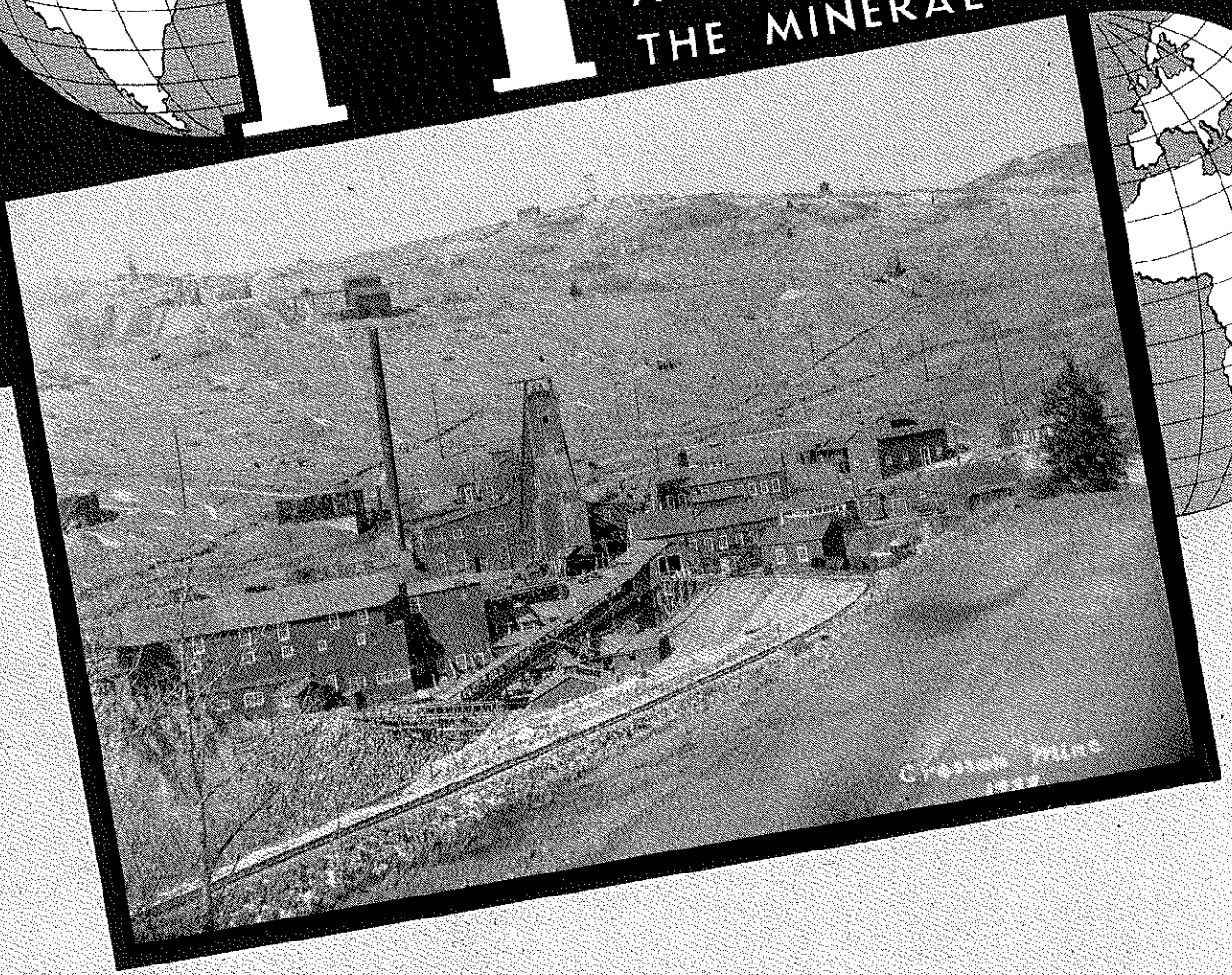
THE MINES MAGAZINE

AROUND THE WORLD WITH THE MINERAL INDUSTRIES



MAY · 1940

VOLUME XXX NO. 5

PERSONAL NOTES

George O. Argall, Jr., '35, who has been in Bishop, California, as mine shift boss for the U. S. Vanadium Corporation, has been transferred to their plant at Uravan, Colorado.

