkinson—Cross-Examination

it as something to prolong the life of the company and its position of having income-producing patents.

Q. 225.—And that was the subject of discussion? A.—That was one of the subjects. It made our jobs look better.

Q. 226.—You mentioned before that you held a patent on one of the flotation machines? A.—Yes.

Q. 227.—Do you hold any other patents? A.—This patent I mentioned was—there was another name on this patent, that of Littleford, and on my own account or joint patents I have perhaps  
 10 dozen or so patents.

Q. 228.—All in the field of flotation? A.—Practically all in the field of flotation.

BY MR. COHEN: That is all.

(Recess: 1.00 to 2.15 P.M.)

#### CROSS-EXAMINATION BY MR. SMART

XQ. 225.—Mr. Wilkinson, what was the nature of the business that you referred to of the Minerals Separation, Limited, and the companies which succeeded them in the United States? A.—They were promoting the use of the process covered by the flotation patents  
 20 they owned, with a view, of course, to collecting royalties from said use.

XQ. 226.—And the litigation work you referred to was in connection with their patents? A.—In connection with their patents, yes, sir.

XQ. 227.—Yes. Now, you have referred to these three classes of reagents, the last class being designated by you as a modifying agent. Was that a private classification of yours, or can you refer me to any scientific articles? A.—I cannot refer you to any scientific articles. I can say it was a term used by the staff of Minerals  
 30 Separation, and by men employed by other companies whom I met in discussing flotation work.

XQ. 228.—Sometimes a reagent, I gather, might be both a collecting and a modifying agent? A.—The sense in which I have been using the terms, no. I have used the expression “modifying” to distinguish a class of reagents which don’t act as collecting agents.

XQ. 229.—Which don’t act as collecting agents. Well, we will go back to the first. The first class was frothing agents. A.—The first we mentioned was collecting—well, frothing and collecting agents—I mean in point of time; we mentioned frothing and collect-  
 40 ing agents, both.

XQ. 230.—Yes. But there are the three, as I understand? A.—Yes.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 231.—The three classes which you have discussed? A.—Yes.

XQ. 232.—And a frothing agent was something to produce froth for carrying the metal values, or help in producing the froth? A.—It helped to produce the froth in which the metal values were carried.

XQ. 233.—Yes. And that was really the subject of the first patent of the Minerals Separation Company, was it not, where you used a small percentage of certain oils to produce the froth? A.—We  
10 did not call them frothing agents then. We used oils which produced the froth and—

XQ. 234.—Yes. In the classification which you referred to in your evidence, they would be frothing agents? A.—Well, not quite. The commonest agent used to carry out the first patent was oleic acid, which was a very strong oiling or collecting agent, which had sufficient frothing properties to make a froth to carry the minerals.

XQ. 235.—Then it was both frothing and collecting? A.—Yes, it collected and oiled and it produced a froth, on which the process depended.

XQ. 236.—And its collecting function depended on some effect this  
20 acid or oil had on the surface of the mineral particles. A.—Oleic acid, which we can call an oil for the present purpose, had the effect of spreading preferentially onto the surface of the mineral particles which you wanted to put into the froth.

XQ. 237.—Yes. A.—And these frothing properties then carried these particles to the surface.

XQ. 238.—That is just about what I said, isn't it? A.—Yes, I am agreeing with you.

XQ. 239.—Yes, you are agreeing with me. A.—I am putting  
30 it in my words.

XQ. 240.—Yes. So that the distinction between a collecting agent and a modifying agent does not depend on whether one or the other affects the particle of metal in the sludge—the pulp? A.—Well, I couldn't say that. A collecting agent tends to physically oil certain metal particles in the pulp.

XQ. 241.—Thereby— A.—But a modifying agent does nothing of the kind. It is not an oil, to begin with.

XQ. 242.—Yes, I know; but I don't think you, perhaps, followed  
40 me. I will put it a different way—that both affected the surface of the metal particles. A.—I don't think that is true. Modifying agents, as I have used the term “modifying,” may not affect the surface of the metalliferous particles at all. I don't know that many of them do. I do know that the collecting oils physically affect them by making the surface greasy. I don't agree that modifying agents necessarily affect the surface of any particle in the pulp, in any way that I know of.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 243.—How would they affect the particles in the pulp if they did not affect the surface? A.—If they didn't affect the surface, and if they did affect the particle, they would have to get inside the particle through the surface without affecting the surface, and I think that is impossible.

XQ. 244.—As I understand it, you have told us that these modifying agents do affect the metal particles in the pulp? A.—No. If I have said so, I was in error.

XQ. 245.—If you said so, you were in error? A.—Distinctly.  
10 I didn't say that they affect the metal particles. They modify the condition, I state, of the pulp so that its effects in the resulting froth are noticeable.

XQ. 246.—Yes, but now you are telling me that a modifying agent, in the sense in which you use the term, does not affect in any way the surface of the metal particles? Is that right? A.—No, I say that in general—I don't believe that it does. In general, it is difficult to say, because—suppose I take, for instance, sulphuric acid as a modifying agent: It might affect the surface of the mineral or the metal in the pulp, but that is not the purpose.

20 XQ. 247.—Now we are getting to the stage that modifying agents may affect the surface of the mineral in the pulp? Is that right? A.—They might, but it is extremely unlikely, and in most cases I don't think they are used for that purpose at all.

XQ. 248.—Well, I don't want you to misunderstand me. I am not talking about the purpose for which they are used, but their actual effect on these mineral particles. A.—In general, I know of no physical effect or chemical function when used strictly as modifying agents. I know of no effect on the mineral particles.

30 XQ. 249.—Then you are going back to your statement that a modifying agent, as you define it, has no effect whatever on the particles, the metal particles in the pulp? Is that right? A.—I can't make such a broad statement, as our knowledge stands today, that it has no effect whatever. It may have, and it may not, but I don't use it for that purpose and I know of no effect. There may be some effect I don't know, which I have never encountered.

XQ. 250.—You have studied a lot of these modifying agents? A.—I have studied them carefully and I have not detected an effect on the surface.

40 XQ. 251.—Well, is there any conceivable effect other than a chemical or physical one on the metal particles? A.—I can't conceive of one—no direct effect.

XQ. 252.—Yes. Now, oleic acid, which was not a modifying agent as you use that term, affected the surface of the particles by putting a film of oil on them? A.—Yes, that is the theory, and I have observed facts to support it.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 253.—Yes. And with xanthate, to what do you attribute the bright sheen in the froth? A.—I really don't attribute it to anything. I don't quite know why it gives that. I don't know what gives the bright sheen. I think it is due to strong chemical or physical action.

XQ. 254.—Wouldn't you suspect it was due to some chemical action? A.—Not to chemical action, I don't think; it is not my impression from the work I have done. If anything, physical.

XQ. 255.—Well, that color, as I understand your statement,  
10 came from the particles of mineral in the froth? A.—Yes.

XQ. 256.—So that in some way the color of those particles had been changed? A.—No, perhaps it had been cleared—the color can be obstructed by other factors in the pulp besides the actual surface of the minerals.

XQ. 257.—You mean that the color of the mineral particles may be obstructed by some dirt or film on the surface of the particles? A.—That is one very possible explanation.

XQ. 258.—Yes. And if I removed that in some way, would I not be affecting the particle either physically or chemically? A.—  
20 That is such a fine point. You would be affecting it the same way as you would affect the color of your hands by washing them.

XQ. 259. Yes. When I wash my hands, don't I take something off them? A.—Yes.

XQ. 260.—Yes, and if the mineral particles—and wouldn't my hands be affected physically? A.—I suppose they would.

XQ. 261.—Yes. Then would you not agree that these modifying agents affect physically these metal particles? A.—Certainly, they may affect them physically.

XQ. 262.—Yes, but you can't refer to any scientific article  
30 which adopts this classification you refer to? A.—You mean my classification of modifying agents?

XQ. 263.—Yes, the three different agents. A.—Practically everybody who has published any matter on flotation uses terms such as the term "modifying."

XQ. 264.—But you told me—I just wanted to confirm what you told me before—that you couldn't refer me to a technical publication where that classification was adopted as a classification. A.—I can't offhand refer to any such, no. I have seen the term used.

XQ. 265.—Yes. A.—In a broad sense.

XQ. 266.—In a broad sense? A.—Only in a broad sense is it  
40 admissible of such a connection.

XQ. 267.—There have been many scientific articles written on the theory of flotation of minerals from a pulp, have there not? A.—Yes.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 268.—And I judge that from time to time the theory of their action has changed? A.—There have been a great number of theories put forward.

XQ. 269.—Yes. There has been, in fact, a battle between those who relied on—those who thought that the effect was due to some kind of chemical action, and others who thought it was due to some kind of physical action? A.—That is correct.

XQ. 270.—Now, so far as the xanthates are concerned, whatever they may do physically, I gather you contend that they do not react  
10 in any way chemically on the metal particles? A.—I have seen the evidence adduced by those holding the chemical theory and given it consideration, but it has not been sufficient to convince me on it.

XQ. 271.—Your particular theory is that it has no reaction on these metal particles? A.—No, that is not my theory. My theory is that the effect of the xanthate is due to physical effects. That is my theory. I don't say there is no chemical effect.

XQ. 272.—You don't say there is no chemical effect? A.—I don't say there is no chemical effect. I think the effect in flotation  
20 is due to physical causes.

XQ. 273.—Yes, but there may nevertheless be a chemical effect of the xanthate on the metal particles in the pulp? A.—I haven't proved that there isn't.

XQ. 274.—You haven't proved that there isn't? A.—No.

XQ. 275.—And you are willing to conceded that there might be? A.—I am willing to conceded that there might be.

XQ. 276.—Yes. Now, I want to look at this second patent—that you referred to as the second patent. That I think you referred to as being related to as organic mineral frothing agent. A.—I  
30 think I did.

XQ. 277.—Yes. And what was the one commonly used? A.—commonly used?

XQ. 278.—Yes. A.—I can't say, for the reason that I don't know of any flotation operations of any magnitude or any frequency employing just the one reagent of that patent. Amyl alcohol is a common one.

XQ. 279.—Yes. Now, I look at the claim—the second claim, for instance, defines the process in patent 962,678, which reads:

“The herein described process of concentrating ores which  
40 consists in mixing the powdered ore with water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture to form a froth and separating the froth.”

Now, the term “organic mineral-frothing agent” would include a very wide range of substances, would it not? A.—Yes.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 280.—The relative effect such substances might have could presumably only be told by tests? A.—That is practically so. That is the way we found those things out.

XQ. 281.—Yes, the way you found those things out. And you tried one after the other of these different ones that would come within that class? A.—Yes, in the class of organic frothing agents soluble in water.

XQ. 282.—Yes, frothing agents which were soluble in water. Now, I notice that there are some illustrations given in this patent,  
10 and I am reading from line 30:

“Among the organic substances which in solution we have found suitable for use as mineral-frothing agents with certain ores are amyl acetate and other esters: phenol and its homologues; benzoic, valerianic and lactic acids; acetones and other ketones such as camphor.”

Now, that would include a very large number of compounds? A.—Yes. it would.

XQ. 283.—And one of those that was commonly used was oleic acid? A.—But not as a soluble frothing agent.

20 XQ. 284.—Not as a soluble frothing agent? A.—It was not within the scope of this patent.

XQ. 285.—Yes. Now, reverting to your classification, how would you define or classify the agents which I have just named? A.—As soluble frothing agents.

XQ. 286.—They are all frothing agents? A.—Soluble frothing agents.

XQ. 287.—And not collecting agents? A.—I won't say that. They have the property of acting to cause a froth, which also collects to a certain extent; they were not oiling agencies, if that is what you  
30 mean, Mr. Smart.

XQ. 288.—Well, I am trying to adhere to your classification. A.—Well, the term “collecting” I have used mainly to cover oiling agents, oiling flotation agents, but some of the oiling flotation agents which are not soluble have frothing properties. There is a little bit of an overlap in there. you know.

XQ. 289.—Well, I wish you would—well, perhaps we will take these one by one. Take it one by one, as you did with my learned friend. A.—I think I could make a statement that would cover it, to save that labor.

40 XQ. 290.—Yes. A.—But if you want to do it that way, all right.

XQ. 291.—No, whichever way is the quickest. A.—Essentially I would say that soluble frothing agents of this patent which we are discussing are frothing agents with possibly some small collecting property, but essentially they are frothing agents as distinguished from what I have called collecting agents.



For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 292.—But some of these have collecting properties? A.—Some of them might have a little collecting property and—

XQ. 293.—Yes. Perhaps they vary. A.—There is a bit of an overlap in there. Something depends on purity.

XQ. 294.—Yes. Now, the first one is amyl acetate and other esters. Now, how would you classify those? A.—I would classify them as frothing agents.

XQ. 295.—With collecting properties? A.—I wouldn't bother about the collecting properties. They would be so small in the sense  
10 I have used "collecting" so far.

XQ. 296.—Would they have any modifying effect? A.—Not in the sense I have used the term "modifying."

XQ. 297.—But they might have some effect on the metal particles? A.—No, I wouldn't say that at all.

XQ. 298.—None of them—none of the esters are within that class? A.—There is no chemical effect on the metalliferous particles.

XQ. 299.—Or physical? A.—And the physical effect, as I understand it, is in so affecting the ore pulp that an attachment of air to mineral, which is useful in making a froth, is effected. For  
20 all I know, that effect might be purely and simply on the air.

XQ. 300.—Well, would you go so far as to deny that would have any effect on the metal particles? A.—I don't go so far as to say that. I do not believe that they have; I haven't any evidence to that effect.

XQ. 301.—You haven't any evidence to that effect? A.—No. I don't believe they do.

XQ. 302.—And what about the phenol and its homologues? A.—The same.

XQ. 303.—And these benzoic, valerianic and lactic acids?  
30 A.—I think it is the same.

XQ. 304.—When they were used in practice, what was generally used with them? A.—With what?

XQ. 305.—With these soluble organic agents described in this patent? A.—When used, there was nearly always used with them some flotation agent of the collecting class.

XQ. 306.—Such as—. A.—Fuel oil, kerosene, stove oil, coal tar, et cetera.

XQ. 307.—Now, going back for a moment to the esters, is it not true that certain xanthic esters are collectors? A.—I don't  
40 know offhand. I am not a chemist, so I can't give you anything scientific along the chemical line.

XQ. 307.—Well, did you ever see any experiments conducted in either of your laboratories, and the result of the experiment with regard to diethyl thiocarbonate? A.—I think I may have.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 308.—And did not those experiments show that that substance was a collector? A.—No, not that I remember.

XQ. 309.—Well, I will come to the details of that later. Now, you referred to certain research work with which you were familiar in the period of 1915 to 1922, but you did not mention the work carried on by Perkins, Sayre & Corliss, of the Mellon Institute. Were you familiar with that? A.—I was not familiar with the work. When was that performed? Was there any special time, or just in that range 1915 to '23?

10 XQ. 310.—Well, some of the results were embodied in a number of patents which were issued in 1917, '18 and '19. A.—Well, I have seen those patents at one time and another, and I have seen articles in the press, perhaps, referring to some of their results.

XQ. 311.—And those related to certain organic collecting agents which were not frothing, did they not? A.—Did they? I don't remember. If you have the patent there and it says so, that is all right.

XQ. 312.—Well, I suppose you are familiar with the Perkins patent—. A.—I am not familiar with it now. I have forgotten.  
20 I have seen it and have been fairly familiar with it.

XQ. 313.—Well, I suppose the Perkins Patent, No. 1, 364,304, which was involved in the suit between the Metal Recovery Company and Anaconda, was not one that would likely escape your attention. A.—Oh, no, I have seen it—there is no question of that, but I am just saying that I am not familiar with the details of it at the present.

XQ. 314.—And that patent refers to agents which you would classify in the second group as collecting agents. A.—Not that I know of. I don't think so. I don't think I referred to anything of that nature as a collecting agent. A collecting agent has to be a  
30 froth-maker.

QX. 315.—Well, I thought the first thing was a froth-maker. A. Well, the collecting agent also makes froth; it helps to make froth.

XQ. 316.—Then these would be modifying agents in your classification (indicating in document)? A.—I think that would be a better classification.

XQ. 317.—I will just read this sentence here, which will probably enable us to clear up this difficulty. On line 28 it says:

40 “Among the agents which are of particular value as collecting agents, and which are substantially non-frothing, are reduced compounds which are relatively easily oxidizable, such as, for example, diazo-amino-benzene.” A.—Yes.

XQ. 318.—Now, that in your classification would be a modifying and not a collecting agent? A.—It would be. I have done experiments with it.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 319—And then he also refers to “aromatic thio-urea,” and many of the azo and diazo compounds. They would be quite a class of compounds. A.—I should think so.

BY MR. COHEN: I didn’t get the question.

THE WITNESS: They would be quite a wide class. That would be my answer. He asked me, they would be quite a wide class, and I said I thought so.

BY MR. SMART: XQ. 320.—Yes. Those would be, I think you have already told me, modifying agents? A.—I don’t know  
10 about that. I don’t know how they worked. I don’t know that.

XQ. 321.—You didn’t try them? A. —No. I tried the diazo-amino-benzene.

XQ. 322.—Yes. There were several of those on the market, I think—one with what they called T.T., was it? A.—There was a T.T. mixture.

XQ. 323.—And what was that? A.—I don’t know that these referred to in this patent were on the market. Some might have been on the market—or just proposed in the patent.

XQ. 324.—Now I am going on to the ones that are now on the  
20 market. Now, what was the T.T.? A.—I believe that was used to some extent.

XQ. 325.—What was that? A.—I don’t know offhand; I couldn’t tell you offhand. You will find it in the patent—one of those patents. It is one of those chemical things I don’t know so very much about.

XQ. 326.—And there was an X-cake on the market? A.—I believe so—yes, it was used to quite an extent.

XQ. 327.—Now, that would be in your classification a modifying agent? A.—No, it happened that was a very good frothing  
30 agent.

XQ. 328.—It was a very good frothing agent? A.—It was used by the Magma Copper Company.

XQ. 329.—And you would regard that either as a collecting agent or a modifying agent? A.—It was a very fine frothing agent.

XQ. 330.—Yes. A.—I don’t think it was a modifying agent. It may have had some collecting properies, because they were able to get an excellent running froth with it. It was a flotation agent, as I understand it.

XQ. 331.—Now, you said you were familiar with the alpha-  
40 naphthylamine? A.—That was X-cake. That X-cake was crude alpha-naphthylamine.

XQ. 332.—Yes. And that was used with oil generally? A.—I don’t remember seeing it used with oil anywhere.

XQ. 333.—I notice in the patent it says, line 34:

For Plaintiff—E. W. Wilkinson—Cross-Examination

“In using the alpha-naphthylamine it may be added to the ore either alone or with added amounts of oil, in any suitable manner.”

That would indicate that it could be used with or without oil?  
A.—I know in the process of the second Minerals Separation patent which has been brought up, alpha-naphthylamine was soluble in water.

XQ. 334.—And it would be a modifying agent? A.—No. I told you it was a frothing agent and soluble in water. It was applied at the Magma Copper Company’s plant in a water solution. Any collecting properties it may have had might have been due to impurity in the form in which it was applied.

XQ. 335.—And that was introduced in small amounts to the pulp? A.—Quite small amounts, yes.

XQ. 336.—One-half pound or so? A.—I don’t remember, but it was of the same order as used with other soluble frothing agents, such as amyl acetate or phenol.

BY MR. COHEN: Will you read the answer, please? (Answer read.) A.—That was in quantity, that was of the same order.

20 BY MR. SMART: Yes. A.—With other soluble frothing agents.

XQ. 337.—Then I notice that Mr. Corliss took out a patent 1,228,184, for nitro-naphthalene. How would you classify that? A.—I don’t know how it would work in flotation.

XQ. 338.—Then there was a patent of Perkins & Sayre, 1,364,307, which gave quite a long list of nitric and sulphur compounds. Were you familiar with those? A.—I am not familiar with them, but I have seen the patent, about at the time it came out.

30 XQ. 339.—Now, I see this statement made at line 96 of this patent 1,364,307:

“Certain of the flotation agents above referred to have been found to have a marked action as collecting or mineral modifying agents, even where they have little, if any, frothing qualities.”

Now, that would be a use of the term “modifying”, which would agree with your own? A.—You said “collecting or mineral—”

XQ. 340.—“Modifying agents.” A.—Modifying agents?

40 XQ. 341.—Yes. A.—No, it is not correct in the sense in which I use the term “modify.” I tried to make it clear that by “modify” I mean having an effect on the pulp, without specifying whether it is on the mineral or the gangue or the water, or what. In any case, you have in that definition both terms, “collecting” and “modifying,” which I have tried to use separately.

XQ. 342.—Yes. A.—But that doesn’t appear to try to distinguish between such terms.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 343.—Well, he is referring to a list of some twenty compounds, and some I take it he meant were collecting and some were modifying. A.—He may have done so, for all I know, but—

XQ. 344.—Will you look at that list? A.—Yes. But in some of these patents to which you have been referring the word “collecting” is not used in quite the same sense in which I have used it.

XQ. 345.—Yes. If you will look at that list, perhaps you could tell me which of those are collecting agents and which are modifying agents in the way in which you have used the term. A.—(Examining document:) I don't know enough about these reagents to make any such statement. I doubt I have tried any of them — certainly very few.

XQ. 346.—Then there is another patent of Perkins & Sayre, 1,364,308, which, among other things, refers to thiocarbanilid. That was essentially a collector, and not a frother. A.—I am not familiar with the use of that material. I think I can get out of the patent whether it was intended to be one or the other.

XQ. 347.—Well, I will read you these two sentences, this being  
20 at line 40:

“Thiocarbanilid has been found to have a marked action as a collecting agent and can be used to particular advantage in conjunction with other flotation agents which have good frothing qualities. For example, where certain flotation agents, such as terpeneol, which have but little selective action but good frothing qualities, are employed, the thiocarbanilid will supplement the action of such agents by its marked selective collecting properties.”

You don't disagree with that statement? A.—I don't think  
30 that use of the term “collecting” is the same as mine. I am inclined to think that thiocarbanilid would come better under my heading of modifying agent.

XQ. 348.—Modifying agent, yes. A.—I thought you said “collecting.”

XQ. 349.—He used the word “collecting.” A.—He used the term “collecting.”

XQ. 350.—But I was putting it to you that, as you used the term “modifier,” it would be more of a modifier. A.—I think it would be better to call it a modifier.

XQ. 351.—Because here he goes on to refer to its use with  
40 pine oil. It says:

“So also, the thiocarbanilid can be used to advantage to improve the flotation results obtained with flotation agents, such as pine oil, for example, which with some ores may have both frothing and selective qualities. Thus pine oil, which

For Plaintiff—E. W. Wilkinson—Cross-Examination

cannot by itself be satisfactorily used with certain ores, such as low-grade porphyry ores, can be used with excellent results when thiocarbanilid is also used.”

That is similar to the effect to which you referred of xanthate on these porphyry ores, is it not? A.—In some respects it is similar, in that both appear to act as what I have called a modifying agent.

XQ. 352.—Yes. And that was used in very small quantities, that thiocarbanilid? A.—I believe so.

10 XQ. 353.—The quantities were as little as one-tenth or one-twentieth of a pound per ton of ore? A.—Those are quite small quantities. Not as small as xanthate, perhaps, but still quite small.

XQ. 354.—I suppose the xanthate, when originally used, was used in larger quantities, was it not? A.—Yes, and then the quantities were steadily reduced.

XQ. 355.—Yes. I notice that in the patent the examples given run from about .3 of a pound up to .69 of a pound. A.—Yes, and then they reduced finally to a tenth or less.

20 XQ. 356.—Yes. In practice it became reduced later? Is that it? A.—Yes.

XQ. 357.—But it is the same order of magnitude? A.—The same order.

XQ. 358.—Now, there is another patent of Sayre's, 1,370,367, which refers to thio-aldehyde.

By MR. COHEN: Excuse me. What is the number of that patent?

By MR. SMART: 1,370,367. And it says:

30 “Such thio-aldehyde compounds have a marked selective or collecting or mineral-modifying action, and materially promote the flotation of the mineral.”

That would be in the same sense as you are using the modifying classification? A.—I don't quite know. Didn't he say something about an effect on the mineral in the paragraph you read?

XQ. 359.—I will read it again:

“Such thio-aldehyde compounds have a marked selective or collecting or mineral-modifying action, and materially promote the flotation of the mineral.”

40 A.—Well, I haven't said mineral-modifying. My definition is broader. By “modifying” I mean an effect on the pulp in general, including the mineral.

XQ. 360.—Yes, including the mineral. A.—Including the mineral and the gangue.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 361.—Yes. And that again was used in quantities of one-half pound per ton, in the same order of magnitude. A.—I am not familiar with the use of those substances.

XQ. 362.—And it refers at the bottom, on line 105, to the compound in this way:

“The thio-aldehyde compounds may thus be used in conjunction with flotation agents which themselves have both frothing and collecting properties, for example, with many of the common flotation oils, et cetera.”

10 That would indicate it was a modifying agent? A.—That would tend to put it under my classification of modifying.

XQ. 363.—There is another patent of Sayre's, 1,415,899, dealing with thiourea compounds such as thiocarbanilid. Would you regard that also as a modifying agent? A.—I don't know just how I would define that. I am not very familiar with its use.

XQ. 364.—And there is another patent of Sayre's, 1,497,699, on dithiocarbamic acids, which are referred to—before I ask you to classify it I will read what it says about it. This is line 22:

20 “I have found that the salts of substituted dithiocarbamic acids have a marked selective action on sulphide minerals, as distinguished from gangue minerals, and when used as flotation agents in the customary flotation practices cause the sulphide mineral to float readily with an attendant high recovery of the metal values.”

Then he refers to employing it with a frothing agent, such as pine oil, which would indicate it was a modifying agent, in your classification. A.—No, not necessarily. He had flotation agents. I understand from what you read that he can effect flotation with this reagent, even though he uses pine oil to help it at times.

30 XQ. 365.—Directing your attention particularly to the selective action on sulphide minerals, would that indicate it was a agent? A.—It doesn't say what kind of action.

XQ. 366.—Have you had any experience with this dithiocarbamic acid? A.—I have been acquainted with some results and I have read the patent, but I understand the patent to read that the dithiocarbamates can effect flotation in themselves, so they come out of my classification of modifiers.

XQ. 367.—Even though they might modify the mineral? A.—I don't know whether they do.

40 XQ. 368.—Now, you referred to the fact that Anaconda carried on with sulphuric acid longer than other companies. Had they a special kind of ore that made it useful to do so? A.—There were several reasons. One was that sulphuric acid was extremely cheap at their plant, where they made it.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 369.—Yes. A.—And another one was that kerosene acid sludge was an extremely cheap reagent, which worked very well in an acid circuit, and their reagent combination, including sulphuric acid, kerosene acid sludge, and hardwood creosote, gave such excellent operating conditions that they held onto it without change for quite a number of years.

XQ. 370.—The question of the cost of a reagent is an important factor in determining whether it should be used on a particular ore or not? A.—The cost in relation with the results obtained, yes.

10 XQ. 371.—Yes. It is a matter of economic balance? A.—Yes, it is only a matter of a few cents per ton as a rule, but those are worth having, because many times they have 20,000 tons a day.

XQ. 372.—Yes. Now, you were speaking about the condition of a pulp circuit as to being acid, neutral or alkaline. I rather gather you indicated the determining factor to be the acid or alkaline character of the reagent used? A.—Yes, I did.

XQ. 373.—Is it not true that many ores themselves have an initial acid characteristic? A.—Not appreciably so in the sense I mean, as regards the condition of an ore pulp made from them.  
20 Of course, the term "acid" in connection with ores has been used for years in reference to their smelting properties.

XQ. 374.—Yes, I see. A.—It is an old term.

XQ. 375.—But what I am getting at is that there are some ore pulps which would be acid as the result of the composition of the ore itself. A.—I will say this: There are some ore pulps which might be acid as a result of the decomposition of the ore. That is what it comes down to.

XQ. 376.—Yes. What I mean is that when you would make a pulp in the ordinary way, by grinding and mixing with water, from  
30 some ores the pulp would be acid? A.—The pulp might be very faintly acid.

XQ. 377.—Yes. A.—That would often be deliberately overcome by the use of alkali. Clean, freshly-mined ore from the face is neutral in a flotation circuit—that includes all ores that are clean—when freshly-mined and cleaned. If given a chance to become decomposed by exposure to air and water, sometimes they turn out to be somewhat acid. I think I agree with you.

XQ. 378.—I don't think we are in any disagreement. I just wanted to clear it up. A.—Yes.

40 XQ. 379.—And if there was an acid condition in the pulp, you would have to take care to use a reagent that would not be decomposed by this acid condition? A.—Yes, unless I were willing to let that take place and make use of the decomposition products.

XQ. 380.—Yes. But if you wanted to obtain the benefit of the original reagent. A.—As such.



For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 381.—As such, you would either have to put some alkali in or otherwise change that acid condition? A.—I might decide to neutralize the pulp.

XQ. 382.—Yes. A.—Or I might decide to go further and make it slightly alkaline.

XQ. 383.—Yes. Now, there are quite a large number of xanthates, are there not? A.—There are quite a few that I know of.

XQ. 384.—Are they all equally active as flotation agents? A.—Not in my experience.

10 XQ. 385.—Perhaps you could tell me something of your experience which led to that conclusion. A.—Well, in laboratory work in which I was assisting Mr. Trotter, who is a qualified chemist, we prepared a number of xanthates with different alcohols and tried them in flotation. From methyl alcohol up through the range to xanthates of alcohols containing twelve or more carbon atoms, we found ethyl xanthate about the best—that and a few other xanthates of the so-called lower alcohols.

20 XQ. 386.—And what were the worst? A.—Well, it depends on what you call the worst. We could make with some difficulty a xanthate with one of the higher alcohols which might not work at all well in flotation.

XQ. 387.—Now, when was this work done with Mr. Trotter? A.—At various times; a good part of it, I should say, after 1929, when I came to San Francisco.

XQ. 388.—Yes. Then apart from the variation in the alcohol, there are variations in the metal? A.—Sodium or potassium xanthates have both been used successfully—the only ones that I know; they are the only metals I know to have been incorporated in successful xanthate.

30 XQ. 389.—You wouldn't expect xanthates involving other metals to be successful? A.—If they can be made at all, they are very hard to make and have undesirable properties.

XQ. 390.—And then there is a cellulose xanthate. You are familiar with that? A.—I am not familiar, but I am aware there is such a thing.

XQ. 391.—There is such a thing? A.—It is used of course in an entirely different character of work from the xanthates used in flotation. It is used in the preparation of rayon.

40 XQ. 392.—Yes. Would you expect it to be of any use in flotation? A.—I would not offhand. I have never tried it.

XQ. 393.—And then there are glycerol xanthates. Have you tried those? A.—I haven't tried them. There may be all kinds of them, but again, I don't think it is so easy to make them, or so cheap.

XQ. 394.—And you would not expect it to work. A.—I hardly would.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 395.—Well, I have had you through all the list. I think we would run into hundreds in xanthates.

Now, you referred to the fact that in your view xanthate had no effect on the surface tension of the pulp mixture. Is that right?  
A.—Yes, the water in the pulp mixture—the surface tension of water in the pulp mixture.

XQ. 396.—Now, the xanthate would be dissolved in the water, would it not? A.—Yes.

10 XQ. 397.—Yes. And is it not a fact that the solution of any compound in water affects its surface tension? A.—I don't know that it affects—that the solution of every compound affects the surface tension. The solution of some compounds reduces the surface tension, and the solution of other compounds will increase the surface tension. I found, on dissolving potassium xanthate in water, no change in surface tension.

XQ. 398.—Did it increase its specific gravity, or lower it? A.—It did increase it.

XQ. 399.—Wouldn't an increase in specific gravity have an effect on its surface tension? A.—There is no connection.

20 XQ. 400.—Have you a report on the test that you referred to this morning on surface tension? A. —I haven't got such a report with me. I think I made one.

XQ. 401.—I would like you to indicate as to whether you meant that there was absolutely no change in surface tension, or so little change that it did not affect the flotation process. A.—I meant that I found no measurable change, totally independent of any flotation process; in the apparatus I had, there was no measurable or observable change.

30 XQ. 402.—But if it had been carried out with a greater degree of refinement, there might have been an observable change in the surface tension? A.—Just in the sense that there are no absolute "Noes" in chemical science, and no absolute "Yeses," and that is all.

XQ. 403.—Perhaps you could describe that experiment to me. A.—I set up a beaker full of water over the pan of a chemical balance in the laboratory and suspended a platinum wire from the beam so that it just made contact with the surface of the water, and I balanced this with weights in the other pan, and with that I measured the surface tension to be determined. On the addition of potassium xanthate to this water, which sent into solution, even up to very  
40 great quantities as compared with what are used in flotation, I found no observable difference in the surface tension.

XQ. 404.—What was the order of the weights you used? A.—The platinum wire possibly weighed about two grams and was two and a half inches long, or so—something like that; and there was a considerable—if I remember rightly, there was a considerably larger

For Plaintiff—E. W. Wilkinson—Cross-Examination

weight needed to balance the surface tension of this wire to the surface of water.

XQ 405.—Was that a single experiment, or were there any more? A.—I made a couple of experiments or so. Perhaps I made my first and observed the result and showed it to somebody else. It was a new thing to me.

XQ. 406.—And did you keep a record of that test? A.—I made a record of the test, yes.

XQ. 407.—Is that record available? A.—No, I don't think so, 10 but I think I made a report. I made up a record in my notes at the time, as I did on everything.

XQ. 408.—And where would that record be now? A.—I think that the Minerals Separation North American Corporation keeps them in the files.

XQ. 409.—And about what time was that made? A.—That is very hard to say. I should say about the middle of 1930.

XQ. 410.—And what was the capacity of this beaker that you used? Was it a tumbler? A.—It was large enough—perhaps 20 about this diameter (indicating), about four or five inches in diameter—possibly four inches; large enough to accomodate that wire two and a half or three inches in length without touching the sides.

XQ. 411.—Yes. Now we come to the period of 1920 to '26, when you were working in the laboratory with Mr. Martin. Were you aware that he produced a series of what he terms bulletins that recorded the various experimental work? A.—No, not at that time.

XQ. 412.—Not at that time? A.—I saw some bulletins he put out regarding some of his flotation work, but not in regard to work on reagents, as I remember.

XQ. 413.—Did you see those bulletins around the laboratory? 30 A.—No, they weren't lying around the laboratory. I saw them; I was shown them. They were addressed to the company or to Mr. Higgins, and went there.

XQ. 414.—Yes. A.—And I often didn't see them until quite a long time after the work on the subject had been done.

XQ. 415.—But you had no difficulty in obtaining access to them if you wanted them? A.—I am not so sure. When he got his work into the form of a bulletin, sometimes he seemed to keep it to himself for a while. I think I have seen—I have seen them all.

XQ. 416.—You have seen them all? A.—In time.

XQ. 417.—In time. Did you see any of them before you left 40 San Francisco in 1920? A.—I think he called my attention to one or two or three, but they related to some work he had done on a copper ore from the Bethlehem Steel Company.

XQ. 418.—But did you see any of these bulletins while you were still in San Francisco? A.—Not more than about one on some

For Plaintiff—E. W. Wilkinson—Cross-Examination

similar sort of subject. I saw his later bulletins as they came out, but not the earlier ones.

XQ. 419.—Where did you see the later ones? A.—Either in New York or in San Francisco.

XQ. 420.—There were copies of them available in San Francisco? A.—There were copies of them, and if I knew they were there I could get to see them. They are not made generally available.

XQ. 421.—Now, you gave evidence—I think it was in 1929 or 1930—in the interference between Martin and Keller, No. 55642?  
10 A.—Yes.

XQ. 422.—And Mr. Higgins also gave evidence in that interference? A.—Yes.

XQ. 423.—Reference was made in that evidence to this telegram, Exhibit No. 5, and it was stated that at the time of the receipt of that telegram there were present Mr. Higgins, Mr. Chapman, Mr. Wilkinson, Mr. Trotter, and Mr. Martin? A.—No, I don't think so. I thought I testified that that was when we were informed of the contents of Keller and Lewis's first report on Xanthate. I saw  
20 I think all of the men you spoke of were present, if they were not present on its receipt.

XQ. 424.—I don't mean at the receipt. Here is Mr. Higgins' evidence. I will read it to see if it agrees with your recollection.

By MR. COHEN: What page?

By MR. SMART: Page 100.

“At the first discussion we had, about the time of the receipt of that telegram, to the best of my recollection there was present Mr. Chapman, Mr. Wilkinson, Mr. Trotter, Mr. Martin and myself.” A.—Yes.

30 XQ. 425.—That agrees with your recollection as to what occurred? A.—That agrees with my recollection.

XQ. 426.—And then reference was made to a remark of Mr. Martin that both he and Mr. Higgins had tried Xanthate and it was no good? A.—No good.

XQ. 427.—That is your recollection about it? A.—I didn't hear that remark. I was present on the occasion when this telegram was discussed, and the remark, as far as I know, was made on the way to lunch from the laboratory, where about five or six of us were walking together in a couple of groups of about three, on account  
40 of the narrowness of the sidewalk, so I didn't actually hear that one remark.

XQ. 428.—But you heard that the remark had been made? A.—I heard that the remark had been made, and I knew that he felt that Xanthate was no good.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 429.—Because he had tried it before? A.—I don't know about that for certain; I don't know about that, no, I didn't know that he had tried it before.

XQ. 430.—But you heard about the remark? A.—I knew that he made the remark.

XQ. 431.—Yes. A.—And I knew that he was not very receptive to Xanthate and—

XQ. 432.—And he told you—

10 BY MR. COHEN: Why don't you let him finish his answer? Finish your answer, please. A.—I knew that he was not very receptive to xanthate; he was more interested in his own reagents.

BY MR. SMART: XQ. 433.—Yes, and that he had referred to Higgins and he having made it before? A.—I beg your pardon. Mr. Higgins having made it before.

XQ. 434.—He — that is, Martin — and Higgins having made it before? A.—If that remark is correctly quoted, then I had heard — that remark as to its being “no damn good” was quoted to me. I remember that.

20 XQ. 435.—Yes. And then in your examination there you were asked this question — on page 79:

“But you are sure you never heard anybody say in his presence that he was not the inventor?”

And your answer was “Positive.” A.—In Keller's presence?

XQ. 436.—No, that is in Martin's presence. A.—That I never heard anybody say in Martin's presence that he, Martin, was not the inventor of Xanthate?

XQ. 437.—Yes. A.—I don't remember that; I mean I don't remember ever having heard that.

30 XQ. 438.—No, you don't remember ever having heard that. That is what you said here. A.—Yes.

XQ. 439. You said “Positive.” A.—The question of inventorship of Xanthate was not discussed.

XQ. 440.—I suppose it wouldn't really be very important, if you were all working for the company. A.—Possibly so, but we assumed that it was invented by Keller. That is what was reported from San Francisco.

XQ. 441.—Did you have any discussion with Mr. Higgins about this previous work of him and Martin? A.—At what time?

XQ. 442.—Well, in 1923 or '24. A.—No.

40 XQ. 443. At any time? A.—Nothing of the sort.

XQ. 444. Did you have it at any time? A.—I possibly had talks with him very much later, when Martin began to claim to be the inventor of Xanthate.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 445.—In reply to a further question you said that you did not hear from any one in your organization that Martin claimed to be the inventor of Xanthate. Did you hear from any one outside of your organization? A.—No.

XQ. 446.—Did you hear from Mr. Janney? A.—No. I have answered that. He was not in our organization. I didn't hear from him.

XQ. 447.—You didn't hear from him? A.—No.

10 XQ. 448.—Were you in New York when Mr. Martin went down to the Cuba Copper Company? A.—I don't think I was at the time. I might have been in on a flying visit, but I don't think I was at the time. I saw his result.

XQ. 449.—Yes. Did you have any discussion with him as to the reagents that he had used or proposed to use? A.—Down at the Cuba Copper?

XQ. 450.—Down at the Cuba Copper. A.—There was some talk with him on the subject. I think he was very sold on his reconstructed oils, and perhaps the kotrix sulphidizing agent.

20 XQ. 451.—Did you hear anything from him as to the difficulty in getting Xanthate to try down there? A.—I don't remember anything.

XQ. 452.—Now, I notice that on Exhibit 1 — no, Exhibit 2, this letter, if you remember (indicating), it refers to the investigations of Keller and Lewis with the mercaptans and ethyl-mercaptans? A.—Yes.

XQ. 453. And it stated that good results were obtained with those. Do you remember noticing in the report on that? A.—I remember noticing it. We were almost put out of the building for those tests.

30 XQ. 454.—The results, though, so far as flotation is concerned, would be as a modifying agent? A.—I think so, yes.

XQ. 455.—Now, reference was made in this exhibit, Exhibit 2, in the first paragraph to the sulphidizing agents, sulphidizing chemicals commonly employed in differential flotation. Now, what would those chemicals be? A.—At that time it was known that in an attempt to separate different sulphides one from the other in successive froths in flotation, that sodium sulphide acted as what I have been calling a modifying agent; that is, there was a separation of two clean sulphides, and there was no scope for chemical action  
40 by the sodium sulphide. It acted as a modifying agent.

XQ. 456.—Well, this uses the phrase "sulphidizing chemicals"—A.—Well, sodium sulphide.

XQ. 457.—And I wanted to know what they were. A.—Sodium sulphide was one of them, and I suppose potassium sulphide or perhaps a polysulphide.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 458.—A polysulphide? Pentasulphide? A.—Possibly so.

XQ. 459.—Now, will you look at the first page of the tests that follow that letter and contain a part of the report. The first is an experiment where mercaptan was used, and the concentrate had 96.2 copper in the concentrate and 3.8 in the tails. That would be a good result? A.—Yes. Those were recoveries—the percentage of recoveries. It was a good result.

XQ. 460.—Yes. And the same thing applies to the second? A.—Yes, another quite good result, but not so good.

10 XQ. 461.—Yes, not so good. And then we come to one with the sodium silicate and sodium pentasulphide. That would not be as good? A.—Not quite so good, but a pretty fair result.

XQ. 462.—A pretty fair result. Then we come, on page 2, to the first one with the xanthate, or potassium xanthogenate, as it is termed here, and the concentrate of copper is 88.9, there is a middling of 4.7, and a tail of 6.4. A.—Those tailings are 6.4% of copper run. It is not an assay.

XQ. 463.—Yes, but I am referring in all of these to the percentages. A.—Yes.

20 XQ. 464.—The assays are given in the previous columns. A.—Yes.

XQ. 465.—Was that a good result? A.—Yes, a very good result. The tailings were a trifle high.

XQ. 466.—How would this compare with the test that you considered before? A.—The tailings were a trifle higher than those of the preceding test on the same ore, and the concentrates were 50% better, so it was a better result on the whole.

XQ. 467.—Yes. And how would you compare it with the result of the — A.—Of the other ones?

30 XQ. 468.—Of the other ones with the mercaptans. A.—Not quite so good.

XQ. 469.—And then the test at the bottom of the page with potassium xanthogenate was better than the one at the top? A.—Yes, that was a better test than the one at the top.

XQ. 470.—Yes. Now, on the third page there are two tests—one at the top of the page, and the next one is marked “acid circuit.” A.—Yes.

40 XQ. 471.—The one marked “acid circuit” I take it is much better than the one at the top of page 3. A.—Not very much better. I think it is better. The tailings were lower, and that gave a higher recovery of the copper in the concentrate.

XQ. 472.—Would you say they were about even? A.—About even, but the one in the acid circuit a trifle better.

XQ. 473.—The one in the acid circuit a trifle better. Perhaps you will explain what that would mean—well, I can ask Mr. Keller about that. A.—You can ask me if you like. I am here.

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 474.—They have added 25 pounds of sulphuric acid, this indicates. A.—As a modifier. That is an example of the quantity used as a modifier.

XQ. 475.—So when you added sulphuric acid in a substantial quantity of 25 pounds — A.—The pulp gave an acid reaction.

XQ. 476.—It gave an acid reaction and a better result? A.—A slightly better result, yes.

XQ. 477.—And then at the bottom of that page there is one with sulphuric acid and crude solvent naphtha. How would you  
10 compare that with the two on the page above? A.—About a standoff.

XQ. 478.—About a standoff. Then on page 4 we get — the first one is the Inspiration crude ore, and it gives the tail of copper as 35.7% and 75.9%. A.—That was oxidized copper.

XQ. 479.—Oxidized copper. That would not be a good result, would it? A.—It was a very good result so far as the sulphide copper in the ore was concerned — a very good result; but this is a very nasty ore, containing six-tenths of one per cent of oxidized copper, which was practically unrecoverable as shown by the figures.  
20 On the sulphide copper, very excellent results were obtained, the tailings being .06% copper in sulphide form.

XQ. 480.—Are we looking at the same — A.—I am referring to the assay of the tailings.

XQ. 481.—Yes, the assay is .62. A.—There is a difference between the assay of total copper that an oxide ore gives you and the assay of sulphide copper.

XQ. 482.—Yes. A.—And that shows 0.06% — a very excellent result.

XQ. 483.—Notwithstanding there was such a large percentage  
30 going into the tail? A.—Yes, that was accounted for by the practically non-recoverable oxidized copper.

XQ. 484.—Then apart from the oxidized copper there was 35.6%. A.—No, that was the total copper. That would be plainer, perhaps, if you would say “total copper.” Total copper, sulphide copper, and oxide copper, instead of the columns that report has.

XQ. 485.—Perhaps you can clear it up to me. I don't understand this figure under “copper” of 35.7% in the tail. A.—35.7% of the total copper in the ore was lost in the tailings.

XQ. 486.—Yes. A.—By which far the greater part was lost  
40 as oxidized copper, which is practically non-recoverable.

XQ. 487.—That is three-fourths of it. A.—Fully three-fourths.

XQ. 488.—Just a little over three-fourths. So that the sulphide copper that was lost was what per cent, about? A.—The sulphide copper that was lost was corresponding to a tailing of .06%.



For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 489.—That was what percentage? A.—I haven't figured it. I will take a piece of paper and get this figured.

XQ. 490.—Can't you get it from the two figures, 35.7 and — A.—No, you can't figure it that way.

XQ. 491.—Well, I don't want to trouble you with too much mathematics. A.—It is only arithmetic. If you happen to know the formula, that is all right. (Calculating.)

XQ. 492.—Can you give us the figure now? A.—About 5% on the total copper — on the total sulphide copper.

10 XQ. 493.—Well, I am not sure that I understand this, in the second column to the left, where it gives the percentage—the total of the copper, in the concentrates and the middling and the tailing amounts to a hundred percent? A.—Yes.

XQ. 494.—And the amount in the tailing is 35.7, and of that 75.9 is oxidized. A.—No, not at all. Those are recoveries of the total tailing.

XQ. 495.—Yes. A.—Containing 0.62—

20 XQ. 496. If you don't mind, show me on this column. I don't just understand that. A.—I will try. This figure of 75.9% on oxidized copper is the proportion of oxidized copper lost in the tailings.

XQ. 497.—Yes. A.—That is the proportion of the total oxidized copper in the original heads.

XQ. 498.—Yes, 75% is lost in the tailing of the oxidized copper? A.—Yes, 75% of the oxidized copper is lost in the tailings.

XQ. 499.—Then what is the interpretation of the second column to the left, where it gives in the tailings 35.7%? A.—35.7% of the total copper in the original heads. The total copper included both sulphide and oxide copper. 35% of that total is lost.

30 XQ. 500.—Yes. A.—But only 5% of the sulphide copper would be lost if you would figure it out in a third column.

XQ. 501.—Well, in the second column, giving the assay, the heads—. A.—1.46.

XQ. 502.—Of sulphide copper? A.—Yes. That leaves 0.84% of sulphide copper.

XQ. 503.—0.84? A.—Sulphide. 0.62 oxide. Add those and you get 1.46 total.

XQ. 504.—Yes. 0.84 went in your tails? A.—Yes.

XQ. 505.—.62—. A.—.62 of total copper.

40 XQ. 506.—Yes. A.—0.56 of oxide copper, leaving 0.06 of sulphide copper.

XQ. 507.—Oh, yes. 0.06 of sulphide copper. And you take that as a percentage of 0.84? A.—As a fraction of 0.84, allow for the weight of the tailings and all. You have two operations taking place

For Plaintiff—E. W. Wilkinson—Cross-Examination

there. You can see one on the oxide copper and one on the sulphide copper.

XQ. 508.—Yes. That is a very low-grade ore. A.—It is a very low-grade ore and they got an excellent result from it on the sulphide agent.

XQ. 509.—It would depend on the cost of your reagent whether it would be worth trying to recover, I suppose. A.—Well, they are not high in this case, and considering the pretty fair grade of concentrate that was made, it would be workable.

10 XQ. 510.—How much per ton would it cost to recover this?  
A.—Including both oxide and sulphide?

XQ. 511.—No, the sulphide. A.—About 15 pounds.

XQ. 512.—About 15 pounds, and if that were worth—. A.—If that were worth, say, 15c. a pound, \$2.25.

XQ. 513.—\$2.25. And your mining costs—. A.—The mining costs would be very low indeed, and the reagent costs, I don't know just what they would be at that time. Potassium xanthogenate—I don't know what it cost then. It had not been made in any great quantity by that time. No commercial production for these purposes was  
20 being done.

XQ. 514.—Well, I don't think we need—A.—But with commercial reagents, I think the total cost would work out a small margin in favor of the operation.

XQ. 515.—Yes. Now, of those reagents, would you tell me the characteristics of those three—light pine oil, coal tar creosote, and sodium silicate? A.—Well, light pine oil might well be steam-distilled pine oil having excellent frothing properties and perhaps some collecting properties.

XQ. 516. And the creosote? A.—The coal tar creosote would  
30 be a black, greasy oil—or, rather, a coal tar distillate containing a fair amount, I think, of frothing agents and a good deal of collecting agents. The sodium silicate is a solution; it would be added from a solution. Sodium silicate is commonly known as waterglass, which is a modifying agent.

XQ. 517.—Yes. Now, at the bottom of that page we come to California Rand ore. That is gold and silver? A.—A gold ore, substantially—gold and silver.

XQ. 518.—Now, would you compare those? A.—Compare the two results?

40 XQ.—519.—Yes. A.—The top result of the two is a good deal better.

XQ. 520.—Both for gold and silver? A.—A fair standoff for silver, but a good deal better for gold—very much better.

XQ. 521.—Yes. And then on page 5 there is a Park Utah silver ore. What would you say as to the large tails in regard to the gold there? A.—You mean the large loss in the tails?

For Plaintiff—E. W. Wilkinson—Cross-Examination

XQ. 522.—Yes. A.—Simply that the gold didn't float as well as the silver did in this ore, so a low recovery was made.

XQ. 523.—Wouldn't that be regarded as a large gold loss? A.—No, because the tailings were very low—only fifteen hundredths of an ounce. That ore was very low-grade in gold, to start with.

XQ. 524.—Yes. A.—Only a twentieth of an ounce in the original head.

XQ. 525.—Now, there is another one on that same page—another ore—this is page 6—a Park Utah lead and zinc ore. What  
10 would you say in comparing those results on page 6, as regards both the lead and the zinc? A.—The first test shows better recovery and grade of lead concentrate. It also shows lower zinc contaminating the lead concentrate.