Philip R. Asel, '34, accompanied by his wife and young son, returned to Denver last month. He resigned his position with the New York & Honduras Rosario Mining Company at San Juancito, Honduras to accept one with Stearns-Roger Manufacturing Company in Denver. His present mailing address is 700 So. Ogden Street, Denver.

J. M. Blalock, Jr., '39, is now associated with the Cerro de Pasco Copper Corporation at La Oroya, Peru, serving in the capacity of junior metallurgist.

George D. Couch, '35, has returned to the States from Bolivia where he was engineer for the Compania Minera y Agricola Oploca de Bolivia, and is being addressed at his home, 4222 No. Ashmand, Chicago, Ills.

F. N. Bosco, '35, who has been doing exploration work in Brazil for the past year has returned to Denver with address 2166 So. Washington Street.

Steven S. Dettman, '31, Consulting Mining Engineer, has changed his address to Auburn, California.

Carl I. Dismant, '31, is now being addressed at Winston, Montana, where he is general manager for the Native Silver Mining Company.

T. L. Donovan, Ex-'26, formerly associated with the Caracas Petroleum Company, is now engineer for The Texas Company, Apartado No. 267, Caracas, Venezuela.

Walter J. Eaton, '13, Consulting Engineer of San Juan Capistrano, California, was a Denver visitor the latter part of April.

John F. Emerson, '38, resigned his position with the San Juan Ramsey Company at Incline, California, to accept position of chemist with the American Smelting & Refining Company at their Selby Plant. His mailing address is 2711 Ashby Street, Berkeley, Calif.

Hank Estabrooks, '38, was in Denver for a few days last month from his duties with the Canyon Corporation at Deadwood, So. Dakota.

Wendell W. Fertig, Ex-'24, who is on the staff of the mining department of Elizalde & Co., has been assigned to the Samar Mining Company, the second largest producer of iron ore in the Philippine Islands. His address is Box 119, Tacloban, Leyte, P. I.

A. E. Fleischman, '31, is shaft boss for the Keystone Mine Syndicate at Amador City, California.

Charles A. Gehrmann, '86, who has been listed in "Address Unknown" for some time has finally been located at 220 Tuam Street, Houston, Texas.

N. G. Glanding, Jr., '34, has a change of address to 508 No. 26th Street, Pennside, Reading, Pa. He is now employed by the U. S. Navy department as assistant inspector of naval materials. Part of his duties is the inspection of the Gamma Ray of steel castings. He not only handles much of the radium work but supervises and instructs in connection with same.

J. H. Hannan, Ex-'37, mine engineer for the Summitville Consolidated Mines, Inc., at Summitville, Colorado, called at the Alumni office the middle of April.

PERSONAL NOTES

L. Roth Harrison, Jr., '38, resigned his position as metallurgist for the Phosphate Recovery Corporation at Mulberry, Florida to accept that of production manager for the Magnet Cove Barium Corporation at Malvern, Arkansas. Their mill and flotation plant is now under construction and when completed will be the largest barite flotation plant in the United States.

Robert W. Harrison, '33, petroleum engineer for Parker, Foran, Knode and Boatright, has returned to Texas from Alberta, Canada, and is being addressed at 1209 Second National Bank Building, Houston.

Sterling S. Huyett, '36, has completed his contract with the New Goldfields of Venezuela, Ltd., and has returned to his home, 337 Terry Street, Longmont, Colorado.

W. D. Jeffries, '37, sales engineer for E. I. duPont de Nemours & Co., Inc., has a change of address to Niagara Falls, N. Y. in care of the R. & H. Chemicals Department of the company.