XQ. 526.—Do you mean balance? A.—No, they are additive agents. The attempt was to keep the zinc out of the lead concentrate, and then in the zinc concentrate to have as much zinc with as little lead as possible. The first test was very much better than the second as an example of selective flotation.

XQ. 527.—And on page 7, Daly Judge M. & S. Co. The lower  
20 test seems better as far as lead is concerned. A.—The lower test, no, I don't think so, considering the grade of concentrates. The grade of concentrates is only 17.5% lead in the lower test, as against 40% lead in the higher, the upper test. The recovery of lead was greater in the lower grade product of the second test, however.

XQ. 528.—Yes. A.—But on the whole the second test is not as good as the first in that respect.

XQ. 529.—The tailing was much lower? A.—The tailings of the second test were lower, but the lead concentrate in the first test was of a much more saleable grade than in the second test.

XQ. 530.—I suppose in selecting the reagents to be used, you  
30 would have to know a good many factors of the cost of operation? A.—The first thing to do is to get the result, and then cut down the cost of the reagents as much as you can to the general cost of the operation, but the cost of the reagents in flotation is only a fraction of the milling costs in any case—often quite a small fraction.

XQ. 531.—Yes. I noticed that the Anaconda in a series of tests in 1923—when they ended up with their commercial tests they had to make a great many calculations before they finally concluded which was the better of the two they were comparing. A.—They  
40 were given to making a great number of calculations before they decided, and it was advisable to do so.

XQ. 532.—Yes. This report, Exhibit 3, I will ask you to look at. This is May 3rd, 1923, a report from Keller and Lewis, reporting on some further tests. There is a statement here in the fourth paragraph: "It is to be expected that in most ores of this type each ore—". A.—Excuse me. The fourth paragraph?

For Plaintiff—E. W. Wilkinson—Cross-Examination  
 For Plaintiff—E. W. Wilkinson—Re-Direct

XQ. 533.—The fourth, starting “Test No. 5 on Cash Mine.”  
 A.—Oh, yes—the last few lines.

XQ. 534.—The last few lines. A.—Yes.

XQ. 535.—“It is to be expected that in most ores of this type each ore should have its own reagent combination worked out to give the best possible separation.”

I take it from your direct evidence you would agree with that statement? A.—If it means anything, yes.

XQ. 536.—And you would regard that as desirable practice?  
 10 A.—Yes.

XQ. 537.—There is one answer of yours I wasn't quite clear about—going back. You were asked as to whether Mr. Martin had mentioned Stanol and you said that he never recommended it at any time. A.—He didn't mention it to me, if that is what you want to know.

XQ. 538.—Yes. A.—No, he didn't mention it.

XQ. 539.—Had you heard the name Stanol? A.—I had not heard the name Stanol.

XQ. 540.—Now, among other reagents in 1923 that were being  
 20 tried, did you hear of the trithiocarbonates being tested in your laboratory? A.—No.

XQ. 541.—There are some reports in San Francisco of tests on them. I wondered if it had come to your attention. A.—Oh, I think it has been tested, and I may have heard of it a good deal later, but I didn't hear of it at that time.

XQ. 542.—Then the test will speak for itself. I will put this question, and perhaps you can give the answer: Exhibits 2, 3 and 4 all signed by Mr. Keller and Mr. Lewis? A.—According to my recollection they were. I think Exhibit 2 shows it, doesn't it?

30 XQ. 543.—Yes, the originals will show it. A.—The initials at the top will show.

XQ. 544. Yes. A.—And I remember seeing the report. It might have occurred to me to think it was a bit funny if it did not have corresponding initials at the top.

BY MR. SMART: Yes. Anyway, the originals which you will have tomorrow will show. That is all.

#### REDIRECT EXAMINATION BY MR. COHEN:

RDQ. 545.—Some of the questions asked you on cross-examination seemed to show some misunderstanding of your classifications  
 40 of the different reagents used in flotation. Would you please state your definitions again? A.—I classed—I defined flotation reagents as being frothers, collectors and modifiers. The frother is employed

For Plaintiff—E. W. Wilkinson—Re-Direct

principally for its good frothing properties, its good assistance in disseminating air through the pulp so as to give a good flotation condition. The frothing agents may have small collecting powers, as I will define them in a minute, but are principally used for their frothing properties. Collecting agents, flotation agents, are usually oily, have small frothing properties, but have a selective affinity for metalliferous minerals, and can be described as helping to bring together the mineral into the froth. "Modifying agents" is a sort of broad term, which covers reagents which I consider to modify  
 10 the pulp conditions and so affect the flotation result. There are several classes—the acid modifying agents such as sulphuric acid, alkaline such as sodium carbonate, and others not affecting the pulp; leaving the neutral, such as xanthates.

RDQ. 546.—Do you class both collectors and frothers as flotation agents? A.—Yes, I do.

RDQ. 547.—Do you class a modifying agent as a flotation agent? A.—No, in the sense that it is unable to promote flotation by itself.

RDQ. 548.—In some of the patents of Sayre and others  
 20 referred to on cross-examination, the word "collecting" appears to have been used as equivalent to the word "modifying." A.—At times it appears to have been used in the sense in which I say "modifying." The use of the terms "collecting" and "modifying" in some of those patents considered today, is confusing at times and is not always consistent.

RDQ. 549.—Did I understand you to say on your cross-examination that you think—that in your opinion the action of xanthate in the flotation circuit has value because of its physical effect, and that there might be a chemical effect, but that, so far as you know,  
 30 that is not a factor?

BY MR. SMART: I object to leading the witness that way on re-examination.

BY MR. COHEN: Well, I will have to ask the stenographer to read the question back—the question and answer, because what I thought happened was that he took down only a part of his answer. A.—Well, I can answer it. I gave it as an opinion—as my opinion—that the useful effect of xanthate in a flotation circuit was physical; that if there were any chemical action involving the xanthate, it was irrelevant and not the reason for the good results obtained by using  
 40 xanthate. I think that is the sum and substance of what I tried to say before.

RDQ. 550.—Other persons have taken other views on it? A.—Oh, yes, very strongly. There are a number of theories on flotation, and that is one of them.

RDQ. 551.—And that is on the action of xanthate? A.—That is the action of xanthate.

For Plaintiff—E. W. Wilkinson—Re-Direct

RDQ. 552.—So far as Martin's bulletins were concerned, you were in San Francisco, were you not, during the period—you were attached to the San Francisco office, were you not, during the period from 1915 to 1920? A.—Yes.

RDQ. 553.—During that interval Martin was attached to the Long Island City laboratory in New York, was he not? A.—Yes.

RDQ. 554.—Did you see any of his reports in that interval—his reports or bulletins in that interval in San Francisco? A.—Not more than one or two at the outside—perhaps two or three.

10 RDQ. 555.—Do you remember which ones you saw? A.—I saw reports of his work on Cuba copper ore, and I think a report of the use of water gas tar as a flotation agent.

RDQ. 556.—Do you know whether any others were received at the laboratory in San Francisco? A.—I don't think so. I didn't see them, if any.

RDQ. 557.—Then after you came to New York and were stationed at the Long Island City laboratory in 1920 and thereafter, did you see Martin's bulletins which he then issued? A.—I saw a number of his current bulletins, and perhaps some back numbers  
20 which he brought out or mentioned and informed me of the existence of, in our discussions of his reagents and how well they had worked on ores in various parts of the country.

RDQ. 558.—None of those bulletins made any reference to Stanol or xanthate, did they? A.—No.

RDQ. 559.—Then when you came back to San Francisco in 1929 did you have occasion to look at any of Martin's bulletins? A.—Yes, I saw a number of them.

RDQ. 560.—Which ones did you see then and there? A.—Then and there I think I saw them all.

30 RDQ. 561.—For what purpose? A.—The earlier bulletins were for the purpose of seeing what he had done when he claimed to invent xanthate, and what he had done with other reagents.

RDQ. 562.—And did you then have a search made of the San Francisco files for a copy of Martin's early bulletins? A.—I believe that a search was made, and they were not found, and copies had to be sent out from New York.

RDQ. 563.—Mr. Smart asked you whether Martin had told you that he had difficulty getting the ingredients of xanthate at the Cuba Copper Company. Do you know when Martin was at  
40 the Cuba Copper Company? A.—No, I don't offhand remember when he was. I think it was in the early twenties. I am not sure. I think it was.

RDQ. 564.—You said before you remembered seeing a bulletin on Cuba Copper Company in San Francisco. A.—Yes, I am mistaken—I must be. It must have been before 1920.

For Plaintiff—E. W. Wilkinson—Re-Direct  
 For Plaintiff—C. H. Keller—Direct

RDQ. 565.—Did you ever have occasion to discuss with Martin the Cuba Copper Company? A.—Yes.

RDQ. 566.—When? A.—Some little time after he had come back from his work there after 1920, when I was in New York. I know he said something about having used kotrix or his reconstructed oils, or both, on that ore.

RDQ. 567.—You were asked about the results disclosed in the Keller-Lewis report of March 28th, 1923, which I believe is "Plaintiff's Exhibit 2." What in general would you say was the  
 10 purport of the reports of those experiments? A.—To show the value of xanthate as a modifying agent in flotation.

RDQ. 568.—Did they show that? A.—Yes, they did. The results were consistently better than those obtained without it.

RDQ. 569.—Were even better results obtained with xanthate upon later experiments? A.—Better results were obtained later, as the operators learned to use it to better advantage.

BY MR. COHEN: I think that is all.

BY MR. SMART: All right, thank you.

CORNELIUS H. KELLER, having been first duly sworn by  
 20 the commissioner, testified as follows:

DIRECT EXAMINATION BY MR. COHEN:

Q. 1.—What is your full name? A.—Cornelius Horace Keller.

Q. 2.—Where do you live. A.—In San Francisco, 3065 Pacific Avenue.

Q. 3.—Are you the Cornelius Keller referred to in the patent in suit? A.—I am.

Q. 4.—What is your present occupation? A.—I am consulting metallurgist for a chemical concern here.

Q. 5.—Here in San Francisco? A.—In San Francisco.

30 Q. 6.—How long is it since you were employed by Minerals Separation? A.—I resigned in September, 1943.

Q. 7.—We were told yesterday that the San Francisco laboratory was closed at the end of 1942. Did you thereafter remain in the employ of the company? A.—Yes, I did.

Q. 8.—What did you do? A.—For the first three months I closed down the laboratory and disposed of the machinery.

Q. 9.—In San Francisco? A.—In San Francisco. And in April I went to Florida—to Lakeland, Florida, to work in Minerals Separation laboratory there.

40 Q. 10.—And you resigned there—. A.—In September.

Q. 11.—In September. And you have since been working for a chemical company in San Francisco? The answer is "Yes"? A.—Correct, yes, sir.

For Plaintiff—C. H. Keller—Direct

Q. 12.—Can you tell us something about your education, Mr. Keller? A.—After passing what is equivalent to high school in Zurich, Switzerland, I went to the Polytechnic Institute in the same place for two years, and one year to Heidelberg in Germany. I then came over to this country.

Q. 13.—Where you found employment? A.—I went down to Mexico, I had better say, where I was employed by M. Guggenheim's Sons, which became American Smelting & Refining Company afterwards. I worked there as assayer, and chief assayer eventually,  
10 for two years. Then I resigned.

Q. 14.—What year did you resign? A.—1901, I think. I have forgotten now exactly. Well, in any event, from there I went to Northern Mexico and started my own office in conjunction with Mr. James Wilding as assayers, metallurgical chemists, and consulting metallurgists. We had this office approximately—upward of ten years, until approximately 1913, when the Mexican Revolution forced me to close down, and I took a position with the Alvarado Mining Company as chemist and assayer. In 1916 I left Mexico and came to the United States, where I was employed by the Shannon  
20 Copper Company in Clifton, Arizona, for approximately two years, and I resigned—.

Q. 15.—Let me interrupt, please. What was your occupation, what was your work there with the Shannon Company? A.—As chemist, metallurgical chemist, and I resigned and went to Douglas, Arizona, where I worked for approximately one year with Cole & Company—the firm of Cole & Company, under the management of Walter Hawley. My work consisted chiefly in investigations on metals such as tungsten, molybdenum, vanadium, and some rare metals like platinum, and so forth. At the end of 1917—or at the  
30 beginning of 1918, rather, I was offered a position as metallurgical chemist and assayer with Minerals Separation in San Francisco, and I retained that position until September, 1943—or I had better say until December, 1942, because that is when the office here was officially closed down.

Q. 16.—Your work while with Minerals Separation was concerned with flotation, was it not? A.—With analyzing flotation products, and of course I became conversant somewhat with flotation in laboratory practice.

Q. 17.—The analysis of flotation products which you did was  
40 the assaying part of the job? Your familiarity with flotation processes came as the other part of your employment? Is that correct? A.—Yes, while it did not include my regular duties, but one could not fail to observe flotation work as carried on in the laboratory.

Q. 18.—What were the working hours which you were accustomed to work in San Francisco? A.—Well, our regular working hours were from 8.00 or half past 8.00 until about 5.00 o'clock,



For Plaintiff—C. H. Keller—Direct

with intermission for lunch, and I was accustomed to work—to come evenings very often, and on Saturdays and Sundays, to carry out some special work of my own at times, but much of that extra time was devoted to the investigation of flotation reagents and problems.

Q. 19.—How old are you, Mr. Keller? A.—66.

Q. 20.—Did you keep records of your work while with Minerals Separation? A.—I did.

Q. 21.—What were those records? A.—They consisted of personal notebooks, in which entries were made, both relative to  
10 Minerals Separation flotation problems, as well as some personal investigations that I carried out with some friends of mine. Aside from the personal notebooks, I kept notebooks which were used for the daily assay result entries.

Q. 22.—Was there a set of records or reports which you used to make concerning the results of your assaying work? A.—Yes, after finishing the daily analyzing work and analytical work I copied these results on assay certificates, signed them, and turned them over to the chief of the laboratory—the one in charge of the laboratory, I had better say.

20 Q. 23.—Are your assay books and assay records and sheets still extant? A.—No, I am afraid not.

Q. 24.—Do you know what happened to them? A.—Much of those books were destroyed when Minerals Separation office was closed down.

Q. 25.—Here in San Francisco? A.—Here in San Francisco, yes.

Q. 26.—In 1943—is that correct? A.—That is correct.

Q. 27.—Did you, however, keep your personal notebook—any of your personal notebooks? A.—Yes, I kept one in particular.

30 Q. 28.—I show you a volume which has written in ink on the cover “G. H. K. No. (blank) May 1919–Nov. 1923–June 1924,” and ask you whether that is your personal notebook? A.—It is.

Q. 29.—Covering the periods stated? A.—Yes.

BY MR. COHEN: I will offer that in evidence as “Plaintiff’s Exhibit No. 12.”

(Notebook marked “Plaintiff’s Exhibit 12.”)

BY MR. COHEN: Now, Mr. Smart, you have a photostat of this book. I should like to leave with the reporter photostats of those pages of the book to which I will refer.

40 BY MR. SMART: I don’t know if I have a photostat of this book. I think I looked it over.

BY MR. COHEN: These are photostats made only recently.

BY MR. SMART: I think I made notes. I looked over this book, but I would like to have a set of photostats.

For Plaintiff—C. H. Keller—Direct

BY MR. COHEN: Well, I have a set of photostats of some pages—most of the pages.

BY MR. SMART: If you will give me a set of those, I am quite agreeable to having them used instead of the book, with the understanding that the book will be produced at the trial.

BY MR. COHEN: Of course. This is off record.

(Unreported discussion.)

BY MR. COHEN: Counsel have agreed that the commissioner need not return to the court the original or any copy of "Plaintiff's  
10 Exhibit 12," which, however, counsel for the plaintiff have agreed to produce at the trial.

BY MR. SMART: And counsel for the defendant will be furnished photostats of the pages—

BY MR. COHEN: Photostats of the pages to which reference will be made in the direct testimony of Mr. Keller.

BY MR. SMART: Yes.

BY MR. COHEN: Q. 30.—Does this notebook contain a record of your first conception of the use of xanthate in flotation? A.—It does.

Q. 31.—Where? A.—On page 47.

20 Q. 32.—Mr. Keller, at my request you have in the last few days made a careful study of the notebook, have you not? A.—I have.

Q. 33.—And you have made certain notes concerning entries in that notebook which you think relevant, have you not? A.—I have. You say in this notebook, or from that notebook?

Q. 34.—From that notebook. A.—Yes.

Q. 35.—Now, what is the entry on page 47, of which you just made mention? A.—Under date "9/18/22" it states as follows:

30 "Use a mixture of Carbondisulfide & Alcoholic Potash as sulfidizing agent."

Q. 36.—That is the entry on the lower right-hand side of the page? A.—It is.

Q. 37.—Will a mixture of those substances make xanthate? A.—It will make xanthate.

Q. 38.—Are there any particular conditions to be followed? A.—If the ordinary rules are observed—that is, mixing the materials in the proper proportions—xanthate will result. As the potash, however, is not very soluble in the alcohol, an excess of alcohol is generally present.

40 Q. 39.—The amount of xanthate that will be produced also depends upon the conditions observed in preparing and mixing the materials? A.—It does.

Q. 40.—Are the amount of impurities that are produced likewise? A.—Yes.

For Plaintiff—C. H. Keller—Direct

Q. 41.—Now, in this entry, Mr. Keller, you have mentioned “sulphidizing agent.” What did you mean by a sulphidizing agent?

A.—A sulphidizing agent, to my mind, was an agent that covered oxide ores or oxidized mineral particles with a sulphide film.

Q. 42.—Why did you want to get a sulphide film on the mineral particles? A.—Because I knew that sulphide film particles would attach themselves better to the oil-covered air bubbles.

Q. 43.—And so float better? A.—And consequently float better, that is correct.

10 Q. 44.—You have said “oxide ores or oxidized mineral particles.” Was a sulphidizing reagent necessary on both types of materials? A.—It is absolutely essential on materials which are thoroughly oxidized in larger quantities. On surface oxidized material, however, even smaller quantities of sulphidizing material seem to aid flotation.

Q. 45.—In what forms does copper ore, for example, generally come? A.—Well, perhaps the largest deposits of copper are mixed sulphide ores, such as chalcopyrite, chalcocite, boronite. Many of these deposits of sulphide minerals have oxidized parts on the surface, and on going down from the surface one is apt to encounter mixed  
20 oxide-sulphide minerals.

Q. 46.—What other forms is copper often found in? A.—In metallic form.

Q. 47.—Aren't there other copper ores other than boronites, chalcocite, and—what is the other one you mentioned? A.—Chalcopyrite.

Q. 48.—And chalcopyrite? A.—No, I think that covers sulphides, generally speaking.

Q. 49.—How about oxides, carbonates and silicates? A.—That of course is the second part of the question, isn't it?

30 Q. 50.—Yes. A.—Oxides occur as red copper oxide, which is relatively easily floated, and black copper oxide, so-called melaconite, which is floated with more difficulty. Carbonates are relatively easily floated after sulphidization. Silicates—

Q. 51.—What are some of the carbonate ores? A.—Malachite and azurite.

Q. 52.—And silicates? A.—Silicates, so-called chrysocolla. These are floated with relative difficulty, owing to the valuable tenor.

Q. 53.—“Valuable tenor”?

BY MR. SMART: “Variable,” you mean?

40 BY MR. COHEN: Q. 54.—Variable tenor? A.—Variable tenor of copper mineral dissolved in solid solution siliceous matrix.

Q. 55.—In what form does copper ore occur most frequently? A.—In sulphide form.

Q. 56.—Very much more frequently in sulphide? Is that not correct? Is that so? A.—It is. Oxidized surface deposits are exhausted quickly. The sulphide reserves are generally larger.

For Plaintiff—C. H. Keller—Direct

Q. 57. Consequently do I understand you to say that you sought for a sulphidizing agent—that one of the reasons why you sought for a sulphidizing agent was for the treatment of non-sulphide ores? A.—It started with that conception first.

Q. 58.—Do sulphide ores ever need sulphidization in the flotation process? By that I mean treatment with a sulphidizing agent? A.—They do respond to certain sulphidizing agents.

Q. 59.—Why is that? A.—Because in grinding, oxide films are formed—or I had better say oxidic films—

10 Q. 60.—In grinding sulphide ores? A.—Sulphide ores—oxide films are formed.

Q. 61.—And grinding is a necessary prerequisite for flotation? A.—It is.

Q. 62.—It is elementary, isn't it, that for a sulphidizing agent you must have a compound or mixture containing sulphur—preferably as much sulphur as possible? A.—I am not so sure of that, but they have to contain—sulphur in considerable quantity is necessary.

Q. 63.—Necessary by definition? Isn't that so? A.—Yes.

20 Q. 64.—Now, was this entry concerning the mixture of carbon disulphide and alcoholic potash your first search for a sulphidizing agent? A.—No, it wasn't.

Q. 65.—All right. Do you remember making a report to Mr. Nutter, the chief engineer of Minerals Separation, with regard to the use of ammonium sulphide as a sulphidizing agent? A.—Yes, I do recall that.

Q. 66.—Have you attempted to find that report? A.—I have, and I have not been able to find it.

30 Q. 67.—Do you remember what the substance of the report was? A.—To use ammonium sulphide or ammonium polysulphates as a sulphidizing agent.

Q. 68.—About when did you learn that? A.—That must have been—I don't recall.

Q. 69.—Was it before or after this? A.—It was a considerable time before.

Q. 70.—It might have been as much as two years before? A.—It is pretty hard—I don't know; I really don't recall.

Q. 71.—All right. A.—I know that a report was rendered, but when I do not recall.

40 Q. 72.—Now, have you examined your notebook in order to find the entries which you made there in your search for a sulphidizing agent? A.—Yes, I have.

Q. 73.—Where is your first entry in your notebook which has to do with flotation? A.—With flotation or sulphidization?

Q. 74.—With flotation. A.—That is page 14.

For Plaintiff—C. H. Keller—Direct

Q. 75.—What entry on that page is the relevant entry? A.—The third entry, under date 3/28/22.

Q. 76.—Will you read that into the record, please? A.—‘Naphthalene in  $H_2SO_4$ , neutralized with sodium carbonate, sodium sulfide added, soluble in  $H_2O$ . Sulfidizing action on cerussite,’ followed by two plus signs, and ‘Sulfidizing action on chryscolla,’ follow by one plus sign. These plus signs, I might interpolate here, are a sign I adopted to show the strength of sulphidization by visual inspection.

10 Q. 77.—Now, what were the results of that experiment as shown in that note? A.—The results—you mean on ores, or what?

Q. 78.—Well, what conclusion did you draw? A.—Oh, I see. Well, this resulted—this material resulted in what was a sulphidizing agent.

Q. 79.—Do the next three entries on the page containing certain combinations of reagents also constitute experiments on sulphidizing action? A.—Yes, the next one following, under date 3/29. Shall I read that out?

20 Q. 80.—No. A.—And the last one on the same page, under date 3/30.

Q. 81.—Why does it have to do with sulphidizing work? A.—Because sodium sulphide was used in each of these substances—in both of these substances.

Q. 82.—And the arrangement makes it clear to you that you made the tests in order to observe the effectiveness of sodium sulphide? A.—I did.

Q. 83.—What is your next entry which has to do with sulphidizing work? A.—The next entry is on page 16.

30 Q. 84.—What entry is that, please? A.—On the top of the page it states as follows—

Q. 85.—And the date? A.—3/30/22. ‘Nitro-Naphthalene, alkaline with sodium carbonate.  $Na_2S$  added. Flocculates’—underlined—‘Flocculates copper silicate strongly.’

Q. 86.—What does that entry mean? A.—The material was made and used on copper silicate ore.

Q. 87.—And what was the unique feature of that, if any? A.—That it caused considerable flocculation of the silicate—

Q. 88.—That was the result. I am asking you for the feature. Was it a sulphidizing agent? A.—It was a sulphidizing agent.

40 Q. 89.—Why? A.—Because it contained sodium sulphide.

Q. 90.—Is that why you used it? A.—It was used for that purpose.

Q. 91.—And what was the result that you got? A.—The result was favorable.

For Plaintiff—C. H. Keller—Direct

Q. 92.—It was what? A.—It was favorable.

Q. 93.—What is flocculation, as applied to flotation? A.—That is a term which was used at the time to denote the formation of mineral flocks, aggregates, which, by reason of their condition, attached themselves with more facility to the flotation oils used.

Q. 94.—In other words, it is a phenomenon that is observed before aeration? A.—Before aeration, it is observed on the surface.

Q. 95.—And it is considered an indication that flotation will result? A.—Yes, it is considered a favorable sign.

10 Q. 96.—Is there any other entry on that page of similar nature? A.—Another entry.

Q. 97.—On that page, a similar entry? A.—On that page, under date 3/31. "Phenol and acetic acid neutralized with soda.  $\text{Na}_2\text{S}$  added coats lead carbonate well. Copper silicate lightly coated washes off."

Q. 98.—Was that an experiment to test the value of sodium sulphide as a sulphidizing agent? A.—Not of sodium sulphide per se, but as a mixture.

20 Q. 99.—With what? A.—With phenol and acetic acid which had been neutralized.

Q. 100.—And what result did you get? A.—The results appear favorable on sodium carbonate—on lead carbonate, and not as favorable on copper silicate.

Q. 101.—Is there another entry having anything to do with your sulphide work? A.—No.

Q. 102.—Do any of the entries on the bottom of the page have any relevancy? A.—They do.

Q. 103.—Which one? A.—Under date 5/1, which is evidently May 1st to May 8th. "Spoke to L.—"

30 Q. 104.—Who is "L"? A.—That is Lewis.

Q. 105.—Lewis or Littleford? A.—Mr. Lewis.

Q. 106.—Yes. A.—Let me recall just a minute. Yes, that was Mr. Lewis.

Q. 107.—Yes. Continue reading. A.—"—about dry grinding of ore, mixing with oil and floating."

Q. 108.—Now, who was Mr. Lewis? A.—Mr. Lewis was one of the flotation engineers who conducted tests in the San Francisco laboratory, and likewise attended to field operations.

40 Q. 109.—He was an experienced, practical flotation man? A.—Yes, he was.

Q. 110.—And when did he die? A.—He passed in 1929.

Q. 111.—Is there any other entry on the left-hand side of the page which has to do with sulphidization work? A.—No.

Q. 112.—How about the entry on the right-hand side of the page? A.—Under date of 5/15 on the right-hand side of the page.

For Plaintiff—C. H. Keller—Direct

Q. 113.—5/15? A.—5/15. It states as follows: “The oil mixed and ore dry, each individual ore particle will have greater affinity towards oil particles emulsified.” The “emulsified” is underlined.

Q. 114.—That is an entry which has relation to the one you just read about dry grinding ore? A.—It does.

Q. 115.—What is its point? A.—Its point was this, to dry grind the ore in oil, and then to treat the resulting pulp through a flotation operation in the presence of water and more flotation oil; and my theory at the time was that these dry-ground oil-coated  
10 particles had a greater affinity to the oil in the flotation circuit, and consequently would float with more ease.

Q. 116.—What was then the practice with respect to grinding the ore? A.—The practice was to grind ore down to, say, a two-inch size or one-inch size, according to the hardness of the material.

Q. 117.—That was grinding dry? A.—Grinding dry in rolls or—well, in suitable apparatus, and then—

Q. 118.—You say “and rolled”? A.—No, on rolls. I corrected myself; I said in suitable apparatus.

Q. 119.—I see. A.—Because there are a multitude of things  
20 that can be used. And after reducing the material to the most suitable size, it was discharged into a ball mill, where it was ground wet with water and sometimes with reagents.

Q. 120.—In other words, the practice at the time was to procure at first a reduction in size of the ore— A.—Dry.

Q. 121.—Dry, and then get it down to the necessary refinement by wet grinding? A.—By wet grinding—that is correct.

Q. 122.—And your conception was to grind it dry all the way down to the necessary size? A.—Yes.

Q. 123.—And to grind it with your reagents, or with some of  
30 your reagents? A.—Grind it with the reagent and flow the material in a flotation machine.

Q. 124.—And your theory was that in that way your reagents would have better opportunity to act on the ore? A.—That is correct.

Q. 125.—Did you do a series of experiments on this dry grinding work? A.—Yes, I did.

Q. 126.—Where are they shown in your notebook? A.—They are shown on pages 30—shall I give the number of the pages first?

Q. 127.—Yes, give all the pages. A.—31, 32, 33, 34, 36, 37,  
40 38, and 39.

Q. 128.—Will you turn to page 30, please. A.—Yes. On page 30, on the left-hand side it has nothing to do with that, really. It is on the right-hand side. There are fifteen different reagents noted; the so-called head numbers of three different minerals; and three sets indicated of those three ores in an ordinary (interpolating)

For Plaintiff—C. H. Keller—Direct

neutral circuit, an alkaline circuit with soda ash, and an acid circuit with  $H_2SO_4$ .

Q. 129.—Now, these three minerals that you mentioned are of what nature? A.—They are sulphide ores.

Q. 130.—Did anybody give you instructions as to the circuits which you contemplated using in the set of experiments which are laid out on this page? A.—It was common practice to try all three.

Q. 131.—To try the alkaline circuit? A.—The neutral circuit and alkaline circuit and acid circuit.

10 Q. 132.—Nobody had to tell you? A.—No. It was common practice—accepted.

Q. 133.—You think there might have been some oxides in those ores? A.—Particularly with the Mexican Milling Company—I am not very certain; that may have contained some, but the Walker ore was quite massive sulphie. Mazapil—that is a Mexican ore; that likewise was fairly massive. Underneath Mazapil, but without any number—now, just pardon me one second. It really should be four ores, instead of three ores, although Britannia has no number—no head number.

20 Q. 134.—It has no head number? A.—It has no head number.

Q. 135.—Go ahead, Mr. Keller. Am I correct in thinking that your entries on pages 31, 32, 33, and 34, each show your experiments on each of these four ores? A.—Yes, sir.

Q. 136.—Now, what ore did you work on as shown on page 32? A.—On page 32, I worked with Walker ore.

Q. 137.—What were the dates of those experiments? A.—8/13 to 8/15, 1922.

30 Q. 138.—And, briefly, what did you do? A.—I ground the ores, a small quantity of the ores in a mortar—these tests were made in test tubes; five grams of ore was ground in a mortar with five to fifteen milligrams of reagent; fifteen to twenty cubic centimeters of water was added; the tube was shaken for from three to five minutes, and the resulting scum or froth visually examined.

Q. 139.—Now, you did that for Walker ore with each of the fifteen reagents listed on page 30? A.—I did.

Q. 140.—And in each of the circuits mentioned on page 30? A.—Yes, sir. However, there is one difference. I stated on page 30—I stated, "Make alkaline with soda ash," but on the experiment on Walker ores I used potassium—sodium hydroxide.

40 BY MR. SMART: May I see that, please? (Examining book).

BY MR. COHEN: Q. 141.—The purpose of your tests on this page was to determine how much of a froth was procured, and what the different qualities of the froth would be? A.—That is correct.

Q. 142.—Did you do the same thing on page 33 with another one of the ores? A.—I did, on the Mazapil.



For Plaintiff—C. H. Keller—Direct

BY MR. COHEN: I am leading him, Mr. Smart—

BY MR. SMART: Well, that is all right. Go right ahead.

BY MR. COHEN: Q. 143.—Did you do the same thing on page 34? A.—With the Britannia ore, it seems—page 34—it seems that only one of the series was made.

Q. 144.—That is, you used only one circuit? A.—Only one circuit. On page 33, on the Mazapil copper ore, only one circuit—only one kind of circuit was used; on the Mexican ore only one kind of circuit was used.

10 Q. 145.—Can you tell which circuit was used? A.—No, I cannot tell, no.

Q. 146.—Do the entries on page 35 have anything to do with the current tests? A.—No, not with the current tests.

Q. 147.—They appear to be out of order in your book? A.—Yes, they are.

Q. 148.—Now, will you turn to the entry on page 36, please. A.—Yes, page 36.

Q. 149.—Will you read the page? A.—Under date 8/17/22.

20 Q. 150.—And what is the entry at the top and the left-hand side, which appears to me to be in German? A.—Shall I translate?

Q. 151.—Read it as it stands, and then translate it. A.—“Schwefel” means “sulphur.”

Q. 152.—Sulphur. A.—“ + Fl. Silber,” which means “quicksilver,” “ + Erz,” means “ore.”

Q. 153.—What did you do with that mixture as shown on that left-hand side of the page? A.—On the left-hand side, I first—I ground these materials wet in a mortar with some mercuric chloride, and I stated that indications are not very favorable.

30 Q. 154.—Why did you use sulphur? A.—Sulphur in compounds with—

Q. 155.—Answer my question. Why did you use sulphur? A.—To sulphidize.

Q. 156.—Why did you use quicksilver? A.—To form a sulphide.

Q. 157.—Do sulphur and quicksilver combine to form sulphide? A.—They do, when ground intimately together.

Q. 158.—Is that an unusual reaction? A.—It is rather unusual.

Q. 159.—Is there anything else which combines with sulphur to do the same thing? A.—Not that I recall right now.

40 Q. 160.—And what was the theory, your theory in getting a sulphide? A.—That mercuric sulphide would show some affinity for the mineral-bearing ore particles, when ground intimately.

Q. 161.—And that would result in a sulphide-coated mineral particle? A.—A sulphide-coated mineral particle which becomes amenable to flotation.

For Plaintiff—C. H. Keller—Direct

Q. 162.—Is there anything significant on the right-hand side of page 36?

BY MR. SMART: Is that page 36?

BY MR. COHEN: Yes, that is page 36.

A.—At the top of the page it states: "Trocken," which means "dry." Then there are three columns, one headed by "Leicht," one headed by "Schwer," and a third one by "Beschweftung."

Q. 163.—What do those entries mean? Easy or difficult sulphidizing? A. No. "Leicht" means "easy." And "Schwer" mean  
10 "difficult." And "Beschweftung" means the degree of sulphidization by visual inspection.

Q. 164.—And what, briefly, was the experiment which you recorded? A.—The first entry is on a silicate of zinc, which is calamine. Under "Leicht"—that is, under "Easy," there are two plus signs, which indicate that in mixing it and grinding it, the sulphur and mercury, it sulphidized easily. In the sulphidization column there are three plus signs, which indicate that there was an apparent good sulphidization, which, however, appeared to be loosened or become loose. The second—

20 Q. 165.—Well, I don't think we have to go through the rest. What was your conclusion as shown at the bottom? A.—At the bottom entry it states as follows: "Am leichtesten am Bleierzen + AgCl."

The next entry states: "folgend Zinc," and "folgend Kupfer."

Q. 166.—Will you translate that, please? A.—"It is easiest to sulphidize lead minerals containing silver chloride. It is less easy to sulphidize zinc, and still lesser easy to sulphidize copper ores by those means.

30 Q. 167.—Do I properly infer that the results you got with your dry grinding, using mercury and sulphur, were better or more favorable than the results you got from your wet grinding? A.—They were.

BY MR. SMART: May I see that? (Examining book.)

BY MR. COHEN: That page is 35, May, 1919.

Q. 168.—Those last tests about which you just testified I think you said were tests made in a bottle or test tube. Did you thereafter run flotation tests with these reagents and the ore ground dry? A.—I did.

40 Q. 169.—Where are those tests shown? Perhaps I can help you with that. A.—On pages 37, 38 and 39.

Q. 170.—What did you do in test No. 1 on the left-hand side of page 37, on August 21, 1922? A.—I ground Anaconda South American copper silicate ore, with the head number 17511. 600 grams of that material was ground with 2.75 grams of mercury, shown by a plus sign, and 4 grams of sulphur, shown by a minus sign, in a rod mill.

For Plaintiff—C. H. Keller—Direct

Q. 171.—And you got an extraction — then you ran flotation tests? A.—And this material was introduced into a flotation machine with water and some frothing oil or collecting oil — I don't know which right now —

BY MR. SMART: That isn't in the notes you are speaking of. You are adding? A.—No, it isn't in the notes. And the resultant concentrate and tails were assayed, and did not show very much of an extraction.

BY MR. COHEN: Q. 172.—Would you say the results were  
10 promising or — A.—No, I wouldn't say that that result was promising.

Q. 173.—In test No. 2 you did substantially the same thing with Cerro Gordo flotation tails, did you not? You ran a flotation test and again assayed? A.—Yes, but here, this corroborates my statement made before. The Cerro Gordo is a lead ore containing cerrusite. This material was subjected to the same treatment, and showed a little better extraction.

Q. 174.—Test No. 3 on page 38 was apparently run with an  
20 ore the head number of which was 20,900. A.—What is that —20,900?

Q. 175.—Have you been able to identify that ore? A.—No, I don't recall right now. Was that the Big Chief? Very likely. 20,900 — that is very likely what it was.

Q. 176.—The Big Chief? A.—Yes.

Q. 177.—What kind of ore was that? A.—That was lead—no, gold and silver ore.

BY MR. SMART: What is the word at the top there, do you know?

BY MR. COHEN: Q. 178.—What kind of a compound was it  
30 —what kind of mineral was it? A.—Well, I don't recall now, but the silver and gold content seem to indicate that it was an ore containing argentite.

Q. 179.—Which is — A.—Silver sulphide.

Q. 180.—Now, what is the word written at the very top of the page on the left-hand side? Is that "Quigley"? A.—That is "Quigley," yes.

Q. 181.—Who was Mr. Quigley? A.—Mr. Quigley was one of the engineers attached to the Minerals Separation flotation laboratory.

40 Q. 182.—What did your assays show as a result of your test? A.—They showed a very good gold extraction and a good silver extraction.

Q. 183.—Test No. 4 on the right-hand side of the page was with Engels copper carbonate ore? A.—Yes.

For Plaintiff—C. H. Keller—Direct

Q. 184.—What was the result of your assays of the product of that experiment? A.—The first concentrate—there were two concentrates made. The first concentrate was relatively high-grade. The second concentrate was lower in grade, and the two concentrates together resulted in a 65% extraction of the copper mineral, which was considered fairly satisfactory on a material of that type.

Q. 185.—Test No. 5, on page 39, was with some table tailings. It states: "Final 20,900." A.—20,958.

Q. 186.—Look at the top—written across the top, "Table  
10 Tails—Final 20,900." A.—Oh, yes.

Q. 187.—I think we identified "20,900" before as the Big Chief ore? A.—Yes. That 20,958 was a table tail derived from 20,900.

Q. 188.—What conclusion do you draw from the assays of the products of that test? A.—Extraction was favorable.

Q. 189.—Test No. 6, on the right-hand side of page 39, on the Hercules ore. A.—Yes.

Q. 190.—What kind of mineral was that? A.—This was a complex copper zinc iron mineral, containing some silver and gold.

20 Q. 191.—Was it a sulphide? A.—It was a sulphide ore.

Q. 192.—And what conclusion do you draw from the assays of that experiment? A.—"20 Qx"—that evidently was one of the code numbers, one of the flotation oils. I do not recall exactly these codes. It is too many years ago.

By MR. SMART: Well, that is sufficient for our purpose. A.—The results obtained on that complex sulphide ore by means of reagents were quite favorable.

By MR. COHEN: Q. 193.—Did you make a report to the chief  
30 A.—I did.

Q. 194.—I show you a document dated September 7, 1922, which is apparently a copy of a report made by you covering the dry grinding of ore with sulphur and mercury, and ask you whether it is a copy of a report made by you? A.—It is.

By MR. COHEN: I offer that in evidence as "Plaintiff's Exhibit 13."

(Said report marked "Plaintiff's Exhibit 13.")

Q. 195.—This document which you have identified is evidently a carbon of the original, is it not? A.—It is.

40 Q. 196.—Have you made a search for the original? A.—I have.

Q. 197.—Have you been able to find it? A.—No, sir.

Q. 198.—Do you know where this copy came from? A.—Evidently it came from New York.

By MR. COHEN: It was taken out of the New York file.

For Plaintiff—C. H. Keller—Direct

Q. 199.—Now, you continued your experiments on page 40, did you? A.—I did.

Q. 200.—Test No. 7 on page 40 was done on Engels carbonate ore, was it not? A.—It was.

Q. 201.—Evidently the same ore as that used in test 4 of page 38? A.—It was.

Q. 202.—Now, what reagents did you use in this test? A.—It states here, “800 grams + 2 reagents.”

10 Q. 203.—What were those? A.—Mercury and sulphur, “+ Schkohlenstoff.” Evidently it was abbreviated. It should have read “Schwefelkohlenstoff.”

Q. 204.—And what is the meaning of that? A.—That is carbon disulphide.

Q. 205.—Why did you add the carbon disulphide? A.—The reason for adding the carbon disulphide was this, to dissolve the sulphur and allow more intimate contact between the mercury, sulphur and oil.

20 Q. 206.—Incidentally, you got a little more sulphur into the mixture, didn't you? A.—Yes, but I do not think that sulphide had anything to do with it.

Q. 207.—You don't think what? A.—I don't think that the sulphur in the carbon disulphide has anything to do with it.

Q. 208.—Your principal purpose was what? A.—It is to dissolve the sulphur.

Q. 209.—Now, I see noted here three other reagents—cresylic acid, solvent naphtha, and — A.—And “4 X.”

Q. 210.—Do you know what “4 X” means? A.—No, I do not.

Q. 211.—Were these reagents usually employed? A.—Yes, they were used as flotation agents.

30 Q. 212.—Do you know whether they were the same reagents you used in test 4? A.—What page is that test 4 again?

Q. 213.—Page 38. A.—The sulphidizing reagents were the same. As regards the flotation reagents, however —

Q. 214.—You don't remember? A.—I do not recall. It doesn't give anything here.

Q. 215.—Well, what was the unusual feature of the combination of reagents used in test 7? A.—The introduction of the carbon disulphide.

40 Q. 216.—Had you ever heard at that time of the use by any one else at any time of carbon disulphide in flotation? A.—I had not.

Q. 217.—Now, what were the results of the test you made using this combination of reagents? A.—The results were favorable.

For Plaintiff—C. H. Keller—Direct

- Q. 218.—How did they compare with test 4, where apparently you used the same ore? A.—They were more favorable than the test on page 38 — test 4 on page 38.
- Q. 219.—Because the grade of concentrates was better? A.—The grade of concentrate — no. The extraction is higher.
- Q. 220.—In test 7 the extraction is 79%. In test 4, the extraction is 87%. A.—87% of the silver.
- Q. 221.—That is right. A.—And 79% — in test No. 7 the extraction is 79% of the copper mineral.
- 10 Q. 222.—Yes. A.—And it resulted in a lower tailings assay.
- Q. 223.—No. 7? A.—On No. 7.
- Q. 224.—What was the extraction of copper on test 4? A.—65%.
- Q. 225.—Would you say in general that the results of your test No. 7, where you used carbon disulphide for the first time, were better or worse than the results of the six tests shown on pages 37, 38 and 39? A.—Well, it only can be compared to test 4, and it shows a higher recovery.
- 20 Q. 226.—Will you turn to page 41, please? I am skipping the one test, No. 8, on page 40, but you may look at it if you like.
- BY MR. SMART: Yes, may I look at it again? (Examining book.)
- BY MR. COHEN: Q. 227.—Will you turn to page 41, now, please?
- BY MR. SMART: Page 41 — that is No. 9, is it? A.—That is No. 9, yes, sir.
- BY MR. COHEN: Q. 228.—Did you use carbon disulphide in test No. 9? A.—I do not think so.
- 30 Q. 230.—Did you use carbon disulphide in test No. 10? A.—In test No. 9 I didn't use any carbon disulphide, nor did I use any carbon disulphide in test No. 10.
- BY MR. SMART: May I look at those two a moment? (Examining book.)
- BY MR. COHEN: Q. 231.—Now, what were the results of your tests 9 and 10, in general? A.—Well, test No. 9 shows a 90% extraction of silver.
- Q. 232.—A pretty good result? A.—A pretty fair result.
- Q. 233.—All right. A.—And test 10 does not show very much.
- Q. 234.—Well, it shows a "no good" result? You so indicated.
- 40 A.—But that is on a different ore too. It can't be compared with 20,900. The result is "no good."
- Q. 235.—Now, will you turn to page 42?
- BY MR. SMART: Is that 11? A.—That is 11.

For Plaintiff—C. H. Keller—Direct

BY MR. COHEN: Q. 236.—The ore you used was again No. 20,900? A.—Yes, I did.

Q. 237.—And that is the Big Chief ore? A.—6 milligrams of ore—

Q. 238.—You didn't answer. That is the Big Chief ore? A.—Yes, that is the Big Chief ore, yes.

Q. 239.—What did you do there? A.—I ground 600 grams of ore with 10 cubic centimeters of "C<sub>2</sub>S," which evidently is CS<sub>2</sub>, or should be CS<sub>2</sub>, plus 6 grams mercury, plus 12 grams sulphur, for  
10 45 minutes.

Q. 240.—And then you ran three separate treatments of this ore mixture? A.—I did.

Q. 241.—And what did you note as the result? A.—That it gave a very clean froth.

Q. 242.—Is that favorable or unfavorable? A.—It is a favorable sign.

Q. 243.—And did you make assays of the test? A.—I did.

Q. 244.—And what was the result of your essays? A.—They show favorable—very favorable.

20 Q. 245.—Now, will you compare that test with test 3 on page 38, where you used the same ore without carbon disulphide as a reagent? A.—I obtained a better extraction both in gold and silver by the use of carbon disulphide.

Q. 246.—Now, will you turn to test 12 on the right-hand side of page 42. A.—Yes.

Q. 247.—There you used ore No. 20,901, didn't you? A.—Yes, sir.

Q. 248.—That is the same ore that you used in test 10 on page 41, isn't it? A.—It is.

30 Q. 249.—Now, will you tell us what reagents you used in this test? A.—I used mercury, sulphur and carbon disulphide.

Q. 250.—The only difference from test 10 being the addition of carbon disulphide? A.—The carbon disulphide, yes.

Q. 251.—And how did your results compare? A.—They compared better; it resulted in better extraction than shown in test 10.

Q. 252.—Now, on pages 43 and 44, tests 13, 14, 15 and 16.

BY MR. SMART: May I just glance over it? Apparently I haven't got those. I will just glance over those. (Examining book.)

40 BY MR. COHEN: Q. 253. In those tests you did not use carbon disulphide? A. No carbon disulphide.

Q. 254.—Test 16 was run on head sample 20,900, the Big Chief ore again, wasn't it? A.—It was.

Q. 255.—Will you compare that test with test No. 11, where the same ore was used, and where carbon disulphide was used? A.—Compare it with—

For Plaintiff—C. H. Keller—Direct

Q. 256.—Test 11 on page 42. A.—Test 11. The first part of the test on test No. 16 resulted in less gold and silver extraction than test 11. However, the tailings—

Q. 257.—That is as far as the tests are comparable? A.—Yes.

Q. 258.—In test 16 you re-treated? A.—Re-treated and re-ground, and got a little additional extraction.

Q. 259.—Page 45, tests 17, 18 and 19, were not done with carbon disulphide? Is that correct? A.—It is correct.

Q. 260.—Can you say in general what your results were? A.—  
10 The addition of carbon disulphide seemed beneficial and was beneficial.

Q. 261.—In these you did not use carbon disulphide? A.—  
Tests Nos. 18 and 19 were made with synthetic ores for the purpose of checking.

Q. 262.—Now, on page 46. A.—Page 46 shows some roasting experiments.

BY MR. SMART: Where is that?

BY MR. COHEN: You haven't got that.

Q. 263.—It shows some roasting experiments. A.—It shows some roasting experiments followed by amalgamation.

Q. 264.—Did they have anything to do with the subject matter  
20 we are talking about at all? A.—No.

Q. 265.—Now, will you look at the right-hand side of page 46, please? You did an experiment there with ore 20,900, didn't you? A.—I did.

Q. 266.—And did you not note that it was the Big Chief ore? A.—Yes, I did.

Q. 267.—Now, the test below on the right-hand side of page 46 is with Akron ore. What kind of ore was that? A.—That Akron ore was a mixed lead zinc sulphide ore.

Q. 268. Will you turn to page 47, please. Does the test  
30 shown on the upper part of the left-hand side of page 47 have anything to do with the matter we are discussing now? A.—It did. This test was made on San Vicente ore.

Q. 269.—What kind of ore was that? A.—That was a complex copper lead ore.

Q. 270.—Sulphide? A.—Containing—a sulphide ore, yes, containing considerable silver.

Q. 271.—It was a dry test with mercury and sulphur? A.—  
40 Yes. No carbon disulphide was added in this case, and it is marked "N.G."

BY MR. SMART: Is that the one there? (Indicating)

BY MR. COHEN: Yes.

BY MR. SMART: That is on page—

BY MR. COHEN: That is page 47.



For Plaintiff—C. H. Keller—Direct

Q. 272.—And “N.G.” meant “no good”? A.—It did.

Q. 273.—Now, what was the experiment shown on the lower half of page 47, the left-hand side? A.—That experiment was carried out on an ore from Tatlayoco, a Mexican ore. This was also a dry grinding test, with mercury and sulphur. That material was ground for one hour. After grinding for one hour the mill was opened and two cubic centimeters of carbon disulphide were added, and it was subsequently ground for another one-half hour. Considerable heat developed. Most of all the carbon disulphide evaporated. “Appearance of ore darker than on ordinary Hg. grinding. Make over again adding CS<sub>2</sub>, at once.”

Q. 274.—Now, what kind of ore was this ore? A.—That Tatlayoco ore was a sulphide ore containing considerable silver and gold. The silver—I do not recall—it was silver sulphide and argentite.

BY MR. COHEN: Will you read the answer?

(Answer read.)

A.—It may have been—I had better correct that. I do not recall.

Q. 275.—You are not sure? A.—No, I am not certain.

Q. 276.—But that is your best recollection? A.—Yes.

Q. 277.—Now, you noted “Appearance of ore darker.” A.—Yes.

Q. 278.—“— than on ordinary Hg. grinding.” A.—Yes.

Q. 279.—What did that mean? A.—It meant that whatever sulphidization had taken place was more intense, was stronger than with the ordinary mercury and sulphur grinding.

Q. 280.—The more the sulphidization, the darker the color of this type of ore? A.—Yes.

Q. 281.—Evidently it was an objection to repeating this experiment, that you didn’t have stable conditions? Is that why you stated that the carbon disulphide evaporated? A.—I don’t know what the reason was that I didn’t carry this test through.

Q. 282.—Well, the fact that you noted that the carbon disulphide evaporated would indicate, would it not, that the material in that form was too unstable to work with? A.—Carbon disulphide—that is correct.

Q. 283.—Carbon disulphide is not itself an unstable compound, is it? A.—It is stable enough, but it evaporates too easily.

Q. 284.—Now, did you ever do this experiment over again? A.—I did.

Q. 285.—And where is it noted? A.—It is shown on the following page, 48.

Q. 286.—On the top left-hand side of the page? A.—It is.

For Plaintiff—C. H. Keller—Direct

Q. 287.—And what did you do there? A.—I used the mercury and sulphur and carbon disulphide together.

Q. 288.—And you ground all three dry? A.—I did.

Q. 289.—And what did you note as the result? A.—The result was negative so far as general appearance goes. Most of the  $\text{CS}_2$  evaporated.

Q. 290.—Now, you have three entries on the right-hand side of page 47. Will you please read into the record the first entry—the first of those entries? A.—The first entry states as follows:  
10 “Mix of 25 grams  $\text{Na}_2\text{S}$ , 25 grams  $\text{H}_2\text{O}$ —”

BY MR. COHEN: It is a quarter of 1:00, and I think Mr. Keller is tired. Shall we stop here?