C. B. Kirch, '33, who recently returned from South America, passed thru Denver recently and called at the Alumni office. He receives mail at his home, 248 Elizabeth Street, Pasadena, Calif.

George W. Leslie, '35, is employed by the U. S. Army Engineers as highway designer. His mailing address is 2942 N. E. 51 Avenue, Portland, Oregon.

Jack J. Lofland, '38, engineer for Mina La India, writes that the company address has been changed to Larrenaga, Nicaragua, C. A., where he is now receiving mail. Since his employment there, a year and a half ago, tonnage has been increased from 125 to 300 tons per day. He and Mrs. Lofland are enjoying the new living quarters which have recently been completed and they like the country too.

A. H. Logan, '38, is cyanide solution man for the Willow Creek Mines at Shasta, California.

Joe McBrian, '23, has resigned as mine superintendent for the Minas de Matagalpa in Nicaragua, and, accompanied by Mrs. McBrian, has returned to the States. Mail addressed to him at Route No. 1, Shawnee, Oklahoma, will reach him.

James L. Morris, '38, geologist for the Pure Oil Company, has been transferred from Illinois to Fort Worth, Texas, where he is now residing at 2716 Rogers Street.

Jack D. Mullinax, '37, geologist in charge of core drilling work for the Continental Oil Company is now located at Great Bend, Kansas, where he receives mail at Box 248.

M. C. Pellish, '25, is partner in firm of Pellish & Wiederanders, selling Mining Equipment and Supplies. His address is 889 National Road, Wheeling, West Virginia.

Charles F. Redmon, Jr., '39, has been transferred by the Phillips Petroleum Company to Oklahoma City, Okla., where his address is 1123 No. Laird Street.

Fred E. Roth, '27, is now residing at 1312 Lincoln Street, Bremerton, Washington, having recently accepted position with the U. S. Navy Yard as ship draftsman in the Hull division.

Earl L. H. Sackett, '33, is in Holden, Washington, where he is employed in the metallurgical department of the Howe Sound Company. *Dick Vincent,* also '33, is assistant metallurgist there. *Joe Jesseph,* Ex-'36, who is with the Timken

(Continued on page 278)

PRIZE WINNER — MARCH 1940

The laurels this month go to the wife of one of our Mines Men for finding the most errors in the March 1940 number of the Magazine.

Mrs. Stephen J. Brown whose letter appears elsewhere in this issue is the winner and receives one year free subscription to MINES MAGAZINE.

Letters

Your letters are welcomed for publication in this column every issue. Send along your bouquets, your suggestions, your news, your problems, your criticisms. You like to read them and so do others. These are a good start, let's hear from others.—ED.

WORD FROM CHINA

From C. L. CHANG, '21
To "Old Pal Bill"

I have read yours of September 15, 1939 with great pleasure. It recalls our golden time in our Golden Tech. I wonder whether there are any new lines added to the Mining Engineer song since the "Dynamite."

As I have done quite a lot of traveling, so your letter was forwarded to me from the Kansu and Shensi provinces. Let me tell you the reason why.

Late in 1937, the Tsiaotso College of Engineering was removed to Sianfu, Shensi. Half a year later, we moved again to Tiensui, Kansu. In the summer of 1938, the college was amalgamated with three other Engineering Colleges to form the National North-Western College of Engineering. We moved again to Kulupa, Hanchung District, Shensi. One year later, I came here to teach metallurgy. I expect to go back to my native town, Nanyang, Honan, by the time when summer vacation comes up.

More than once I got letters and publications from Denver. Just a couple of weeks ago Mr. Waldschmidt sent me a "Big M," the most lovely sign in this world. Tho' I am unable to attend the football game, yet I can feel the old joy and glory when one big victory was to be celebrated by a Holiday.

I am sorry that I didn't bring my typewriter with me. Certainly, my handwriting will give you a little bit of trouble to read.