THE WITNESS: No, If you want to, let's finish this.

BY MR. COHEN: All right. Let's finish this.

BY MR. SMART: The reporter can copy that right in from the notebook. It is very difficult to read it. A.—“25 grams  $\text{Na}_2\text{S}$ , 25 grams  $\text{H}_2\text{O}$ , 18 grams to 20 grams S, filtered through glass wool, for sulphidizing reagent on Anaconda. Specific gravity 1.482 to 1.49 Pentasulfide,” underlined.

20 BY MR. COHEN: Q. 291.—Now, you noted there the use of this substance which you prepared as a sulphidizing reagent on Anaconda? A.—I did.

Q. 292.—What was the nature of the Anaconda material that you worked on? A.—That was a straight sulphide.

Q. 293.—And you conceived of this substance you prepared as a sulphidizing agent for this sulphide ore? Is that correct? A.—I did.

Q. 294.—The specific gravity figure that you noted is the specific gravity of what? A.—Of the resulting pentasulphide.

30 Q. 295.—What is a pentasulphide? A.—A sulphide containing five—

Q. 296.—A sulphate compound? A.—A sulphate compound, yes.

Q. 297.—Containing— A.—Approximately five atoms of sulphur.

Q. 298.—Can you write out the formula for pentasulphide in one line? A.— $\text{Na}_2\text{S}_5$ .

40 Q. 299.—Do you remember what suggested to you the use of such substance? A.—Yes, having done work before with sodium sulphide, at the time—to my best recollection, at the time I thought by adding more sulphur to the material that the sulphidizing action might be enhanced.

Q. 300.—What did you do with the material after you prepared it? A.—I turned some over to Mr. Lewis.

Q. 301.—Do you know whether he made any tests with it? A.—Yes, he did.

For Plaintiff—C. H. Keller—Direct

Q. 302.—Have you examined his notebooks to find out whether he ever recorded any tests he made on this ore with substances you gave him to try in flotation? A.—Yes, I have gone over his notebooks.

Q. 303.—I show you three notebooks, the first of which has written across the back "C. P. L., July 1922," the second of which has written on the front cover "Jan 4, 1923 To 5/10/23," and the third of which has written on an inside page "May 4th 1923 To 2/1/24," and ask you whether you can identify those three volumes  
10 as being Mr. Lewis's laboratory notebooks kept in the periods noted on them? A.—These notebooks are in Mr. C. P. Lewis's handwriting.

Q. 304.—Did you ever see him make entries in them? A.—I have.

BY MR. COHEN: I offer the notebooks in evidence; the first one as "Plaintiff's Exhibit 14" — that is the book which has on the cover "July 1922." The second one, covering the period from January 4th, 1923, to May 10th, 1923, as "Plaintiff's Exhibit 15;"  
20 1st, 1924, as "Plaintiff's Exhibit 16."

(Said notebooks marked "Plaintiff's Exhibits 14, 15 and 16.")

Q. 305.—Is there a record in Mr. Lewis's book of any experiments with pentasulphide prepared by you? A.—There is.

Q. 306. Where? A.—On page 75.

Q. 307.—Of Plaintiff's Exhibit 14? A.—October 23, '22.

Q. 308.—Where else? A.—Pardon?

Q. 309.—Are there others? A.—And furthermore on pages 86  
and 92.

Q. 310.—Can you give the dates? A.—The first one I have.  
30 The others I didn't put down.

BY MR. COHEN: I will supply them. They are October 28th and October 30th, 1922.

Q. 311.—Now, there are some entries in Mr. Lewis's notebook, which is "Plaintiff's Exhibit 14", of some work with Keller's sodium persulphide. Those entries are on pages 76 and 77, and were made on October 23rd, '22, as was the entry you just referred to. Do you think, or do you know whether or not those experiments were with the pentasulphide mixture which you made pursuant to the entry we are now discussing — the entry in your own  
40 notebook we are now discussing? A.—I do not know.

Q. 312.—What is the next entry in your notebook? A.—Under date 9/18/22: "Sodium sulphide + H<sub>2</sub>O in ice, adding carbon bisulphide and dilute H<sub>2</sub>SO<sub>4</sub>, separated H<sub>2</sub>S<sub>2</sub> as flotation reagent in carbon bisulphide.

For Plaintiff—C. H. Keller—Direct

Q. 313.—Does that entry mean that  $H_2S_2$  separated itself out as a flotation reagent in carbon disulphide, or that you did something to separate it out? A.—No, it separates out by itself. It is very unstable. It separates out on acidifying sulphide solution.

By MR. COHEN: I am not sure I understand your answer. Will you read the question, please.

(Question read.)

Q. 314.—What is  $H_2S_2$ ? A.—It is hydrogen persulphide.

Q. 315.—And what is your next entry? A.—The next entry?

10 Q. 316.—That is the one you have already referred to earlier in your testimony. Will you read it, please? A.—“9/18/22. Use a mixture of carbon disulfide and alcoholic potash as sulfidizing agent.”

Q. 317.—Did you know that that would make xanthate? A.—I did.

Q. 318.—What is the formula for xanthate, written on one line? A.— $C_2H_5OCS_2K$ .

Q. 319.—That is potassium ethyl xanthate. Is that a stable compound? A.—It is.

20 Q. 320.—Did you show that entry to anybody? A.—I did.

Q. 321.—When? A.—The same day or the day following.

Q. 322.—To whom? A.—To Mr. C. P. Lewis.

Q. 323.—Did you prepare any? A.—I prepared some of the material a few days after that entry.

Q. 324.—What did you do with it? A.—I turned it over to Mr. Lewis.

Q. 325.—And when was the first formal test made with it? And by “formal test” I mean a test in a laboratory flotation machine, as a result of which concentrates were taken off and the products  
30 assayed, and the experiment and its results written up formally in the laboratory record. A.—The first test, formal test, was run March the 2nd, 1923.

By MR. COHEN: I am prepared to go to lunch.

By MR. SMART: All right.

(Recess: 1:15 to 2:30 P.M.)

By MR. COHEN: May we have the last question and answer, please?

(Last question and answer read.)

40 Q. 326.—Now, before we turn to the nature of that test and subsequent tests, can you tell us what other work of a relatively extended or substantial nature you did in that interval of time? A.—Is that between September, 1922, and March 2nd? Is that the question?

For Plaintiff—C. H. Keller—Direct

Q. 327.—Yes, that is the question. A.—Could I have my notebook, please?

Q. 328.—Yes. A.—On the 22nd of September I discussed with Mr. John Littleford, the man in charge of the laboratory, the subject of acid sludge and this — can I explain now what “sludge” is?

Q. 329.—Yes, of course. A.—Acid sludge is a product from the refinery from refining petroleum oils by means of sulphuric acid. The resulting sludges have been used extensively, particularly  
10 on Anaconda.

Q. 330.—Have been used in flotation? A.—Used in flotation. I think they are protected by a patent, or were protected by a patent at the time. That material at times, owing to overheating in transit or for other reasons, was not effective, or I had better say was not as effective as it should have been and consequently I made some suggestions to Mr. Littleford, which, according to my entry, he evidently must have thought of himself approximately at the same time. This conversation led to rather extensive work.

Q. 331.—And where in your notebook is that work recorded?  
20 A.—On pages 48, 49, 50, 52, 53, 54, and 55.

Q. 332.—The last entry, on page 55, is dated October 16th, 1922, isn't it? A.—It is.

Q. 333.—Did you ever make a written report on your work on acid sludge? A.—No, I do not recall that I did.

Q. 334.—What else did you do, if anything? A.—At about that time I worked with thiocarbonate.

Q. 335.—What is thiocarbonate? A.—A salt of thiocarbonic acid.

Q. 336.—Has it any alkyl radical in it? A.—No, it has not.

30 Q. 337.—Is it related to xanthate? A.—In so far as carbon disulphide enters into its composition.

Q. 338.—Did you prepare any thiocarbonate using carbon disulphide? A.—I did.

Q. 339.—How did you do it? A.—I subjected some potassium hydroxide to the action of carbon disulphide for a prolonged period of time at a slightly elevated temperature.

Q. 340.—Was the potassium hydroxide in stick form? A.—It was.

40 Q. 341.—Potassium hydroxide and caustic potash are the same thing? A.—They are.

Q. 342.—When you say you subjected the potassium hydroxide to the action of carbon disulphide, what physically did you do? A.—I inserted the potassium hydroxide in a small bottle containing carbon disulphide, stoppered it, and left it in a warm place.

For Plaintiff—C. H. Keller—Direct

Q. 343.—What was the resulting product? A.—The result of the product?

Q. 344.—What was the resulting product? A.—Oh, the resulting product was an orange-colored salt which had formed accretions over the surface of these sticks of potassium hydroxide.

Q. 345.—Did you recover that salt? A.—I did.

Q. 346.—And what did you do with it? A.—I had Mr. Lewis make some tests with it.

Q. 347.—Have you examined Mr. Lewis's notebooks to see  
10 whether he recorded any of the tests he made with it? A.—I have examined his notebooks, and on page 68 —

Q. 348.—In "Plaintiff's Exhibit 14"? A.—Yes. October 18th, 1922; and on page 116, November 11th, 1922.

Q. 349.—November 11th? A.—Tests are noted, and furthermore in May —

Q. 350.—Just a minute. You said November 11th? A.—Yes.

Q. 351.—I show you the page of Mr. Lewis's notebook which is marked "116," and ask you whether that was the correct date that you gave? A.—No, that was the wrong date. Evidently I  
20 made a mistake on the page. Evidently it was the 16th of November, instead of the 11th.

Q. 352.—Did you ever make a report on that work? A.—I did make a report on that in the following year.

Q. 353.—I show you a report dated May 7th, 1923, and ask you whether that is the report that you made? A.—It is.

BY MR. COHEN: I offer it in evidence as "Plaintiff's Exhibit 17."

(Report marked "Plaintiff's Exhibit 17.")

Q. 354.—What in substance was the recommendation that you  
30 made with respect to the substance? A.—That it be patented.

Q. 355.—That its use as a reagent in flotation be patented? A.—Yes, as a flotation reagent that it be patented.

Q. 356.—What else did you do then? A.—In November I carried out some investigation on ethyl-mercaptan specifically.

Q. 357.—What is the formula of ethyl-mercaptan? A.— $C_2H_5SH$ .

Q. 358.—I don't think I asked you what is the formula for thiocarbonate? A.— $K_2CS_3$ .

Q. 359.—Is mercaptan related to xanthate? A.—No.

Q. 360.—Did you make any entries in your notebook with  
40 respect to mercaptan? A.—I made one entry. I am not certain of the time or place.

Q. 361.—I will ask you to look at your notebook, page 58. A.—Page 58.

For Plaintiff—C. H. Keller—Direct

Q. 362.—On the right-hand side, the lowest entry. A.—Page 58, yes. It states —

Q. 363.—Read the date. A.—“11/27/22. Test with ethyl-mercaptan on zinc ore (O.K.) and Anaconda (O.K.). Alkali metal salts of the mercaptans to be used.”

Q. 364.—Does that entry indicate to you that you made some tests — that you made the material and made some tests with it? A.—No, I did not make the material, but the entry seems to indicate that I made some bottle tests with it.

10 Q. 365.—Where did you get the material? A.—I procured that material from the Eastman Kodak Company.

Q. 366.—Did you ask Mr. Lewis to make any tests with it? A.—I did.

Q. 367.—Have you examined his notebook to see whether he did? A.—I have.

Q. 368.—Did you find any record? A.—I have, on page 131 and page 136.

Q. 369.—Have you got the dates? A.—I have not.

20 Q. 370.—Can you find them by looking in the notebook? A.—Yes. On page 131 is an entry covering a test on Anaconda ore, under date 11/27/22. It states —

Q. 371.—I don't think we need that. I just want the dates. A.—I see.

Q. 372.—And what is the date of the other one, on page 136? A.—11/28/22.

Q. 373.—What else did you do, if anything? A.—I made some solubility tests on thiocarbanilid, and a report to Mr. Nutter.

Q. 374.—Where is your work on thiocarbanilid shown in your notebook? A.—It is shown on pages 59 and 60.

30 Q. 375.—As of what date? A.—December 6th, 1922.

Q. 376.—I show you a report dated December 11th, 1922, and ask you whether that is the report that you made to Mr. Nutter on that subject? A.—I recognize the report as having been made by me.

By MR. COHEN: I offer it in evidence as “Plaintiff's Exhibit 18.”

(Report marked “Plaintiff's Exhibit 18.”)

40 Q. 377.—What else did you do in that line? A.—I carried on some independent work not related with the affairs of the company, as noted on pages 57, 58, 61, 63, 64, 65, and 66, of my notebook.

Q. 378.—During this period you also did the routine assay work? A.—I did.

Q. 379.—In the laboratory? A.—Yes.

Q. 380.—Did you do the assaying for the whole laboratory? A.—I did.

For Plaintiff—C. H. Keller—Direct

Q. 381.—Have you made a compilation of the number of assays you did in the interval from September 18th, 1922, to March 2nd, 1923? A.—I have made a compilation.

Q. 382.—What records did you use in order to make that compilation? A.—I used the laboratory record book.

Q. 383.—What is the laboratory record book? A.—The book in which all tests were finally recorded, as transferred from the small notebooks that each and every one of the operators in the laboratory had.

10 Q. 384.—That was the formal ultimate record of the company? A.—It was.

Q. 385.—I show you two volumes, and ask you whether those are the laboratory record books covering the period in question? A. —Yes, sir.

BY MR. COHEN: I offer in evidence as "Plaintiff's Exhibit 19" a volume beginning with a report of a test January 12th, 1922, and ending with the report of a test October 27th, 1922.

(Said laboratory record book marked "Plaintiff's Exhibit 19.")

20 BY MR. COHEN: I also offer in evidence as "Plaintiff's Exhibit 20" the record book beginning with a record of a test on October 20th, 1922, and ending on August 25th, 1923.

(Said record book marked "Plaintiff's Exhibit 20.")

Q. 386.—Now, how were these laboratory record books made up? You can take all the time you want on this.

Mr Smart, I don't propose to leave these here. Can it be stipulated, as with the other exhibits, that I will produce the originals in court; that I will supply you with photostats of the pages showing the test on March 2nd, 1923, and that the Commissioner need return no copies to the Court?

30 BY MR. SMART: Well, I haven't had an opportunity to go over it. Perhaps we can let it stand until tomorrow.

BY MR. COHEN: Oh, yes.

BY MR. SMART: And take a look at it.

BY MR. COHEN: Let the record show how Mr. Smart responded to the request.

40 Q. 387.—Now, will you answer the question, Mr. Keller? A.—Well, the date regarding each test, which consisted of grinding the class or ore—the kind of ore, the class of ore, the number of the head sample, the reagents added while grinding, the reagents added while floating, were entered by each operator into his own personal notebook. From these notes the final entry was made.

Q. 388.—Into the laboratory record? A.—Into the big laboratory record book.

Q. 389.—And each man who made those entries, himself indicated by the signing of his initial on the entry, did he not? A.—He did—and when the work was terminated on each individual ore, or the investigation terminated, a report was made in due course to the chief engineer.



For Plaintiff—C. H. Keller—Direct

Q. 390.—All right. We will come back to that and go into it a little more fully. Is it possible to ascertain precisely from these laboratory record books how many assays you made during the period in question? A.—Yes.

Q. 391.—Have you done so? A.—I have done so.

Q. 392.—How many assays have you made? A.—In that time interval, 110 to 120 days, I carried out 1,063 dry assays, many of them in duplicate, and 3,094 wet determinations, making 4,157 determinations in all, not counting duplicates.

10 Q. 393.—Do you consider that enough work to alone have occupied your full time during this interval? A.—It kept me busy during that period.

Q. 394.—You had a considerable variety of ores to work on, or products to work on during that period, didn't you? A.—Yes.

Q. 395.—So that you could not run all your assays in a single series, could you? A.—That is correct. Shall I define the wet work?

Q. 396.—No, that is all right. Now, Mr. Lewis's job in the laboratory was testing, wasn't it? A.—It was.

20 Q. 397.—And, so far as you know, all of the tests of which he took off the concentrate or concentrates for analysis by you, were recorded in his notebooks? A.—Not only the concentrates, but the whole entire test.

Q. 398.—The tailings as well? A.—Yes.

Q. 399.—And the middlings? A.—Certainly, all the products.

Q. 400.—All the products. Now, have you gone through his notebooks in order to determine how many experiments he made—how many laboratory flotation experiments he made? A.—I have. He carried out 209 tests, laboratory flotation tests on 74 different  
30 ores, and aside from that he made three larger-scale basement tests. That was the locus of our small test plant, which permitted us to run 200 pounds of material per hour. These tests, these so-called basement tests, because the plant was located in the basement, required considerable time to prepare and conduct.

Q. 401.—Did you make a tabulation of the information you took from his notebooks? A.—I have.

Q. 402.—Did you at the bottom of that tabulation make a note of your own assaying work during the same period? A.—I did.

40 Q. 403.—I show you this document, which consists of three large sheets, and ask you whether that is the tabulation you made? A.—It is.

BY MR. COHEN: We offer these in evidence as "Plaintiff's Exhibit 21."

(Three large sheets of tabulation marked "Plaintiff's Exhibit 21.")

Q. 404.—And finally, Mr. Keller, you and Mr. Lewis also did some work in pursuance of the entry you made on September 18th,

For Plaintiff—C. H. Keller—Direct

1922, with respect to the mixture of carbon disulphide and alcoholic potash, didn't you? A.—Yes, we carried out some.

Q. 405.—You carried out some tests? A.—Some tests.

Q. 406.—And you told us before that you made some xanthate within a few days of the making of that entry. How did you prepare the xanthate? A.—I dissolved potassium hydroxide in an excess of alcohol; to this solution I added carbon disulphide from a measuring cylinder, and when the reaction terminated I measured the amount of carbon disulphide which I had added, cooled the material, and centrifuged it to eliminate the excess alcohol, which contained some xanthate, of course, as xanthate is somewhat soluble in alcohol.

Q. 407.—You say you cooled the material. In what form was the material then? A.—The material after cooling?

Q. 408.—Before. A.—Before cooling it was in a mushy sort of condition.

Q. 409.—And after centrifuging? A.—A yellowish, cream yellow salt resulted—a crystalline mass, salt.

Q. 410.—What did you know of xanthate at that time? A.—Not very much. I knew that xanthate had been used for pest control. Aside from that I did not know of any use of the material.

Q. 411.—Had you ever seen it made? A.—I had seen it made.

Q. 412.—Some years before? A.—A considerable number of years before.

Q. 413.—Did you know it was a compound, the result of a re-action? A.—I was told that it was the product resulting from inter-acting carbon disulphide with alcoholic potash.

Q. 411.—Do I understand you to say that you had actually seen the reaction? A.—I had seen the preparation of the material.

Q. 415.—Now, what did you do with the material that you had? A.—I turned it over to Mr. Lewis.

Q. 416.—Did you give him any instructions? A.—And asked him to run some tests with it at his convenience, whenever he had spare time.

Q. 417.—Why didn't you do it yourself? A.—Because I was too busy, and, moreover, Mr. Lewis's judgment, being a trained flotation man, seemed superior to mine.

Q. 419.—He had had more experience and had the mechanics of flotation? Your answer to that? A.—Yes, he had had considerable experience, yes.

Q. 419.—Did you tell Mr. Lewis what reagents to use in these experiments? A.—That was not necessary.

Q. 420.—Mr. Lewis would employ those oils or other reagents that he considered necessary in these experiments? A.—Aside from xanthate?

For Plaintiff—C. H. Keller—Direct

Q. 421.—Aside from xanthate. A.—No, that was not necessary. Mr. Lewis would employ those oils or other reagents that he considered necessary.

Q. 422.—You expected him, did you not—

BY MR. SMART: Well, the start of that question is objectionable—

BY MR. COHEN: All right, strike it out.

Q. 423.—Did you tell Mr. Lewis what circuits to employ the material in? A.—I did not. It was not necessary, as the routine  
10 procedure consisted in using all three circuits, as I indicated.

Q. 424.—All what circuits?

BY MR. SMART: All three circuits, he said.

BY MR. COHEN: Q. 425.—All three, did you say? A.—All three—neutral, alkaline and acid.

Q. 426.—Did you tell Mr. Lewis what ores he should use in the flotation tests? A.—Not that I recall.

Q. 427.—Did you know what ores he had been working with? A.—Yes, at that time the question of Anaconda ores was very much to the front.

20 Q. 428.—The Anaconda? A.—Particularly Anaconda slimes.

Q. 429.—They presented a difficult technical flotation problem? A.—They did.

Q. 430.—Were they sulphides? A.—They contained a very large amount of sulphides, besides an appreciable amount of oxidized material.

Q. 431.—In short, you left the conditions of the tests to Mr. Lewis, didn't you? A.—I did.

Q. 432.—Now, what did Mr. Lewis do with the xanthate that you gave him? A.—He carried out some flotation tests and ran  
30 some bottle tests—so-called bottle tests.

BY MR. SMART: Just a minute. I don't want the witness to go on too far stating what Mr. Lewis did, except so far as it was reported to him or that he saw. A.—I observed it.

Q. 433.—BY MR. COHEN: All right. What is the answer? A.—Mr. Lewis conducted some flotation tests in the flotation machine, as well as some bottle tests, and whenever he carried out any of these tests he called me in.

Q. 434.—He called you in to observe it? A.—He called me in to observe them, yes.

40 Q. 435.—Were assays made of the products? A.—No.

Q. 436.—What kind of tests were they? A.—Well, one might designate them as being qualitative indicative tests.

Q. 437.—What does that mean? A.—That the products of the operation are visually inspected, and no regular analytical work is carried out on them.

For Plaintiff—C. H. Keller—Direct

Q. 438.—Can an expert flotation man tell by visual inspection whether the products are valuable? A.—He can.

Q. 439.—Could you tell that by visual inspection at that time? A.—I could to a degree, but not to the same degree as Mr. Lewis.

Q. 440.—About how many of those tests can you recall having seen? A.—There must have been between 20 and 25, if not more.

Q. 441.—Did Mr. Lewis always wait to make the test until you had time to come in and inspect it? A.—He did.

10 Q. 442.—What was the result of these 20 or 25 tests? A.—We arrived at the conclusion to carry out the investigation more thoroughly.

Q. 443.—What caused you to reach that conclusion? A.—The chemical appearance of the frothing and — well, the general appearance of the tests.

Q. 444.—Well, was it good or bad? A.—Yes, good.

Q. 445.—Did xanthate appear to work on sulphide ores? A.—It did.

20 Q. 446.—Did it appear to work on oxide ores? A.—No, it did not work on oxide ores.

Q. 447.—What conclusion did you draw from those facts? A.—That the action of xanthate is different from the action of a sulphidizing agent.

Q. 448.—And you said your first formal test was made on March 2nd, 1923. Who was present at that test? A.—Mr. E. H. Nutter and Mr. John Littleford.

Q. 449.—You have identified them as the chief engineer and the man in charge of the laboratory, respectively. A.—I do.

30 Q. 450.—The test was a rather full-dress performance, wasn't it? A.—It was.

Q. 451.—On what ore was that test run? A.—That was run on Cash Mine ore.

Q. 452.—Why did you choose that ore? A.—Because it was a very difficult ore to do anything with.

Q. 453.—And you thought your test would be more impressive if you could get a result? A.—That was what we thought.

Q. 454.—Did you prepare some xanthate for the test? A.—I did.

40 Q. 455.—And did you make a record of that test? A.—Yes, that test was recorded.

Q. 456.—Where is it shown in the laboratory record book? A.—On page 199.

Q. 457.—That is the second one of those volumes, Exhibit No. 20. A.—Under date 3/2/23, the initials C.P.L., and the head sample No. 22760, Cash Mine ore.

For Plaintiff—C. H. Keller—Direct

BY MR. COHEN: Now, I will offer in evidence for convenience at this point a photostat of that particular page. Will you mark that, please, as "Plaintiff's Exhibit 22."

(Page 199 of Plaintiff's Exhibit 20, marked "Plaintiff's Exhibit No. 22.")

BY MR. SMART: Where are Mr. Lewis's initials here? A.—On the right-hand side.

BY MR. COHEN: We will read this through, and I think in that way we will be able to determine how this record was made up.

10 BY MR. SMART: Yes, I see it.

BY MR. COHEN: It is headed "Cash Mine." Do you mind if I lead him here?

BY MR. SMART: Go ahead. That is all right.

BY MR. COHEN: Q. 458.—It is headed "Cash Mine," is it? A.—It is.

Q. 459.—And on the same line is written, "Rept Mar 22 1923." What does that mean? A.—A report was made covering this test March 22, 1923.

Q. 460.—That is the report to the chief engineer, is it? A.—It is.

20 Q. 461.—Now, the next line reads: "1000 — 15/Min." What does that mean? A.—No, the next line reads "22760 Etc."

Q. 462.—What does that mean? A.—That means that it is one of the number of ores that we had from the Cash Mine.

Q. 463.—Does the "Etc." indicate the numbers of the products taken? A.—No. The head sample is marked "22763."

Q. 464.—All right. A.—So that points to a number of different Cash Mine ores.

30 Q. 465.—Now, on the next line, what does that "1000 — 15/Min." stand for? A.—That means 1,000 grams which was ground for 15 minutes in a ball mill with water.

Q. 466.—Now, skip the next line for a moment, which is the line carrying the heading of the columns. Over on the right-hand side you have 3/2/23 C.P.L." What does that mean? A.—C. P. Lewis.

Q. 467.—What is that intended to denote? A.—Carl Pierce Lewis.

Q. 468.—Why does he write his initials? To show that he made the test? A.—He certainly did.

40 Q. 469.—Is that why he wrote his initials and the date? A.—It is.

Q. 470.—Now, this information which you have told us so far, as I understand it, was recorded in Mr. Lewis's personal notebook? A.—It was.

For Plaintiff—C. H. Keller—Direct

Q. 471.—And subsequently transcribed in this permanent record? A.—It was.

Q. 472.—Now, what is the number "22763 H"? A.—"H" stands for "head sample", and "22763" is the number of the head sample, according to our so-called number book.

Q. 473.—You had a laboratory book—another laboratory book, in which you recorded the numbers that you gave to the different ores that were received in the laboratory for testing? A.—We had.

10 Q. 474.—And this Cash Mine ore was given this number 22763? A.—Yes.

Q. 475.—On the next line, what does the number "22941 Pb C" mean? A.—That means lead concentrate.

Q. 476.—Lead concentrate was taken off and given that number? Is that correct? A.—It was.

Q. 477.—It was taken off from the flotation machine? A.—Yes.

Q. 478.—What is the next line, "22942 Cu C"? A.—That was the copper concentrate.

20 Q. 479.—The next line, "22943 Zn C"? A.—That was the zinc concentrate.

Q. 480.—And "22944 Fe C"? A.—That was the iron concentrate made by tabling.

Q. 481.—Now, the first column running perpendicularly, which is headed by the symbol "WT."—what is that? A.—That stands for "weights."

Q. 482.—The weight of the different products—the head sample and the different products? A.—No, the head sample is the sum total of all the concentrates including the tails.

30 Q. 483.—All right. Now, what is the next column "KWT"? A.—No, "% weight."

Q. 484.—"% weight." All right. A.—That is a computation—a percentage computation.

Q. 485.—Now, what is the next relevant entry? A.—"Treat Pb."

Q. 486.—What does that mean? A.—That means a lead treatment.

Q. 487.—What does that mean? A.—The reagents below shown are the ones that were employed for the treatment, for obtaining a lead concentrate.

40 Q. 488.—And that was the first treatment to which the ore was subjected? A.—It was.

Q. 489.—And what are the reagents which were used there? A.—"KZ," which stood for xanthate.

Q. 490.—Potassium xanthate? A.—Potassium xanthate.

For Plaintiff—C. H. Keller—Direct

Q. 491.—Yes. A.—And “4 H”, which according to our code was cresylic acid.

Q. 492.—And what is the next one? A.—The next?

Q. 493.—Was that ten minutes? A.—Ten minutes.

Q. 494.—What does that mean? A.—It was frothed ten minutes; a froth was taken off.

Q. 495.—Now, what number was given to the froth that was taken off that? A.—22941.

Q. 496.—That is the second line of the tabulation. What was  
10 done next? A.—This was followed by the copper treatment.

Q. 497.—That is, a second flotation was effected of the material remaining? A.—By the addition of a further amount of cresylic acid, a copper concentrate was taken off for five minutes.

Q. 498.—And what was the number of that concentrate? A.—22942.

Q. 499.—What was the next thing that was done? A.—5/10ths of a pound of copper sulphate was added.

Q. 500.—Was added to what? A.—To the remaining pulp after removing the lead and the copper.

Q. 501. Yes. A.—And one pound of “4 J,” which was water  
20 gas tar, and 21 — I don’t know what that is.

BY MR. COHEN: We will introduce the code later on. A.—Yes, 1/10th of a pound.

Q. 502.—No. 100 pine oil? A.—Yes.

Q. 503.—And what was the purpose of that third flotation? A.—To take off the zinc and the iron.

Q. 504.—And what was the number of that concentrate? A.—22943, after the iron had been removed by tabling.

Q. 505.—And the iron that was removed by tabling was given  
30 No. 22944? A.—22944.

Q. 506.—And the material that was left — A.—Is 22945, the tailings.

Q. 507.—The tailings. All of the information given so far was taken from — was taken by Mr. Lewis from his personal notebook, was it not, and recorded here? A.—It was, and recorded here.

BY MR. COHEN: I offer at this point a photostat of the page from Mr. Lewis’s personal notebook, dated 3/2/23, which carries the information which is thus recorded in the laboratory record book. Mr. Lewis’s book is offered in evidence.

40 BY MR. SMART: Yes, that is right.

(Page 19 of Mr. Lewis’s note book marked “Plaintiff’s Exhibit 23.”)

BY MR. COHEN: Q. 508.—What was done with the concentrates which were taken off and numbered as you have described?

For Plaintiff—C. H. Keller—Direct

A.—These were filtered and dried and turned over to the sampler for mixing, and turned over to me for analytical work.

Q. 509.—What was the sampler—a person or a machine?

A.—No, that was a person.

Q. 510.—And then you made your assays? A.—I made my assays.

Q. 511.—And I think you mentioned before that it was your habit to issue assay certificates? A.—It was.

Q. 512.—I show you three pages, each entitled “Assay Certificate,” dated 3/5, 3/6 and 3/7, 1923, respectively, and ask you whether your report of your assays of the products obtained on this test is not contained on those three pages? A.—Yes.

Q. 513.—As a matter of fact, you have put an “X” alongside of the relevant entries? A.—Yes.

BY. MR. COHEN: I offer those three pages in evidence as “Plaintiff’s Exhibit 24.”

(Three assay certificates marked “Plaintiff’s Exhibit 24.”)

Q. 514.—How does it happen, Mr. Keller, that these assay sheets are extant? A.—These assay sheets are what?

Q. 515.—Are extant? Well, the chances are they were obtained from New York.

Q. 516.—Well, you observe, don’t you, that they already carry an exhibit number of a previous litigation? A.—I see.

Q. 517.—To whom did you give those assay certificates? A.—I turned these over to Mr. Lewis.

Q. 518.—And did he record your results in the laboratory record book? A.—He did.

Q. 519.—And you found that the first concentrate, No. 22941, was 4.88% copper? Is that correct? What is that “4.88”? A.—30 Lead concentrate containing 4.88 copper.

Q. 520.—4.88 copper? A.—Yes.

Q. 521.—What else? A.—63.6 lead.

Q. 522.—Yes. A.—5% of zinc, and 4.7 of iron.

Q. 523.—Are those results contained in this laboratory record book? A.—They are. These are the assay results.

Q. 524.—Did Mr. Lewis then compute— A.—Yes, computed the percentage of extraction, calculated the percentage of extraction, which was noted on the same line.

Q. 525.—Those are carried on the same line? A.—Yes.

Q. 526.—Under the headings “Gold, Silver, Copper, Lead, Zinc and Iron”? A.—Yes.

Q. 527.—Consequently the result of your test was that you got lead concentrates of 63.6% and the extraction of 81.9% of the lead? A.—Of the total lead in the material.



For Plaintiff—C. H. Keller—Direct

Q. 528.—Was that a good result? A.—It was.

Q. 529.—Were these tests with xanthate thereafter made in considerable numbers? A.—Yes, a large number of tests were carried out.

Q. 530.—Were they all contained in the laboratory record book?  
A.—I believe so. I don't recall.

Q. 531.—Many were? A.—Yes, many were, but I don't recall.

Q. 532.—So far as you know, all were? A.—Yes.

Q. 533.—Have you, for our convenience, made a tabulation of  
10 the tests made with xanthate from March 2nd 1923 up until sometime in August 1923? A.—Yes, I have.

Q. 534.—And that tabulation is almost a complete transcript of the laboratory record book, isn't it? A.—It is.

Q. 535.—It includes as well certain dates from your assay books?

(The witness nods his head affirmatively.)

BY MR. SMART: The witness nods.

BY MR. COHEN: The witness nods.

Q. 536.—And have you attached to that tabulation a list  
20 explaining the code of reagents which were used? A.—I have.

BY MR. COHEN: I offer that tabulation in evidence as "Plaintiff's Exhibit No. 25."

(Sais tabulation marked "Plaintiff's Exhibit 25.")

Q. 537.—Did you participate in the making of those tests?  
A.—Not actively, but I observed most of them.

Q. 538.—Did you soon thereafter make a series of reports to the chief engineer about the result of your experiments? A.—I did.

Q. 539.—I show you a letter and report under date of March  
30 28, 1923, signed by you and C. P. Lewis, and ask you whether that is the first report you made?

BY MR. SMART: It is already in.

BY MR. COHEN: It is in Mr. Wilkinson's testimony.

BY MR. SMART: Yes. You don't need to put it in again. You can refer to it as Exhibit 2 on this commission.

BY MR. COHEN: That document has already been introduced as Exhibit 2 under this commission.

Q. 540.—What is your answer? A.—I made that report.

BY MR. SMART: With Mr. Lewis? A.—With Mr. Lewis.

BY MR. COHEN: Q. 541.—Did you supplement that report on  
40 May 3rd with another letter and report? A.—It was supplemented.

Q. 542.—I show you a report dated May 3rd, 1923, signed by you and Mr. Lewis, and ask you whether that is the supplement?  
A.—It is.

For Plaintiff—C. H. Keller—Direct

BY MR. SMART: That is Exhibit 3 under this commission.

BY MR. COHEN: Yes.

Q. 543.—I show you a letter dated May 7th, 1923, from Mr. Nutter, the chief engineer, to the Minerals Separation office in New York, and ask you whether you can identify this letter as one in the preparation of which you assisted materially? A.—I recognize this letter, and recall that I assisted in its formulating.

Q. 544.—In its formulation? A.—Yes.

BY MR. COHEN: I offer that letter of May 7th, 1923, in evidence  
10 as "Plaintiff's Exhibit 26."

(Said letter marked "Plaintiff's Exhibit 26.")

BY MR. COHEN: Q. 545.—Did you make another report on  
May 11th, 1923? I show you a letter and ask you whether or not  
that is it?

BY MR. SMART: That was already in, wasn't it?

BY MR. COHEN: I think that was Exhibit 2.

BY MR. SMART: This is Exhibit 4, yes.

A.—Yes, another report was made. This appears to be chiefly  
regarding Anaconda ore.

BY MR. COHEN: That was introduced as "Plaintiff's Exhibit  
20 4" under this commission.

Q. 546.—All of these reports that we have introduced so far  
were reports—that is, Exhibits 2, 3, and 4, were reports of your  
experiments on the use of xanthate in flotation? A.—They were.

Q. 547.—We have also introduced before as an exhibit a report  
dated May 7th, 1923, having to do with thiocarbonate.

BY MR. SMART: You have already introduced that as "17."

BY MR. COHEN: Yes, as Exhibit 17.

Q. 547. I show you a letter from you alone to Mr. Nutter,  
30 dated May 15, 1923, and ask you whether that is the letter that you  
wrote him on that day? A.—Yes. There are a number of supposed  
flotation reagents, and some of them found very effective. I had  
better say "proposed" reagents.

BY MR. COHEN: I offer that letter of May 15, 1923, in evidence  
as Exhibit "27."

(Said letter marked "Plaintiff's Exhibit 27.")

Q. 548.—Did you then on May 16, 1923, make a report to Mr.  
Nutter about the use in flotation of an alkali salt of mono-ethyl-  
tri-thiocarbonate? A.—With Mr. Lewis.

40 Q. 549.—That was a report with Mr. Lewis? A.—Yes.

BY MR. SMART: Give me that question again, please.

(Question read.)

BY MR. COHEN: Q. 550.—I show you a letter dated May 16th,  
and ask you whether it is that letter. A.—Yes.

For Plaintiff—C. H. Keller—Direct

BY MR. SMART: How would you read that? A.—An alkali salt — an alkaline salt of mono-ethyl-tri-thiocarbonic — evidently “acid” is left out. And in the lower part of the letter it says “potassium mono-ethyl-tri-thiocarbonate.

BY MR. COHEN: Q. 551.—That substance, potassium mono-ethyl-tri-thiocarbonate, is not xanthate, is it? A.—It is not.

BY MR. SMART: You are not putting that letter in?

BY MR. COHEN: I offer that as “Plaintiff’s Exhibit 28.”

(Said letter marked “Plaintiff’s Exhibit 28.”)

10 Q. 552.—Did Minerals Separation find it necessary for the purpose of introducing this reagent in the field to insure a supply of the material from some manufacturer? A.—Yes, it did.

Q. 553.—Were arrangements made with a local manufacturer for a supply of the substance? A.—Yes, an arrangement was made.

Q. 554.—What was the company? A.—The Great Western Electro-Chemical Company.

Q. 555.—Where are they located? A.—Pittsburg, California.

Q. 556.—How far from San Francisco is that? A.—About 35 miles.

20 Q. 557.—They were at that time a manufacturer of chemicals? A. They were.

Q. 558. Where were the first large-scale tests of the use of xanthate in flotation conducted? A.—They were made at Anaconda —the Anaconda Copper Mine.

Q. 559.—That is Anaconda, Montana? A.—Anaconda, Montana. Isn’t it Butte? Anaconda.

Q. 560.—Do you know when that was? A.—When these tests were conducted?

30 Q. 561.—I am not talking about the operation in the mill at Anaconda. I am talking about large-scale tests at Anaconda. A.—In the latter part of 1923.

Q. 562.—Was it as late as that?

BY MR. SMART: It is all in the correspondence. You won’t need it.

BY MR. COHEN: Q. 562.—In July, 1923, Mr. Keller, it was arranged by Mr. Nutter that some large-scale tests of xanthate should be carried on in the Anaconda mill, and for that purpose Mr. Nutter made arrangements with the Great Western Chemical Company to supply 1,000 pounds of potassium xanthate to Anaconda. Do you 30 remember that? A.—I recall that very well.

Q. 564.—That, as I said, was in the beginning of July, 1923. A.—I don’t recall the date, but I remember the quantity.

BY MR. SMART: Well—

BY MR. COHEN: I just want to tie it up with certain reports.

For Plaintiff—C. H. Keller—Direct

BY MR. SMART: All right.

BY MR. COHEN: Q. 565.—In connection with that manufacturer did you make certain studies with respect to the preparation and manufacture of the material—A.—I did.

Q. 566.—Just a minute. With respect to the best methods of shipping it, and with respect to methods of analyzing the substances produced for its xanthate content? A.—I did. Pardon me. There is one question I wanted to ask.

BY MR. COHEN: This is off record.

10 (Unreported discussion.)

BY MR. COHEN: Will you read the last question and answer, please.

(Last question and answer read.)

A.—I do not recall whether I carried on or made analyses for the xanthate content. I don't recall that now.

Q. 567.—Do you recall the others? A.—Yes, I recall the others, but it was rather regarding the suitability of the material than its xanthate content.

20 Q. 568.—Did you have some discussions with Mr. Nutter and with Dr. Rosenstein, who was then the chief chemist of the Great Western Company, with respect to the best method of manufacturing xanthate? A.—Yes, some of them very acrimonious.

Q. 569.—Did you on July 21, 1923, inspect a copy of a letter—a copy or the original of a letter written by Dr. Rosenstein to the Minerals Separation San Francisco office—I should say there were two letters on that day—in which he outlined examples of his preferred method of preparing xanthate? A.—I did.

Q. 570.—I show you a letter and ask you whether that is it? A.—Yes, I recall this letter.

30 BY MR. COHEN: I offer it in evidence as "Plaintiff's Exhibit 29."

BY MR. SMART: Is that two letters or one?

BY MR. COHEN: I will offer them as one exhibit. And you have copies of them.

BY MR. SMART: Yes, I have copies of them. A.—Yes.

(Said letters marked "Plaintiff's Exhibit 29.")

BY MR. COHEN: Q. 571.—Did you as a result of that letter make certain investigations into methods of manufacturing xanthate and make a report to Mr. Nutter? A.—I did.

40 Q. 572.—I show you a letter from you to Mr. Nutter dated July 25, 1923, and ask you whether that is the letter. You observed that Dr. Rosenstein's method resulted in the production of certain impurities, including thiocarbonate? A.—Yes.

For Plaintiff—C. H. Keller—Direct

Q. 573.—And you determined that the presence of that impurity along with the xanthate in the acid circuit, such as was used up at Anaconda, would have a tendency to impede the action of the xanthate? A.—I did.

Q. 574.—Was that because you observed that the thiocarbonate tended to produce hydrogen sulphide in an acid circuit? A.—I did.

Q. 575.—And it was hydrogen sulphide, was it not—the deleterious part? A.—It was.

10 BY MR. COHEN: I will offer this in evidence as “Plaintiff’s Exhibit 30.”

(Said letter marked “Plaintiff’s Exhibit No. 30.”)

Q. 576.—Mr. Lewis was at that moment in Anaconda working on that shipment of xanthate, was he not? A.—Working with the shipment of xanthate, yes.

Q. 577.—Did he report the result of his work? A.—He did.

Q. 578.—What was the essence of his report? A.—That the material was not as good as the material prepared in the laboratory, and he asked for an investigation regarding the manufacture  
20 of that thousand pound lot.

Q. 579.—Well, hadn’t you already made that investigation as a result of your controversy with Dr. Rosenstein? A.—No. The investigation was made when Mr. Lewis found that material was not up to grade, as far as I can recall now. I cannot remember the date exactly.

Q. 580.—I show you a copy of a telegram sent by Mr. Nutter to Mr. Lewis on August 3rd, 1923, and ask you whether you saw that telegram when it was sent? A.—Yes, I was—I asked Mr. Nutter to send this telegram.

30 BY MR. COHEN: I offer it in evidence as “Plaintiff’s Exhibit 31.”

(Telegram marked “Plaintiff’s Exhibit 31.”)

Q. 581.—Now, as a result of that communication the work was stopped up at Anaconda, was it not? A.—Yes.

Q. 582.—And arrangements were made for the preparation of a new thousand-pound batch according to the method insisted upon by you? A.—It was.

Q. 583.—What was the method insisted upon by you? A.—The method that I insisted on was not to introduce any water.

40 Q. 584.—Was what? A.—Was not to introduce any water.

Q. 585.—And Dr. Rosenstein’s method was first to dissolve the potassium hydroxide in water? A.—It was.

Q. 586.—In which it was fully soluble? A.—Although he promised that the material would be made along my method, then suddenly he introduced that water method. After that was decided

For Plaintiff—C. H. Keller—Direct

as not being very good, we went back to the alcohol method, and I think there must be some letter extant, if I am not badly mistaken, from Mr. Henderson, then sales manager of the Great Western, wherein he pledged himself to make—to see that the xanthate would be prepared by the alcohol method.

Q. 587.—I show you a letter dated August 9th—a copy of a letter dated August 9th, 1923, from Mr. Nutter to the Great Western Electro-Chemical Company, and ask you whether that is not the letter in which the Great Western Company was given  
10 definite instructions to follow the method insisted upon by you?  
A.—Yes, this letter and the attached flow sheet—this was written by Mr. Nutter upon my insistence.

Q. 588.—Did you prepare the letter? A.—I did.

BY MR. COHEN: I offer it in evidence as "Plaintiff's Exhibit 32."

(Said letter marked "Plaintiff's Exhibit 32.")

Q. 589.—I show you two letters dated August 9th, 1923; one from Mr. Nutter to the Anaconda Copper Mining Company—that is a copy of a letter—and the other by Mr. Nutter to Minerals  
20 Separation in New York—that is an original—and ask you whether those letters, which explain the whole Anaconda difficulty in July of 1923, were prepared by you? A.—No. that first letter was not prepared by me, but the substance of it was suggested to Mr. Nutter.

Q. 590.—By you? A.—By me.

Q. 591.—How about the second letter? Your answer is the same for that? A.—Just one second. I want to get something through my head. Yes, the substance is the same.

BY MR. COHEN: I offer those letters as plaintiff's exhibits;  
30 "33" is the letter to Anaconda, and "34" is the letter to Minerals Separation.

(Said letters marked "Plaintiff's Exhibits 33 and 34.")

Q. 592.—Now, there are several other reports made by you, which I should like to introduce quickly. I will show you a letter dated July 23, 1923, from you alone to Mr. Nutter, and ask you whether you can identify that as in part a report on a preferred method of shipping xanthate to Anaconda?

BY MR. SMART: July 23rd?

BY MR. COHEN: July 23, 1923. A.—Yes.

40 BY MR. COHEN: I offer that as "Plaintiff's Exhibit 35.")

(Said letter marked "Plaintiff's Exhibit 35.")

Q. 593.—I show you a letter dated July 27th, 1923, from you alone to Mr. Nutter, and ask you whether that is a report you made to him on certain work you had done in attempting to make cellulose xanthate? A.—Yes, this report was made by me.

For Plaintiff—C. H. Keller—Direct

BY MR. COHEN: I offer it in evidence as "Plaintiff's Exhibit 36."

(Said report marked "Plaintiff's Exhibit 36.") 93.

Q. 594.—I show you two letters dated August 2, 1903, each of which is entitled "Manufacture of Alkali Xanthates," and ask you whether those are two reports you alone made to Mr. Nutter on that day with respect to that subject?

BY MR. SMART: I have four letters of that day.

BY MR. COHEN: Two of them are entitled "Manufacture of Alkali Xanthates." There are others of that date with other titles. A.—Yes, these letters are mine.

BY MR. COHEN: I offer them in evidence as "Plaintiff's Exhibit 37."

(Said letters marked "Plaintiff's Exhibit 37.")

Q. 595.—I show you three other reports made by you alone on the same date to Mr. Nutter, entitled "Xanthic Acid" and "Ammonium Xanthate" and "Xanthogenamide or Xanthamide", respectively, and ask you if you can identify them as reports made by you on that day? A.—Yes, they were written by me.

20 BY MR. SMART: That is three letters.

BY MR. COHEN: Three letters. I offer them in evidence as "Plaintiff's Exhibit 38.")

(Said letters marked "Plaintiff's Exhibit 38.")

Q. 596.—I show you four further reports — copies of further reports made by you alone to Mr. Nutter, having to do generally with the subject of analysis of the product produced by Great Western, the analysis being for its xanthate content, and ask you whether those are reports rendered by you on those dates?

BY MR. SMART: What are the dates?

30 BY MR. COHEN: The dates are October 15th, October 17th, and October 29th — two reports on October 29th.

BY MR. SMART: That is four reports.

BY MR. COHEN: Yes.

BY MR. SMART: That is four letters.

BY MR. COHEN: I offer the four, then, in evidence — have you identified them? A.—Yes.

BY MR. COHEN: I offer them in evidence as "Plaintiff's Exhibit 39."

40 BY MR. SMART: The first one is the 15th? A.—The first one is October 15th; October 17th, and October 29th, yes.

(Said letters marked "Plaintiff's Exhibit 39.")

Q. 597.—Now, in the method which was followed at that time for the manufacture of xanthate, there was a by-product called "Mother Liquor," which was essentially an excess of alcohol used

For Plaintiff—C. H. Keller—Direct

the the method, in which was contained in solution some xanthate? Is that so? A.—Yes.

Q. 598.—And did it become a commercial problem—did the disposition of that substance become a commercial problem?—A.—It was, but that material did not consist only of excess alcohol containing some xanthate; it contained a fairly large amount of water, because the ordinary commercial alcohol, ethyl alcohol of commerce, is around 89%; consequently a certain amount of water was present, which, if Great Western followed instructions, would  
10 have been eliminated by decanting the potassium hydroxide alcohol phase. If they did not do this, the mother liquor was apt to contain impurities.

Q. 599.—Did you make an analysis of that substance? A.—I did.

Q. 600.—Did you make a report to Mr. Nutter containing its possible utilization? A.—I did.

Q. 601.—I show you a letter from you alone to Mr. Nutter, dated November 26th, 1923, and ask you whether that is the report? A.—Yes, I recognize this letter.

20 BY MR. COHEN: I will offer this in evidence as "Plaintiff's Exhibit No. 40."

(Said letter marked "Plaintiff's Exhibit No. 40.")

Q. 602.—Mr. Keller, what is benzyl xanthate? A.—Xanthate made from benzyl alcohol.

Q. 603.—What is benzyl alcohol? A.—An aromatic alcohol.

Q. 604.—What is its formula? A.—I don't recall.

Q. 605.—Do you know? A.—Well, it is in that letter there.  
 $C_6H_5CH_2OH$ .

30 Q. 606.—In February, 1924, did you and Mr. Lewis make a report to Mr. Nutter concerning certain work you had done with benzyl xanthate? A.—We did.

Q. 607.—I show you a letter dated February 7, 1924, and ask you whether that is that report? A.—It is.

BY MR. COHEN: I offer it in evidence as Exhibit 41.

(Said letter marked "Plaintiff's Exhibit 41.")

Q. 608.—Have you prepared from Mr. Lewis's notebook and your assay book a tabulation of experiments shown in those books with benzyl xanthate? A.—I have.

40 Q. 609.—I will show you a tabulation and ask you whether that is the tabulation? A.—That is the tabulation.

BY MR. COHEN: We offer it in evidence as "Plaintiff's Exhibit 42."

(Said tabulation marked "Plaintiff's Exhibit 42.")



For Plaintiff—C. H. Keller—Direct

Q. 610.—Did you apply for and were you sent a patent, speaking generally, on the use of benzyl xanthate flotation? A.—I was.

Q. 611.—I show you patent No. 2,044,851 — A.—That is it.

BY MR. COHEN: I will offer in evidence United States Patent 2,044,851 as "Plaintiff's Exhibit 43.")

(Said patent marked "Plaintiff's Exhibit 43.")

Q. 612.—Do you also hold a patent on the use of mercaptan, or mercaptides? A.—I do.

10 BY MR. COHEN: I offer in evidence United States Patent No. 1,728,764 as Plaintiff's Exhibit 44."

(Said patent marked "Plaintiff's Exhibit 44.")

Q. 613.—Did you ever make a report to Mr. Nutter about your work with those substances? A.—I have.

Q. 614.—I show you a report dated September 11th, 1925, and ask you whether that is the report? A.—This is the report.

BY MR. COHEN: I offer it in evidence as "Plaintiff's Exhibit 45."

(Said report marked "Plaintiff's Exhibit 45.")

20 Q. 615.—You subsequently made some other reports on mercaptans, didn't you, Mr. Keller? A.—I have.

Q. 616.—Have you made a tabulation from Mr. Lewis's notebooks and your assay books of the experiments done by you with these substances? A.—I have.