You will be heartily welcomed, if you are good enough to make a trip to this part of the world. As soon as I get your notice, I'll try my best to get the members of the "old gang" to be present in the party. Then, let's drink our cups clear.

As soon as I can buy International Money order (Now under government control, no such convenience for private individual) I'll join the Alumni Association. Thro' its activities the "Mines" spirit can be shown and put together the world over.

Many thanks for your kindness to write me this letter, I remain.

National University of Kwangsi, Kuilin, Kwangsi, China, Feb. 21, 1940.

PRIZE WINNER

From MRS. STEPHEN J. BROWN

The articles that weren't "over my head" were so interesting that I almost forgot to look for mistakes, as it was, I found very few errors. March—1940 issue.

The wives of Mines men that I know are just as interested in the Mines Magazine as their husbands are and I want to congratulate you on your selection of articles.

I had to look very closely for these, hope they all count.

610 Forrest Ave., Fountain Hill, Bethlehem, Pa., April 2nd, 1940.

The Mines Magazine

VOLUME XXX MAY, 1940 NO. 5

Contents

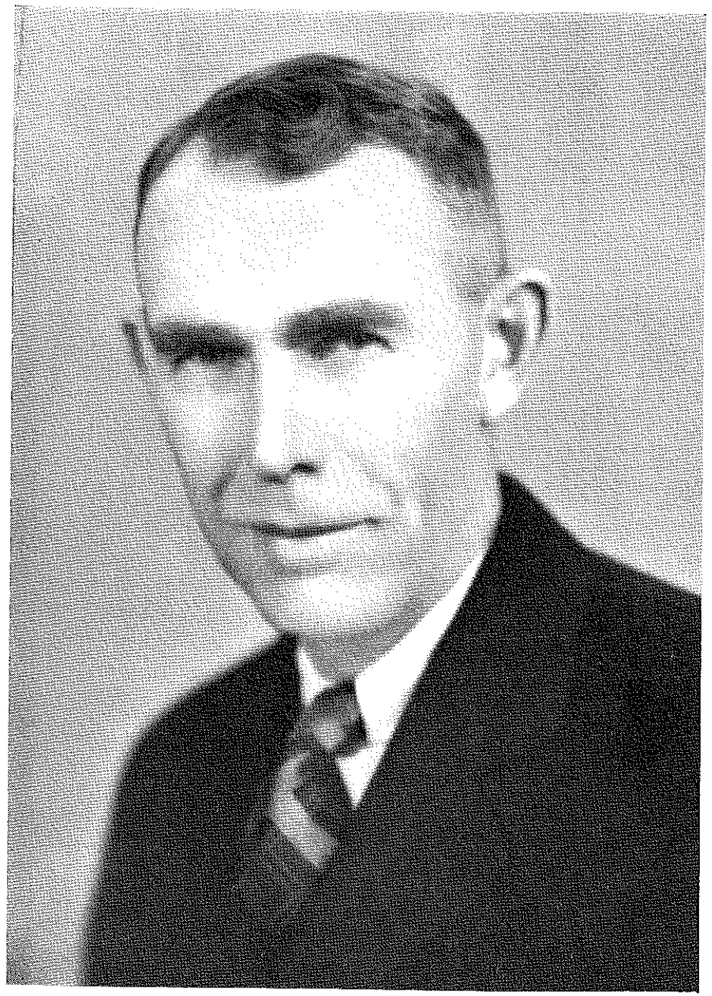
Departments

Front Cover

The Cresson Mine. One of the principal producers which the Carlton Tunnel will drain. This mine has produced $43,000,000 in gold.