Q. 617.—I show you a photostat and ask you whether it is a photostat of that tabulation? A.—Yes. Many of these tests were made not by Mr. Lewis; they were made by Mr. Williams.

Q. 618.—Mr. Carl Williams? A.—Mr. Carl Williams, another flotation operator—flotation engineer.

30 Q. 619.—Employed by Minerals Separation? A.—Employed by Minerals Separation.

BY MR. COHEN: I offer this in evidence as "Plaintiff's Exhibit 46."

(Said tabulation marked "Plaintiff's Exhibit 46.")

BY MR. COHEN: I should like also to introduce in evidence a certified copy of the file wrapper and contents considered upon the patent application which resulted in patent No. 1,554,216 to Cornelius H. Keller, which patent contains the same specifications and claims as the patent in suit.

40 (File wrapper and contents marked "Plaintiff's Exhibit 47," and retained by Mr. Cohen.)

BY MR. COHEN: It is stipulated that neither the original nor a copy need be returned by the Commissioner, provided plaintiffs produce the original on the trial?

For Plaintiff—C. H. Keller—Direct  
 For Plaintiff—C. H. Keller—Cross-Examination

BY MR. SMART: Yes.

BY MR. COHEN: Q. 620.—You came to New York in March of 1924, did you? A.—I did.

Q. 621.—And among other things you carried on some experiments with xanthate in the Long Island City laboratory, didn't you? A.—I attempted to make some xanthate from naphthols.

Q. 622.—And phenols? A.—Pardon me?

Q. 623.—Phenols? A.—No, I don't recall what else.

Q. 624.—In any case, you did some work? A.—Yes, I did some  
 10 work in the Long Island City laboratory.

Q. 625.—Did you meet R. B. Martin there? A.—I met him there.

Q. 626.—You came to New York again in June, 1925, didn't you? A.—On the Sayre interference.

Q. 627.—For the purpose of testifying? A.—Yes.

Q. 628.—Did you see Mr. Martin then? A.—I do not recall whether I did or not, because my whole business was with the lawyers, and I did not have to go out to the Long Island laboratory.

Q. 629.—In January or February, 1926, R. B. Martin did some  
 20 work in the San Francisco laboratory, didn't he? A.—Yes.

Q. 630.—Did you see him then? A.—Yes, I saw quite a lot of him.

Q. 631.—Did he ever say to you that he was the discoverer of the use of xanthate in flotation? A.—He didn't say anything regarding xanthate.

Q. 632.—At all? A.—That is quite correct.

#### CROSS-EXAMINATION BY MR. SMART

XQ. 633.—Mr. Keller, you read into the record at the beginning of your examination the entry at page 47 of your notebook, Exhibit  
 30 12. That is the entry of September 18, 1922, and I gather from your evidence that that is the first formulation, either orally or in writing, of the alleged invention covered by your Canadian patent in suit? A.—It is.

XQ. 634.—Now, at that time I understand also you were familiar with potassium xanthate through some knowledge of it in Switzerland that you had recollected? A.—Yes, that is correct.

XQ. 635.—Did you know at that time of any other xanthates? A.—No, I did not.

XQ. 636.—It later appears that you acquired knowledge or  
 40 you experimented with other xanthates. Where did you get your knowledge as to these other xanthates? A.—From perusing certain treatises, certain books; and this was after about April—March or April of 1923, when I went at it very intensely.

For Plaintiff—C. H. Keller—Cross-Examination

XQ. 637.—Do you remember some of the text books or technical literature that you referred to? A.—Yes, I do.

XQ. 638.—Would you name them? A.—I consulted especially a dictionary of chemistry by Watts and Weir, 1902 edition.

XQ. 639.—And then you tried, of the xanthates you found, those that you thought would be likely to be useful in a process of this kind? A.—I did.

XQ. 640.—I presume you learned of other xanthates which you did not try? Is that not so? A.—I may have.

10 XQ. 641.—Well, now, you gave me the Watts chemistry. Are there others? Or had you completed that answer? A.—Specifically there are no further xanthates mentioned, as far as I recollect, in Watts.

XQ. 642.—I am not sure whether I stopped you in your answer. Were you going to give a reference to some other text books or literature that you consulted at that time? A.—Yes, there was one that I consulted in regard to the manufacture of cellulose xanthate, for rayon—the cellulose xanthate, which is used for the manufacture of rayon.

20 XQ. 643.—That was a well-known xanthate in use for rayon at that time? A.—Yes, for rayon.

XQ. 644.—That was a Cross & Bevans book? A.—Oh, yes.

BY MR. COHEN: What is that question, please?

BY MR. SMART: That was a Cross & Beyans book. A.—Yes, now I recall.

XQ. 645.—I think they were the first to show how that xanthate could be made. A.—Cellulose xanthate.

XQ. 646. Yes, cellulose xanthate. A.—Yes.

30 XQ. 647.—Looking at this entry of September 18, 1922, I think you said that you knew that a xanthate would result from the mixture there defined? A.—I did.

XQ. 648.—And I presume that any other competent chemist would have had that same knowledge? A.—He should.

XQ. 649.—And would also know, if he were told to do so, how to produce a potassium xanthate? A.—He should.

XQ. 650.—I think you gave evidence about the year 1925 in an interference between yourself and Mr. Sayre? A.—I did.

XQ. 651.—In part of your cross-examination in that interference—

40 BY MR. COHEN: Where?

BY MR. SMART: XQ. 652.—At page 105, there are two questions and answers which I will read to you. A.—Yes.

XQ. 653.—And I will ask you later if you will confirm them or not.

For Plaintiff—C. H. Keller—Cross-Examination

“XQ. 128.—Did you prior to September 18, 1922, or on that day, consult any text book or any other reference, to refresh your memory with respect to the method of making xanthate?

“A.—The operation being such a very simple one does not require any refreshing of memory and as far as I recall I did not consult any book either prior to that date or on that date.

10 “XQ. 129.—Then I am to understand that the recollection of that rather putrid smelling substance was so vividly impressed on you that after a lapse of 30 years you recalled from memory exactly how to make xanthate? Is that correct? A.—“It is substantially correct.”

That agrees with your present position? A.—Yes, sir.

XQ. 654.—And then you made this further question and answer:

“XQ. 130.—Just please state in what respects it is not substantially correct? “A.—Because it was not only the putrid odor of the substance alone, but the simplicity of the procedure involved in making it.”

That is correct? A.—Yes, sir.

20 XQ. 655.—Now, may I see your book again? As a matter of fact, xanthate turned out not to be a sulphidizing agent in a flotation process? Is that right? A.—That is correct.

XQ. 656.—In your direct examination you have given an account of the work done by yourself and some of the work done by Mr. Lewis between the fall of 1922 and the spring of 1923. Now, so far as the issues with which we are here concerned relating to the subject matter of this patent, I understand there was a division of labor between yourself and Mr. Lewis—that you made the xanthate which was to be tried as a flotation agent, and Mr. Lewis carried  
30 out the tests under conditions selected by him? Is that right? A.—That is correct.

XQ. 657.—And I think in that interference which I referred to Mr. Lewis, who was alive then, also gave evidence? A.—Yes.

XQ. 658.—There are two answers of his there which perhaps you know something about, on page 72, XQ. 309 to 311. A.—That is Lewis's testimony?

XQ. 659.—Yes, that is Lewis's testimony, on page 72, of interference No. 50,394. XQ. 309—A.—309 on page 72? Pardon?

40 XQ. 660.—Yes, of interference 50,394, Keller vs. Sayre. A.—Oh, yes. What again is the number of the question?

XQ. 661.—309. A.—309.

XQ. 662.—Now I will read that:

“When did you first learn that xanthate and a mineral-frothing agent, such as steam-distilled pine oil, could be successfully used in froth-flotation?

For Plaintiff—C. H. Keller—Cross-Examination

“A.—The first record of this combination of reagents falls between the date of March 9, 1923, and March 13th, 1923. A test using potassium xanthate and steam-distilled pine oil was made during that time on a sample of Phelps-Dodge ore.

“XQ. 310.—Who made that discovery? “A.—I did.

“XQ. 311.—Did Mr. Keller have anything to do with it?

“A.—Not that I recall.”

Does that seem a correct statement? A.—I think the statement is incorrect.

10 XQ. 622.—Is it not something that Mr. Lewis would know about? A.—It doesn't constitute anything new, because one would use xanthate with any frothing agent that one's knowledge of the art of flotation may induce one to use.

XQ. 663.—Well, I am not really asking for an argument about it, Mr. Keller. So far as it is a statement of fact, it was Mr. Lewis who first made the combination of potassium xanthate with a pine oil? Is that right? A.—That is Mr. Lewis's statement.

XQ. 664.—And you know of nothing to contradict that? A.—I do not know.

20 XQ. 665.—On page 30 of your notebook, under date of November 8th, 1922, there is a list of flotation agents. The list there is of flotation agents? A.—Yes.

XQ. 666.—Now, I want to ask you a question or two about them. No. 11 is X-cake. What was that? A.—X-cake was the proprietary name for a flotation agent which was extensively used at the time.

XQ. 667.—Do you know what it contained? A.—I do not recall now.

30 XQ. 668.—But not a thiocarbanilid? A.—No, it was not a thiocarbanilid.

XQ. 669.—It was a soluble organic compound? A.—It was not very soluble, if I recall rightly.

XQ. 670.—I am told that it was alpha naphthylamine. A.—Yes, that is correct, alpha naphthylamine.

XQ. 671.—Now, on page 27, under the date of June 21, 1922, there is this entry in your notebook, Exhibit 12: “Dissolve resin in alkaline hypochloride,” and in brackets, “Luckenback & Vegetable Extract Patent.)” Can you tell me what that reference is to?

40 A.—Evidently at that time I must have seen Luckenback's patent regarding such a substance.

XQ. 672.—And then on page 29, under date of August 1st, 1922, there is an entry reading: “Anthracene —solvents; Carbazol +solvents; Phenantrene + solvents; to be used either solo or together.”

Those are all bracketed as tar constituents, and it is under the heading “Flotation.” Will you tell me what those substances

For Plaintiff—C. H. Keller—Cross-Examination

were? A.—Well, these substances are derived from tar, which in turn is a residual substance from coal tar distillation, and aside from those three mentioned there may be other constituents that I did not try.

XQ. 673.—And you were proposing to try or did try them?  
A.—No, I proposed to try them.

XQ. 674.—You proposed to try them. Now, I notice in the notebook on some pages there is written the symbol “K/L” or “L/K.” The “K” is for Keller? A.—Yes.

10 XQ. 675.—Will you tell me what that is intended to indicate?  
A.—“L” stands — sometimes it stood for “Littleford,” and sometimes it stood for Lewis.

XQ. 676.—That is, the experiment was to be done by Littleford — A.—Yes, or with him.

XQ. 677.—Or with him? A.—Yes, or Quigley.

XQ. 678.—I think you told my learned friend that you were not aware at the time, at this period — that is, in 1922 — of the use or proposed use of carbon disulphide in a flotation process?  
A.—That is correct.

20 XQ. 679.—I think you became aware of that later, did you not? A.—I did.

XQ. 680.—There was a reference in the prosecution of your United States application, which corresponds to the patent in suit here, where the examiner referred to a publication of 1916, a book by Magraw, entitled “Flotation Process,” in which on pages 217 and 218 reference is made to the use of carbon disulphide with resin oil. A.—I was not aware of that until it was pointed out to me in that interference, never having read the book.

By MR. COHEN: Will you read me that answer?

30 (Answer read.)

By MR. SMART: XQ. 682.—As a matter of fact, up to this time you had not had any experience in the commercial operation of flotation? A.—I may have to amend that, because in 1916 — ‘15 or ‘16, while employed by the Alvarado Mining Company at Parral, Mexico, I did some work on flotation, specifically floating in cyanide solutions.

XQ. 683.—That was the only work you had done? A.—That was the only work.

40 XQ. 684.—And your experience, unlike that of Mr. Lewis, was not in the field? A.—That is correct.

XQ. 685.—In this first notebook of Mr. Lewis, Exhibit 14, on page 67, there are notes of an experiment, at the bottom of which it says: “Tried Keller’s yellow sulf Ca mixture (3 lbs.)—”

By MR. COHEN: Point three.

For Plaintiff—C. H. Keller—Cross-Examination

BY MR. SMART: XQ. 685. — (Continuing:) “Indicated good effect on zinc lead ores — brightens up lead for rapid float — No assays — Same K mix gave quicker brightening 1/10# ton.”

Am I correct in understanding that that experiment, which was October 10, 1922, referred to one of these sulphides that you referred to as working on at that time? A.—I think it is October 18th.

XQ. 686.—October 18th. I got mixed up. A.—May I look at that?

10 XQ. 687.—Yes. The upper part there, there is a formula for  $\text{Na}_2\text{S}$ , which indicates a sodium sulphide — A.—Yes, there is.

BY MR. COHEN: This is off record.

(Unreported discussion.)

A.—It may be that it was one of the sulphide reagents that I worked with.

BY MR. SMART: XQ. 688.—Did you observe the effect that is described in the language I quoted? A.—I do not recall.

XQ. 689.—On page 97 there is reference to something called “Kotrix.” A.—On page 97.

20 BY MR. COHEN: Is it 96? A.—No, it is 97.

BY MR. SMART: Page 97 of Exhibit 14.

XQ. 690.—What was that compound? A.—That was calcium polysulphide. If I recall rightly, that was on hand in the flotation laboratory.

XQ. 691.—You were familiar with it at that time? A.—No, I was not very familiar with it at the time. I knew of its existence.

XQ. 692.—What was its origin? A.—You mean the way it was made?

XQ. 693.—Where did it come from — what you had on hand?  
30 A.—Oh, I do not know where it came from.

XQ. 694.—How did you know its composition? A.—Because it was marked on the bottle.

XQ. 695.—Were you not aware that that was one of the reagents proposed by Martin, R. B. Martin, whom we have already referred to? A.—I may have known at the time that Mr. Martin did some work on that polysulphide.

XQ. 696.—There is also a reference on the next page — that is page 98 of Exhibit 14 — where the statement is made: “Does not clean up as fast as Penta or Kotrix.”

40 Now, the “Penta” referred to would be pentasulphide?

XQ. 697.—And the kotrix would be this compound? A.—That compound before-mentioned, that is correct.

XQ. 698.—Now, on page 116 of Exhibit 14 there is a reference to a “Thio carb as prepared by Mr. K.” Can you tell me which

For Plaintiff—C. H. Keller—Cross-Examination

thiocarbonate that would be? A.—That may have been potassium thiocarbonate that was prepared by me during the time.

XQ. 699.—The term “thio” indicates that it is a sulphur derivative? A.—It is.

XQ. 700.—On page 132 of Exhibit 14 there is reference to “Skunk Oil,” and underneath is written, apparently in another handwriting, “Ethyl Mercaptan.” Can you tell me what that entry indicates? A.—Well, skunk oil was the name that we gave to the mercaptans in those days, because it was rather redolent,  
10 and there is no further significance to that.

XQ. 701.—But it was an ethyl mercaptan, was it? A.—It was mercaptan—ethyl mercaptan.

XQ. 702.—Now, Exhibit 18. You think that the term “ethyl mercaptan” is written in the same handwriting as the rest of the entry? A.—I rather think it was.

XQ. 703.—Exhibit 18 is the report to Mr. Nutter of December 11th, 1922. That, I take it, is a report on some experiments on thiocarbanilid? A.—It is.

XQ. 704.—Which were undertaken as a result of some report  
20 from Mr. Chester B. Allen of the use of that compound on Anaconda slimes? A.—Yes.

XQ. 705.—Mr. Allen was one of your field representatives, I take it? A.—He was.

XQ. 706.—Now, you have told about meeting Mr. Martin in 1924 and 1925. I think in some of your earlier evidence you stated you met him soon after you came with the company in 1918. Is that right? A.—I did.

XQ. 707.—What was the circumstances of that first meeting with him? A.—He was working as assistant to Mr. Higgins, and I  
30 think it was at the time of some Federal hearing—I have forgotten now—some Federal Trade Commission hearing, and Mr. Higgins conducted experiments in the laboratory previous to demonstration, and Mr. Martin assisted him.

XQ. 708.—You were both working together on that occasion? A.—No, I didn't have anything to do with that litigation at all.

XQ. 709.—You were visiting New York, wherever the hearing was? A.—Oh, I thought you meant when I first saw Mr. Martin shortly after I came to the country.

XQ. 710.—Yes, that is right. A.—Well, that was in 1918.

40 XQ. 711.—Yes. A.—And I didn't visit New York at that time.

XQ. 712.—Where was that? A.—That was at 220 Battery, right here in San Francisco.

XQ. 713.—Oh, Mr. Martin was out in San Francisco at that time? A.—Yes, he was here in San Francisco.



For Plaintiff—C. H. Keller—Cross-Examination

XQ. 714.—And you met him then? A.—I met him a couple of times.

XQ. 715.—And you met him on other occasions between 1918 and 1924? A.—No.

XQ. 716.—Did you have any correspondence with him? A.—No, sir.

XQ. 717.—Or see any of his correspondence? A.—No, sir.

XQ. 718.—Or of his reports? A.—Not that I recall.

10 XQ. 719.—Were you aware that some of his reports were around the San Francisco office? A.—I was not aware of Mr. Martin having made any reports.

XQ. 720.—When did you learn that he had made some reports, or bulletins, as you call them? A.—I do not recall the date, or the year even.

XQ. 721.—But at some time you did learn about it? A.—Yes, I heard about them afterwards.

XQ. 722.—Now, the interference of Martin vs. Keller—you remember that interference? A.—I do.

20 XQ. 723.—I think I will give the number of it. It is 55,642, and evidence was taken in 1929. You remember that? A.—Yes, I remember that.

XQ. 724.—And I suppose your recollection at that time was as good as it is now? A.—I think it was.

XQ. 725.—And you have had nothing to refresh your recollection previous to giving testimony in this case? A.—That is correct.

XQ. 726.—And on page 123 of that, after referring to a time in 1926, when you saw Mr. Martin in California, you said you had seen quite a lot of him. This question was put to you:

30 “Did he ever claim to you that he was the inventor of a process of flotation employing xanthate?”

And your answer: “Not that I recall.”  
A.—That is correct.

XQ. 727.—That is correct? That is the way it appears to your mind? A.—Yes.

XQ. 728.—You did not then recall and do not now recall that he did? A.—That is correct.

XQ. 729.—Now, about these tests at the Anaconda plant in 1923: You have given some evidence about the xanthate that was made by the Great West Company?

40 BY MR. COHEN: Great Western.

BY MR. SMART: The Great Western Company.

XQ. 729.—(Continuing:) And I presume you were aware that there were some tests run there—I think it was in August, 1923—competitive tests with the Callow process? A.—Yes, sir.

For Plaintiff—C. H. Keller—Cross-Examination

BY MR. COHEN: That was September, I think.

BY MR. SMART: In September, 1923. A.—Yes, sir.

XQ. 730.—The reagent used by the Callow Company was called their T.T. mixture, I think. A.—Yes, sir.

XQ. 731.—And that consisted of a certain amount of thio-carbanilid and a certain amount of ortho-toluidine? A.—Yes, sir.

XQ. 732.—Now, the result of that test was that, although the Callow reagent obtained a better recovery of the copper, there was less profit on account of the cost of their reagents? Is that right?

10 A.—I do not recall that specific case.

XQ. 733.—Well, did you see a copy of the report that the Anaconda Company forwarded to your company after the test was over? A.—I do not recall.

BY MR. SMART: If you will refer to Exhibit 20, which is the laboratory record book, there are two tests recorded at the bottom of page 30, which I think I will ask the reporter to copy in here, if he will. It is easier than reading it.

BY MR. COHEN: You can have a photostat.

BY MR. SMART: I guess it would be better for you to furnish a  
20 photostat.

BY MR. COHEN: Yes.

BY MR. SMART: I will be furnished with a photostat of page 30 of Exhibit No. 20, which will be marked as "Defendant's Exhibit A."

XQ. 734.—Those two tests were tests in which ethyl-mercaptan was used as the flotation reagent, were they not? A.—Yes, sir.

XQ. 735.—And they gave a very good recovery of copper? A.—They do.

XQ. 736.—One of them gives 96.2% of copper in the concentrate, and the other one 94.5% copper in the concentrate; the tails being  
30 respectively 3.8% and 5.1%? A.—That is correct.

XQ. 737.—And both of those tests were recorded by Mr. Lewis? A.—They were.

XQ. 738.—And you furnished the reagent? A.—Furnished the mercaptan.

XQ. 739.—Yes, the mercaptan. Now, dealing with benzyl xanthate: You gave a list of your benzyl xanthate experiments, which was filed as Exhibit 42. I think there was one additional benzyl xanthate experiment which is not noted in that Exhibit 42, but which is described in your notebook, Exhibit 12. (Examining  
40 record books.)

(Unreported discussion.)

XQ. 740.—I notice in Exhibit 21 that this compound kotrix is referred to in the right-hand column in three places. It indicates that it was used as a reagent by Mr. Lewis—A.—In three tests, yes.

For Plaintiff—C. H. Keller—Cross-Examination

XQ. 741.—In three tests. A.—Correct.

BY MR. COHEN: I think you have already called attention to one of them.

BY MR. SMART: Two of them—that is right.

XQ. 741.—I noticed in some of the correspondence reference to the alphabetical reagents of Callow. I think that term was used by you. What does that indicate? A.—Well, Callow at that time used certain reagents, to which he applied letters of the alphabet. That is all I know about it.

10 XQ. 742.—Those were, I take it, organic reagents? A.—I venture to say they were, yes sir.

XQ. 743.—Did you become familiar with the work, the investigation that had been carried out at the Mellon Institute by Perkins, Sayre and Corliss—that you read about it? A.—No, sir, I did not.

XQ. 744.—Well, at some time I presume you read about it in the literature? A.—I may have.

XQ. 745.—But you have no recollection now as to when you became familiar with that? A.—Yes, I have no recollection of it.

XQ. 746.—On Exhibit 17, which was your letter of May 7th,  
20 1923, dealing with some soluble sulphidizing reagents, you say:

“As far as I am aware no patent has been taken out on them, nor are they covered by Mr. Martin’s patent 1236856.”

Now, what does that patent relate to? A.—If I remember rightly, that patent covered that substance marked “kotrix.”

XQ. 747.—Yes. So by this time you were familiar with the origin of kotrix? A.—Yes.

XQ. 748.—Now, in Exhibit 27, a letter of May 15th, 1923, you give a list of salts of sulfo-carbonic ethers, quite a long list, and I take it that that list was taken from Watts dictionary? A.—It was.

30 XQ. 749.—It was. They appear in about the same order as in the dictionary? A.—Yes, sir.

XQ. 750.—Do you think that was the first time that you had consulted Watts dictionary—about that time in May, 1923? A.—No.

XQ. 751.—It was warlier than that, was it? A.—It was earlier than that.

XQ. 752.—In the latter part of page 2 of that letter, Exhibit 27, you refer—on the end of page 2 of that letter there are listed salts of various thiocarbonates. Isn’t it true that most of those compounds would not form salt, but are salts themselves? A.—No,  
40 sir.

XQ. 753.—So you would say that is correct to designate them as “salts of —”? A.—Shall I mention one specifically?

XQ. 754.—Yes. A.—It says here “salts of mono-ethyl-tri-thiocarbonate,” and in brackets xanthogenic acid, which is of course xanthate.

For Plaintiff—C. H. Keller—Cross-Examination

XQ. 755.—And does it apply to the others? I don't know whether we are at one on this. The point I was making is that many of these substances are already salts, and would not be properly designated as salts of the compounds which are named. A.—You are correct.

XQ. 756.—I am correct. That is what I thought. The term "positive," I take it, indicated that from the tests which are indicated in that letter you had satisfied yourself that they had utility as flotation agents? A.—I did.

10 XQ. 757.—In the record of the interference, *Keller v. Sayre*, 50394, at page 115 to 116, you were shown copies of the Perkins and Sayre patents 1,364,859 and 1,364,308, as the result of which you recollected that you had seen copies of those patents towards the last part of 1922. Is that right? A.—That is correct.

BY MR. COHEN: What is correct? That you so testified, or— A.—Yes.

BY MR. SMART: XQ. 758.—If I may refer to the record in *Lewis v. Sayre*, in interference No. 50,888, at page 91, there were a few questions about the decomposition of xanthate.

20 BY MR. COHEN: Where is that reference?

BY MR. SMART: Page 91.

BY MR. COHEN: Of which record?

BY MR. SMART: Of the *Lewis v. Sayre* record.

XQ. 759.—I will read it to you:

"XQ. 84.—When did you discover that xanthates are decomposed with the formation of xanthic acid when added to an acid solution?" A.—Some time subsequent to March 2nd, 1923.

"XQ. 85.—How did you make that discovery? "A.—Because I read about it.

30 "XQ. 86.—You never actually tested the fact yourself, did you? "A.—I think I did.

"XQ. 87.—When did you do so? "A.—Subsequent to my reading about it."

That evidence is correct? A.—Yes, sir.

XQ. 760.—Now, if I may refer back again to Exhibit 17, which is your letter of May 7th, 1923, to Mr. Nutter. Now, am I correct in understanding that the thiocarbonic acid, the sodium sulfocarbonate, and the potassium sulfocarbonate referred to therein are all sulphur derivatives of carbonic acid? A.—They are.

40 XQ. 761.—Then if I may refer to Exhibit 27, which I had just before—the letter of May 15th, 1923, from yourself to Mr. Nutter—in that list of compounds are included ethylene di-thiocarbonate and ethylene tri-thiocarbonate. I take it that those are both sulphur

For Plaintiff—C. H. Keller—Cross-Examination

derivatives of carbonic acid containing an organic radical? A.—They are.