INDEX TO ADVERTISERS SEE PAGE 282

Official Organ of the Colorado School of Mines Alumni Association. Entered as Second Class Matter at the Postoffice at Denver, Colorado, under the Act of Congress of March 3, 1879. Subscription price $3.00 a year. Single copies 50 cents. No additional charge for foreign subscription. Published every month in the year by the Colorado School of Mines Alumni Association. Address all correspondence, including checks, drafts and money orders to Frank J. Nagel, Secretary, 734 Cooper Bldg., Denver, Colo. Address all correspondence relating to Mines Magazine to Frank C. Bowman, Editor, 734 Cooper Building, Denver, Colo.



ALFRED H. BEBEE, '15

Vice President in charge of Mining

The Golden Cycle Corporation

The Cresson Consolidated Gold Mining & Milling Company

The United Gold Mines Company

Cripple Creek, Colorado

CARLTON DRAINAGE TUNNEL
CRIPPLE CREEK, COLORADO

By
ALFRED H. BEBEE, '15

Mine drainage in Cripple Creek has been a problem since the early days of the District. Most of the shafts encountered large flows of water before they reached any considerable depth, and pumping has always been a troublesome and expensive handicap to mining in this district. From measurements of the flow of water encountered in the Roosevelt Tunnel, it is estimated that each vertical foot of breccia area contains not less than 50,000,000 gallons of water in storage.

It was not many years until various tunnels, such as, the Moffat, Illand, Standard, and El Paso were driven. These various tunnels gradually drained the district down to their respective levels. In 1907 the larger mining companies operating in Cripple Creek, financed and started to drive the Roosevelt Tunnel. This tunnel drains the various mines of the district to an approximate elevation of 8100 feet above sea level, and connects with the El Paso, Elkton, Portland, Ajax, Vindicator and Cresson shafts.

The Roosevelt Tunnel has been a life saver for the mines of the Cripple Creek district for more than 20 years. The Cresson, Portland, Vindicator, Ajax and many other properties could not have worked to the depth already attained, without the drainage this tunnel affords.

The Golden Cycle mill at Colorado Springs is almost wholly dependent upon Cripple Creek for its supply of ore, and it was realized by the Golden Cycle Corporation that it was necessary to provide additional drainage in order that ground at greater depth than can now be worked profitably, could be developed and mined. For the above reason this company decided to take the gamble on driving the 32,000 foot Carlton Tunnel, to provide 1100 feet of additional permanent drainage for the Cripple Creek district.

It is one of the few projects of its kind in this country today, financed entirely by private capital, in which a private corporation is taking a gambler's chance on developing and opening sufficient ore to pay for this work. It might be well to point out, at this time, the handicap placed on such an enterprise by the ever increasing tax load, resulting mainly from the so called Social Legislation enacted in the past few years. Various taxes, such as, Sales and Use Tax, Old Age Pension, Unemployment insurance and many others amount to nearly $2.00 per foot of tunnel.

The portal of the Carlton Tunnel is located 8½ miles south of the towns of Cripple Creek and Victor, near the junction of Cripple Creek and Oil Creek. The portal elevation is 6893 feet.

Its course is N49° 54′E and the main drive will be 32,000 feet in length to a position under No. 2 Portland Shaft, at an approximate elevation of 6990 feet, or 1120 feet below the present drainage level of that property. The grade will be + 0.3%. To accomplish complete drainage for the Cresson and Vindicator, two laterals will be driven from 4,000 to 5,000 feet each. The approximate depth gained, below the lowest workings in the larger mines is as follows:

Cresson	700 Feet
Ajax	500 Feet
Vindicator	1,000 Feet
Portland	200 Feet

The tunnel will be driven almost its entire length in granite. Breccia will be encountered near the end. The granite is extremely hard and tough; it is uniform and has very few fracture joints.