XQ. 762.—Now, so far as the remaining compounds, apart from those two I have just named, I think they are all sulphur derivatives of carbonic acid containing an alkyl radical? Is that right? A.—Do you mean of all those mentioned—

XQ. 763.—Apart from the two I have just named—that is, ethylene di-thiocarbonate and ethylene tri-thiocarbonate. A.—There are a number which are not sulphur derivatives of carbonic acid.

10 XQ. 764.—Will you point out the ones to me which are not? A.—Ethylene sulphide, di-ethylene disulphide—

XQ. 765.—Well, perhaps I can get at it in this way—perhaps you will list the compounds for me which are sulphur derivatives of carbonic acid containing an alkyl radical. I have a list here, if you could perhaps agree with it. I have examined the list, and I want you to see if you agree that the following compounds are sulphur derivatives of carbonic acid containing an alkyl radical. Perhaps you will say “Yes” or “No” after each one as I list it. A.—Yes.

XQ. 766.—Potassium ethyl tri-thiocarbonate? A.—Correct.

20 XQ. 767.—Just “Yes.” A.—Yes.

XQ. 768.—Potassium salt of mono-ethyl-thiocarbonic acid? A.—Yes.

XQ. 769.—Di-ethyl thiocarbonate? A.—Yes.

XQ. 770.—Salts of ethyl-isobutyl-thiocarbonate? A.—Yes.

XQ. 771.—Salts of isobutyl-ethyl-thiocarbonate? A.—Yes.

XQ. 772.—Di-ethyl-thiocarbonate? A.—Yes.

XQ. 773.—Di-ethyl-dithiocarbonate? A.—Yes.

XQ. 774.—Methyl-ethyl-dithiocarbonate? A.—Yes.

XQ. 775.—Di-ethyl-dithiocarbonate? A.—Yes.

30 XQ. 776.—Ethyl-propyl-dithiocarbonate? A.—Yes.

XQ. 777.—Di-ethyl-tri-thiocarbonate? A.—Yes.

XQ. 778.—Di-ethylene-di-thiocarbonate? A.—Yes.

XQ. 779.—Ethylene-ethyl-di-thiocarbonate? A.—Yes.

XQ. 780.—Then I think you did some work also that you have reported in the documents which went in with regard to xanthogenamide. That would also be a sulphur derivative of carbonic acid containing an alkyl radical? A.—Yes.

XQ. 781.—And as you pointed out to me, there are in that list some compounds which are not sulphur derivatives of carbonic acid? A.—That is correct.

XQ. 782.—Such as, I take it, ethyl-ortho-thiocarbonate, ethylene sulphide—A.—Pardon. That ethyl-ortho-thiocarbonate may also be a thiocarbonate.

For Plaintiff—C. H. Keller—Cross-Examination

XQ. 783.—The ethylene sulphide and di-ethylene disulphide would not be? A.—Are not—that is correct.

XQ. 784.—Are not. I suppose the compounds there don't exhaust by any means the sulphur derivatives of carbonic acid? A.—They do not.

XQ. 785.—Now, I will go back to your notebook, Exhibit 12. There are two entries in German—A.—Pardon?

XQ. 786.—There are two entries in German about January 19, 1924. A.—Perhaps I may be able to find it.

10 XQ. 787.—Perhaps you can find them for me. A.—Yes. (Examining book.)

XQ. 788.—They were attached to this photostatic copy, and I don't quite find them there. I show you this photostatic copy. Perhaps you can tell me what that is from. A.—Oh, yes, yes. (Examining book.)

XQ. 789.—I am handing you a photostat copy of a page which was handed to me as part of a page from one of your notebooks. I understand that you have looked through your notebook, Exhibit 12, and find that there is no entry of this kind in it? A.—That is so.

20 XQ. 790.—Is that in your handwriting? A.—It is.

XQ. And it is a notation that you made at the time stated on the page which I show to you. Is that right? A.—That is correct.

XQ. 792.—And will you translate the two entries that appear on that page, which are written in German? A.—“January 3rd—” no, I think it is January 13th, 1924. “Made a xanthate by directly combining sodium carbonate, water, caustic lime, carbon disulphide and alcohol. Gives very good result.”

XQ. 793.—That is one entry? A.—Yes.

30 XQ. 794.—Now, translate the next entry. A.—“January—”. I can't make it out. “January, 1924. Made a xanthate like combination by means of ammonium carbonate, carbon disulphide and alcohol.”

XQ. 795.—“and alcohol”? A.—“Gives very good result with a special separation of the lead versus zinc.”

XQ. 796.—Could that last phrase be translated “with a particularly smooth separation of the lead from the zinc”? A.—That is a perfect translation.

40 XQ. 797.—That is a perfect translation. And at the beginning would it be proper to translate it as “Made a compound analogous to xanthate”? You put it “xanthate like.” A.—That is in the beginning of the second?

XQ. 798.—Yes. A.—Yes, that is correct.

BY MR. SMART: I will ask to have this marked as “Defendant's Exhibit B.”

(Page of notebook, Exhibit 12, marked “Defendant's Exhibit B.”)

For Plaintiff—C. H. Keller—Cross-Examination

XQ. 799.—Where do you suppose the book is from which this was taken? A.—I think, like so many others, it has been thrown out when Minerals Separation closed its office.

XQ. 800.—Do you recollect if there was another notebook of yours as of this date? A.—I do not recall of that date, but there were two or three notebooks.

XQ. 801.—Of which you have only one in your possession now? A.—Yes, this one is the only one in my possession, or in Minerals Separation's possession.

10 BY MR. SMART: I understand that counsel for the plaintiff will make a search of his records in New York and see if this notebook can be located, and if so you will produce it?

BY MR. COHEN: Oh, yes, and if not counsel is willing to have the photostat go in.

BY MR. SMART: Yes.

XQ. 802.—I hand you a second photostat of a page of certain experiments, dated in January, 1924, and draw your attention to one dated 1/12/24, which reads:

20 "Made benzyl xanthate according to probable formula  
 $C_6H_5CH_2 OH + KOH + CS_2 = KOCS_2C_6H_5CH_2 + H_2O.$ "

And followed by the notation "1/28/24 test made by Lewis on Anaconda ore on the above material."

And bearing the signatures "Cornelius H. Keller, C. P. Lewis," and "Witness, Edward H. Nutter, Feb. 4, 1924."

That indicates an experiment that was performed at that time? A.—It does.

XQ. 803.—And it was in addition to the list that you gave of the benzyl xanthates? A.—It is.

30 XQ. 804.—And that photostat is apparently from the same notebook as the previous one, Exhibit B? A.—Yes.

XQ. 805.—Is that right? A.—Yes.

BY MR. SMART: I will ask that this be marked "Defendant's Exhibit C."

(Page of experiments marked "Defendant's Exhibit C.")

XQ. 806.—As far as Exhibits B and C are concerned, they appear to be the same kind of notebook as Exhibit 12? A.—Yes, sir.

BY MR. COHEN: There is a jump in the paging there; they jump from 89 to 92.

40 BY MR. SMART: That is right; it jumps from 89 to 92. It is about the same time, you see, but not exactly. It might be that this page had come out of your notebook. A.—It is possible.

XQ. 807.—Still dealing with your notebook, Exhibit 12, on page 76 I find this statement—it follows a reference to a talk

For Plaintiff—C. H. Keller—Cross-Examination

you had with "N," which I presume is Mr. Nutter? A.—Yes, sir.

XQ. 808.—And there is a reference to "R," Mr. Rosenstein, about whom you have given some evidence, and the statement is in these words: "Told him that method was old as hills and that text books gave it."

That was Mr. Rosenstein's method you were there referring to? A.—That was Rosenstein's method.

XQ. 809.—And that would also apply to other methods of making xanthates that had been known for years — A.—Yes.

10 XQ. 810.—That there were methods of making xanthates that had been known for years? A.—I must have seen that method somewhere.

XQ. 811.—Yes, that is right. And there were other methods that were quite as old — not as old as the hills, but at least many years old, for making xanthate? A.—No, I said not "more than," but "one method."

XQ. 812.—One method, yes, but I am now putting it to you that there were other methods than Rosenstein's which were known. A.—There may have been.

20 XQ. 813.—I have a notation that there was an entry in this book under 6/5/23 of making a xanthate with glycerine, sodium hydroxide, water, and carbon disulphide. Do you remember making such a xanthate? A.—No, I don't think — the experiment I recall, but I don't think it resulted in anything like a xanthate, if I remember rightly.

XQ. 814.—You remember making that experiment? A.—Yes, I think I made it too.

XQ. 815.—And do you remember making a similar experiment about the same time in 1923 with oleic acid? A.—In what  
30 connection?

XQ. 816.—On 6/6/1923, oleic acid + H<sub>2</sub>O + NaOH + CS<sub>2</sub> —you made such a compound? A.—I do not recall whether I did or not.

XQ. 817.—There is a note at page 77, under date of 6/12/23. Perhaps you will read that into the record. A.—You mean the bottom note?

XQ. 818.—Yes, about ammonium xanthate. A.—"6/12/23. Ammonium Xanthate. Make tests on Anaconda, Sunnyside, Afterthought sulfides but not native copper."

40 XQ. 819.—That is an entry you made in your handwriting at that time? A.—That is correct.

XQ. 820.—And then on the next page, 78, there is a reference to the glycerine and oleic acid experiments that I have referred to. A.—Yes, sir.



For Plaintiff—C. H. Keller—Cross-Examination

XQ. 821.—And about that time you tried a mixture of the xanthate with phenol, cresylic acid, naphthalene and benzene?

A.—Yes, sir — pardon. The question is, did I try them or —

XQ. 822.—Did you try them? A.—Oh, no, I don't recall that.

XQ. 823.—But you made a note of them. I find an entry under date of 9/27/22, which I will read.

BY MR. COHEN: What page?

BY MR. SMART: Page 48.

XQ. 824.—I will read it to you:

10        "Make the following combination to be tried out: Dissolve CS<sub>2</sub> in oils — such as creosote, phenols, benzene, xylene, pine oil. Add caustic soda and use as sulfidizing reagent.

      "*Conversely.* Dissolve caustic soda in oils or other organic solvents as alcohol, pine oil, xylene, benzene, etc. Add CS<sub>2</sub> and use as flotation reagent."

Is that a note you made at that time? A.—Yes.

XQ. 825.—Did that just occur to you, or had you read something about that? A.—No, that simply was an idea I had. Of course, as far as the combination of alcohol, carbon disulphide 30 and potassium hydroxide is concerned, that would form xanthate, and the other combinations I have not tried, as far as I can remember.

XQ. 826.—Now, under date of 3/22/23, there is a heading "Combination of xanthogenate compounds," and I will read this and see if I am correct:

      "Z 4 H    Mix CS<sub>2</sub> + Barret No. 2 add KOH Alc.

      "Z 8 Q    Mix CS<sub>2</sub> + Naphthalene in xylene add Alc.

      "Z P     CS<sub>2</sub> + P add KOH in Alc.

      "Z I     CS<sub>2</sub> + T add KOH in Alc.

30        "Z R 1    Resin in alcohol + KOH in Alc. + CS<sub>2</sub>

      "Z R 2    Resin in CS<sub>2</sub> + KOH in Alc.

      "Z L 1    Lanolin in Alc. + KOH in Alc. + CS<sub>2</sub>.

      "Z L 2    Lanolin in CS<sub>2</sub> + KOH in Alc.

      "ZZ     Rubber CS<sub>2</sub> in Alc. Potash + H<sub>2</sub>S."

Those are your notes made on that date? A.—3/22/23, yes, these are my notes.

XQ. 827.—Just a second. I will ask you to clear up something here. "CS<sub>2</sub> + T" — A.—May I have a look at the book again?

40        XQ. 828.—Yes. A.—Where is that?

XQ. 829.—"Z 1, CS<sub>2</sub> + T —" A.—That is "I" — iodine.

XQ. 830.—Oh, iodine. Where I said, "Z 1, CS<sub>2</sub> + T," it should be "Z 1, CS<sub>2</sub> + I add KOH in Alc." Is that right? A.—That is correct.

For Plaintiff—C. H. Keller—Cross-Examination

XQ. 831.—And then the “P” would be phosphorous? A.—Phosphorous.

XQ. 832.—Then there is a heading “Tri-thiocarbonate,” with a notation of “Make Tests. Offers loophole for interlopers.” A.—May I have a look at that?

XQ. 833.—That appears on that page. A.—Oh, yes, I see.

XQ. 834.—And you made some tests on those that you have told us about afterward? A.—I do not recall whether I did or not. I think I made some of these combinations, but I do not recall  
10 whether I made any tests.

XQ. 835.—Then at the bottom of that page there is a notation, “Z A 1 Mix Amytal + H<sub>2</sub>O add to CS<sub>2</sub> mix well add KOH Alc 2 layers.” A.—Amytal? What is amytal?

XQ. 836.—Was that in the same category as a xanthate combination? A.—No — amyl alcohol.

XQ. 837.—Oh, it was amyl alcohol? A.—Amyl alcohol, yes.

XQ. 838.—Not amytal? A.—No. These entries were made by me, and some of these combinations were made by me, but I do not recall having made any tests with that.

20 XQ. 839.—Then there are some notes at page 70, which I gather are notes of conversations with Mr. Nutter. I will read the first of them into the record.

“Re: xanthate & personal affairs. Had conversation with E. H. N. Was promised that in case xanthates should be patented & accepted by —”

Perhaps you will read the two paragraphs there. It is your writing. A.—May I read that?

XQ. 840. Read the first two paragraphs on the record. A.—“Had converse with E. H. N. Was promised that in case  
30 xanthate should be patented —”

XQ. 841. If there are any abbreviations, you might expand them. A.—All right. “—should be patented and accepted by company and prove its usefulness in the art, both Lewis and self might obtain a bonus possibly.”

The second entry states as follows:

“Make suggestions to Nutter Re: obtaining formulas for denaturing alcohol and using all the denaturants separately to prevent horning in of outsiders. Also regarding Real de Monte. Also decomposing of xanthate in water for shipping making it  
40 inadvisable.”

XQ. 842.—That was your note of the conversation at that time? A.—It was.

XQ. 843.—Now, on the next page — that is, the right-hand side of page 70 — the third entry under date of 5/5/23. Will you read that? A.—Shall I interpolate?

For Plaintiff—C. H. Keller—Cross-Examination

XQ. 844.—Yes, as long as we get the effect of the note on the conversation, that is what I want. A.—Yes. "Nutter gave me c.p.x. —" which stands for "xanthate" — "telling me he wants tests at once. He suggested as coming from Rosenstein that copper xanthate, cobalt xanthate, calcium xanthate, etc., might be useful. Told him they were not as they are insoluble. Moreover they are covered by potash and soda in original report. He stated that Rosenstein had suggested it but when told that it did not work when tried he said, 'I thought it might be useful'."

10 Shall I continue?

XQ. 845.—That is all right, thank you. Now, on the right-hand bottom of page 81 there are some compounds designated, "S Z, T Z, U Z, and V Z." The "Zed" indicating "xanthate," I take it? A.—May I have a look? (Examining book.) Yes.

XQ. 846.—Now, I will ask you to read those notes about those things, will you, and expand them if necessary where there are any abbreviations. The date is 6/20/23. Is that right? A.—Yes, sir. "(Acid Sludge +2-3 H<sub>2</sub>O+CS<sub>2</sub>)+(KOH+H<sub>2</sub>O) R Zx1."

Then these are ditto marks on the next line, and "x 2."

20 Then below that, "x1," in German, "Leicht oben," then "x 2, Schwer Unten."

Then in brackets, "(Amyl alcohol +KOH+H<sub>2</sub>O)+CS<sub>2</sub> S Z."

The next line: "(Methyl alcohol +KOH+H<sub>2</sub>O)+CS<sub>2</sub> T Z.

"Water White Benzol +CS<sub>2</sub>+KOH+H<sub>2</sub>O U Z.

"Camfort oil+CS<sub>2</sub>+KOH+H<sub>2</sub>O V Z."

XQ. 847.—Thank you. Then under date of January 5, 1924, there is this notation: "Nutter mentions Graphite & Coal to be added to xanthate patent." A.—Yes, sir.

30 XQ. 848.—That is where that idea originated? A.—E. H. Nutter.

XQ. 849.—Yes. And, of course, graphite and coal are not sulphides, are they? A.—No, but for the treatment—using xanthate for the treatment of graphite and coal. That is the way I would interpret it.

XQ. 850.—Has the xanthate, in fact, any effect on the flotation of graphite or coal? A.—It seems to have, because a patent was taken out on coal flotation by Mr. Wilkinson, wasn't it, by the use of xanthate?

XQ. 851.—Have you made any tests of it yourself? A.—No.

40 BY MR. SMART: That is all, thank you.

REDIRECT EXAMINATION BY MR. COHEN:

RDQ. 852.—You were asked, Mr. Keller, what books you consulted to discover all of the properties of xanthate. Did you consult Beilstein? A.—I may have.

For Plaintiff—C. H. Keller—Re-Direct

RDQ. 853.—Beilstein is the leading handbook, isn't it? A.—It is a leading compilation on organic chemistry.

RDQ. 854.—You were asked about cellulose xanthate and reference was made to Cross & Bevans. Do you remember their discussion about such compounds? A.—Yes.

RDQ. 855.—Was their discussion limited to that single variation of xanthate—cellulose xanthate? A.—I do not recall, but it gives a method of preparing cellulose xanthate.

RDQ. 856.—Was cellulose xanthate at the time known for its  
10 usefulness in anything else except the manufacture of rayon? A.—No, I am not aware of any other use but for that purpose.

RDQ. 857.—Were you aware of the purposes for which any kind of xanthate was used at that time? A.—No.

RDQ. 858.—You knew it had been used in viticulture, didn't you? A.—I knew.

RDQ. 859.—I think there has been some mention here of its use as a rubber accelerator. A.—I was not aware of it at that time.

RDQ. 860.—Did you know of any commercial use of xanthate at that time in this country? A.—No, I did not.

RDQ. 861.—Do the xanthates lie in a familiar branch of chemical  
20 substances? A.—I don't know what you mean.

RDQ. 862.—Was xanthate in 1922 a substance with which research chemists were generally familiar?

BY MR. SMART: Well, I object—well, he can say whether he knows or not. A.—Very likely.

BY MR. SMART: "Very likely," you said? A.—Very likely.

BY MR. COHEN: RDQ. 863.—Did you look to see whether it was listed as a product for sale by any of the chemical houses? A.—I do not recall. Pardon. I had better—it was not given in the price  
30 quotations given in chemical journals, such as the Chemical and Metallurgical Journal and the Oil and Drug Reporter.

RDQ. 864.—You had to show the Great Western Electro-Chemical Company how to make it, didn't you?

BY MR. SMART: Well, obviously that is leading, and I will object to the question in that form. A.—No. I had to show them how to make a purer xanthate for my purpose.

BY MR. COHEN: RDQ. 865.—You were asked for your comments on Mr. Lewis's testimony given in the Keller-Sayre interference in 1925, that he made the discovery which he said was involved in  
40 using potassium xanthate and steam-distilled pine oil? A.—Pardon? What is the page again?

RDQ. 866.—The page is 72, and the question is 309, 310 and 311; and you said, if my recollection is correct, that there was not anything new in that, and that an experimenter could use any frothing

For Plaintiff—C. H. Keller—Re-Direct

agent that his knowledge of the art would permit in conjunction with xanthate. Have you any further comment to make on that? A.—No, I do not have to add anything to that.

RDQ. 867.—Your attention was called to Mr. Lewis's testimony that you did not have anything to do with that alleged discovery, and you were asked whether that was correct so far as it is a statement of fact; and if my recollection and notes are correct, you said in that sense you know of nothing to contradict the statement, and you agreed that Lewis was the first to make a combination of xanthate  
10 and pine oil. Now, yesterday there was introduced in evidence a complete list of the reagents which Mr. Lewis employed after March 2nd, 1923, in his tests with xanthate. I show you that list, and ask you whether it was not also true that Mr. Lewis was the first physically to make in flotation a combination of xanthate and all of the reagents therein listed, in so far as those reagents are not xanthate or xanthate containing? A.—Well, I do not see Mr. Lewis's name mentioned anywhere on this tabulation.

RDQ. 868.—The tabulation is a tabulation taken from the laboratory record book of the experiments conducted by Mr. Lewis,  
20 and it shows the code for the reagents used by him. A.—Yes.

RDQ. 869.—Pine oil in various forms is included in that list, isn't it. A.—It is.

RDQ. 870.—As a matter of fact, any reagent that Mr. Lewis used in combination with xanthate would have first been employed by Mr. Lewis in combination with xanthate, wouldn't it? A.—It would have.

RDQ. 871.—Mr. Lewis was the first physically to make any flotation tests with xanthate and any reagent? A.—He was.

RDQ. 872.—Are there any other reagents listed in that schedule,  
30 "Plaintiff's Exhibit 25," with which you were not familiar at the time? A.—I was familiar with all of them.

RDQ. 873.—Were there any among that list which were not employed in routine operations in the laboratory? A.—Aside from the xanthate mixtures, all of them were routine reagents.

RDQ. 874.—You were asked on cross-examination as to the meaning of certain symbols on the top of some of the pages in your personal notebook—"K/L, K/S," and some others, and you said that it indicated that the work indicated on the page was work to be done with the persons so indicated, Mr. Lewis or Mr. Littleford?  
40 A.—Yes.

RDQ. 875.—Who was the "S" referred to in some of those symbols? A.—That was Mr. Spohn.

RDQ. 876.—Was he a chemist? A.—No.

RDQ. 877.—He was not employed by Minerals Separation? A.—No.

For Plaintiff—C. H. Keller—Re-Direct

RDQ. 878.—So that in that case your symbol meant that that was work you were doing for him, did it not? A.—No, not for him, but with him.

RDQ. 879.—What part of it did he do? A.—Well, he made certain suggestions, particularly regarding paper pulp and possibly other things.

RDQ. 880.—Some references was made to Mr. R. B. Martin's reports or bulletins, and you were asked when you learned that he in fact made such reports or bulletins. You said you didn't recall  
10 when you learned of that fact. Could you have learned of the fact before—did you learn of the fact before Martin's departure from the employ of the company in 1926? A.—I do not recall when I first heard about the case.

RDQ. 881.—When you first heard about the fact—

BY MR. SMART: "Case," he said. A.—About this case—these reports or bulletins, whatever it was.

BY MR. COHEN: RDQ. 882.—You were asked about your testimony in that interference, in the Martin-Keller interference in 1929, and you said you did not recall that Martin had ever claimed  
20 to you that he was the inventor of a process of flotation employing xanthate? A.—That is correct.

RDQ. 883.—Some emphasis was put upon the word "recall", as perhaps implying that you were not sure—that Martin may have made such claim to you. In that the meaning of your phrase "I do not recall"? A.—That is correct.

RDQ. 884.—Did you ever prepare mercaptan for use by Mr. Lewis in any tests? A.—No.

RDQ. 885.—Where did Mr. Lewis procure the material? A.—I procured it for Mr. Lewis.

RDQ. 886.—You bought it from some commercial house? A.—  
30 Yes.

RDQ. 887.—You were reminded of your testimony that you saw some of the Perkins and Sayre patents in the last part of 1922, and the specific patents were mentioned to you. A.—Yes.

RDQ. 888.—Are the reagents covered by those patents related to xanthate in any way? A.—No.

RDQ. 889.—You were asked about the decomposition of xanthate in an acid circuit, and you corroborated some testimony that in such a circuit xanthate becomes xanthic acid. Is pure xanthic  
40 acid a stable compound? A.—It is not at ordinary temperatures.

RDQ. 890.—That is the principal objection to using it in flotation? A.—It is.

RDQ. 891.—When xanthic acid is in dilute solution with water, what is its stability? A.—Unstable.

For Plaintiff—C. H. Keller—Re-Direct

RDQ. 892.—In what dilution does it become stable? A.—I could not say; I do not know.

RDQ. 893.—Do you know that there is a point at which it does become stable? A.—No. May I off record—may I explain something here? Is that permissible?

By MR. SMART: Yes.

(Unreported discussion.)

By MR. COHEN: RDQ. 894.—Now, your attention was called to a number of entries in your notebook, in which you noted a number  
10 of mixtures, most of them containing all of the ingredients of xanthate plus one or two additional substances, and in some of which you noted possible substitutes for one or more of the ingredients of xanthate. Now, if my notes are correct, your attention was called to notations in your notebook at pages 76, 77, 78, 48, 69, 70, 81, and on the two pages of which we have photostats, and which were introduced as Defendant's Exhibits B and C. You examined those entries as your attention was called to them, did you not? A.—I have.

RDQ. 895.—Did you ever make a report to the chief engineer  
20 about them. A.—I did not.

RDQ. 896.—Did you ever make a test on any one of them? A.—I may have.

RDQ. 897.—Can you remember any? A.—I may have made qualitative indicative tests on a few of those things. I do not recall them.

RDQ. 898.—Did you prepare all of these mixtures? A.—I did.

RDQ. 899.—In addition to noting them in your notebook? A.—Yes.

RDQ. 900.—I thought you testified —

30 By MR. SMART: Well, now, you are cross-examining.

RDQ. 901.—After March 2nd, 1923, there were intensive experiments with pure xanthate, were there not? A.—There were.

RDQ. 902.—Those were the only experiments of which laboratory records were kept and assays made? A.—That is correct.

RDQ. 903.—Was it during the few months after March, 1923, that the controversy which you had with Dr. Rosenstein, to which you made reference, took place? A.—It was.

RDQ. 904.—Was it your position in the controversy that  
40 Dr. Rosenstein's method was not calculated to produce sufficiently pure xanthate? A.—It was.

RDQ. 905.—And much of your energies were directed to getting Great Western to adopt a method which would produce pure material? A.—They were.

RDQ. 906.—Have you ever seen any of Martin's early bulletins? A.—No, sir.

By MR. COHEN: That is all.

By MR. SMART: That is all.