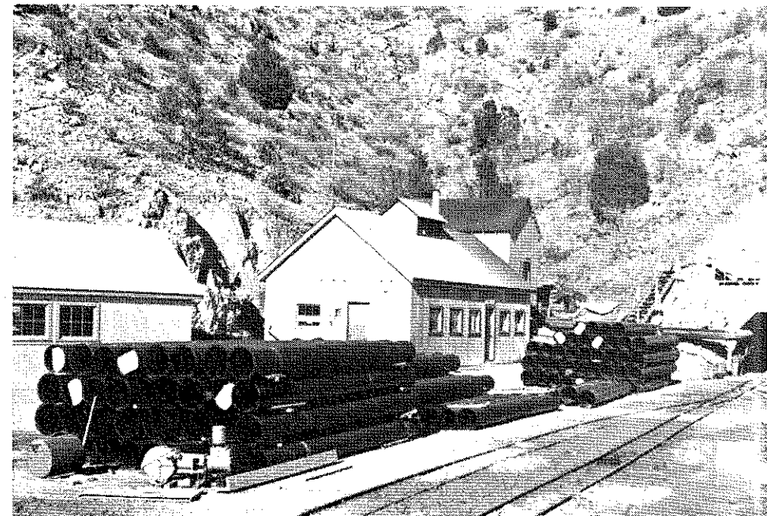
The first 300 feet had to be supported. Originally it was 8½ feet by 9 feet but at present it is 11 feet by 10 feet, including a 4 foot 6 inch radius circle arch. The finished tunnel size depends on the type of ground encountered.

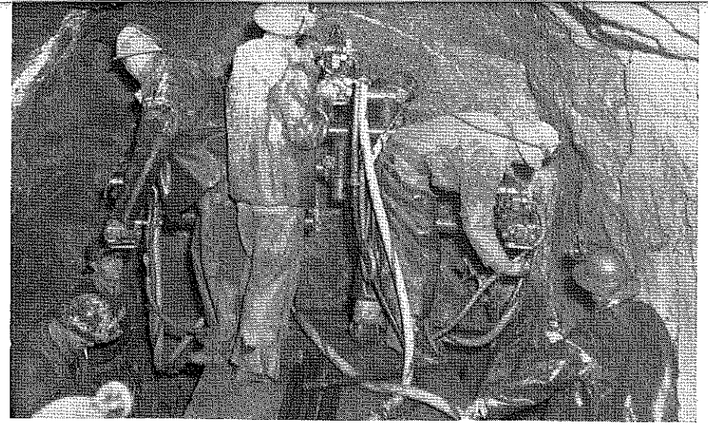
The first part of the tunnel was driven with conventional steel. Detachable bits are now used; however, to date it is not sure which is the cheaper. Both bit and steel costs are very high owing to the extreme hardness of the granite. Drill steel is 1¼ inch hollow round with standard lugged shanks, cut in 3, 5, 7, and 9 foot lengths.

Drilling is accomplished by five, 3½ inch automatic feed, sliding cone drifting machines, equipped with steel centralizers. These five machines are mounted on a drill jumbo. The jumbo designed and built in the Cresson Shops, is 20 feet long and weighs about 5 tons without machines and steel. Machines are not dismounted when moving the jumbo, the vertical columns are left in position and the arms swung back parallel to the tunnel. Five minutes are required to get all machines running after the jumbo reaches the face. Additional machines may be mounted on the side of the jumbo for clabbing.

A jumbo crew consists of five machine men, four chucktenders, one

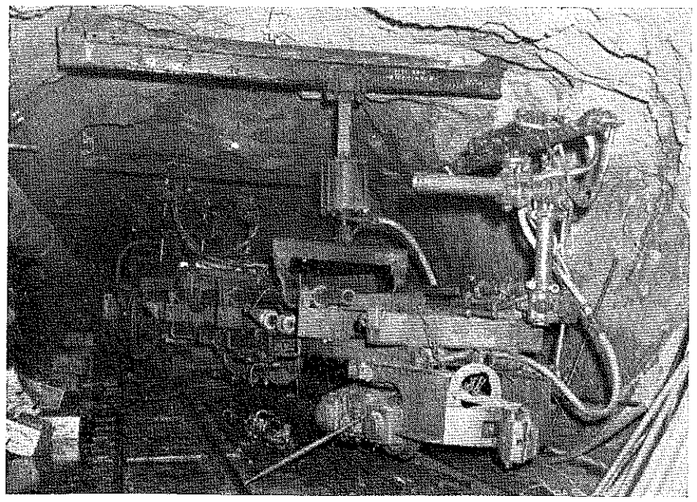
▼ Portal Carlton Tunnel.



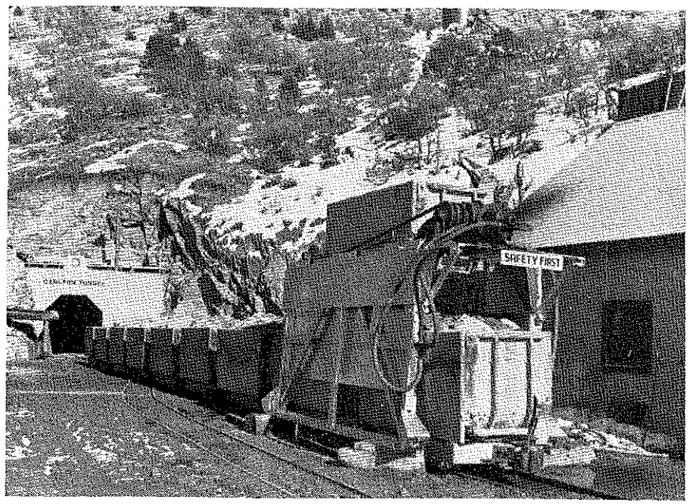


▼ Drilling Carlton Tunnel showing set-up of five machines.

▼ Shifting Jumbo Carlton Tunnel.



▼ Overhead "Cherry Picker" before it was taken in tunnel. 3-yd. Granby Type Cars.



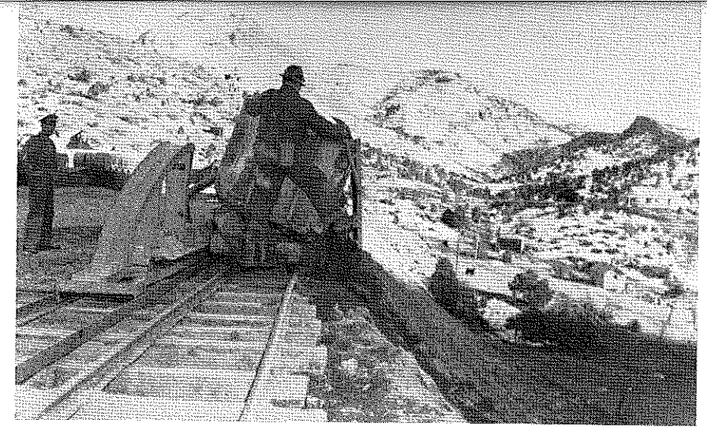
steel nipper and a shift boss. Seven or more complete rounds are fired every 24 hours. Rounds are blasted electrically by the locomotive battery, using No. 6X delay caps in 10 delays. The explosive used is a semi-gelatin of 60% strength. The machine men and chucktenders load the holes under the supervision of the shift boss in an average time of 15 minutes.

An Eimco Model 21 loader is used, mucking into Granby type cars of 84 cubic foot capacity. In March 1940 the average loading time per car was 6.5 minutes. The cars are shifted behind the mucker by a Cherry Picker, designed by John Austin, the tunnel superintendent and Robert Welch, master mechanic. It consists of a portable steel frame on skids, built with sufficient horizontal and vertical clearance to clear cars, motor, jumbo and all other equipment. A shaft is mounted on top and at each end of the frame work; two small drums are keyed to each of these shafts; on each drum a chain is wound with a hook on the end. Both shafts are rotated by a chain and sprocket drive, driven by a small air motor thru a worm gear. When an empty car is to be raised from the string of cars, a hook is placed on each corner of the car frame, and the car is raised to a sufficient height to allow the passage of the motor and loaded cars. After the loaded car is pulled back from the loader an empty car is lowered to the track and pushed to the loader, another empty one is picked from the string of cars and the same cycle repeated.

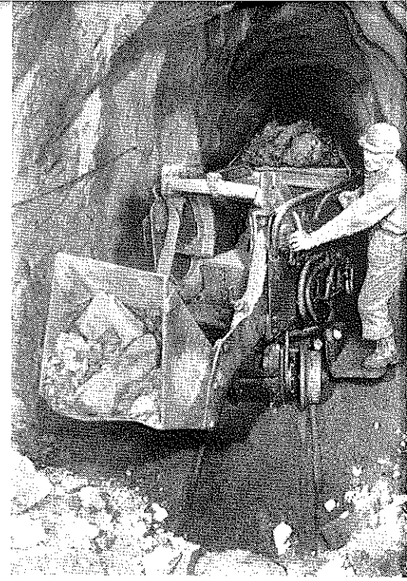
This type of a Cherry Picker is more satisfactory than the old method of picking cars with an air cylinder and a crawl, then shifting them to the side, for three reasons: first, it is faster; second, it is not necessary to remove as much ground from the back for the new type picker, as it was when slabbing the walls for the older type; and third, by shooting the back, the loader can handle all the broken muck, while, by slabbing, a large amount of it had to be hand-mucked.

Three, eight-ton, storage battery locomotives are used for haulage. Track consists of 40 and 45 lb. rails laid to a 24 inch gauge. For lengthening the track at the face, six foot rail sections bolted to steel ties are laid as soon as mucking is completed. The rail sections are kept as close to the breast as possible.

Slide rails of modified channel sections are used when necessary. These rails fit over the top and down on each side of the regular rail. The six foot rail sections are laid by part of the regular drill crew, as the loader is taken out and the jumbo is being



▼ Car Dump showing movable ramp.



▼ EIMCO Model 21 Loader. Mucking into 84 cubic foot cars.

brought in. No time is lost in track laying as the section is in place before the jumbo arrives at the face. As the face advances, five, six-foot rail sections are replaced by 30 feet of regular track. Laying the final grade is done during drilling, so that no drilling or mucking time is lost.

The Tunnel heading is ventilated by exhausting 5,000 cubic feet of air per minute thru 18 inch, 14 gauge, welded steel vent pipe. The pipe is welded into 40 foot lengths and installed 40 feet at a time. Flanged joints with rubber gaskets eliminate leakage. A booster fan has been installed in the line at the 8,000 foot point. The outside fan can be speeded up to give more capacity as needed. Vacuum now carried at the outside blower is 22 inch of water. The vent line is carried to within 30 feet of the face and is protected by short lengths of screened pipe, against damage my flying rock. With the present system the heading is cleared of smoke in from six to ten minutes or while the power mucker is being brought up. There is no lost time in waiting for smoke to clear out and the main tunnel is at all times clear of powder smoke.

Compressed air for drilling and mucking is supplied to the face by six inch steel tubing, welded into 60 foot lengths at the portal. One of these lengths is installed, using flanged joints, in less than ten minutes, usually during the moving of the jumbo or mucker. The flanges are designed, forged and made at the Cresson mine shops. One 1800 cubic foot and one 1000 cubic foot compressor furnishes air for under ground and surface use. Air pressure is 120 lbs. at the compressors or about 115 lbs. at the machines, while running.

No serious water problem is anticipated before a point 25,000 feet from the portal has been reached.

A water ditch is carried on both sides of the track. This ditch is made by raising the track back of the face and slipping 4" x 6" plank under the edges of the ties. Muck from the sides is then shoveled into the center for track ballast.

For shifting the jumbo from the main track, after drilling is completed, a station is slabbed from the side of the tunnel some 30 feet in length, by means of a jumbo shifter, which consists of two I-beams placed 15 feet apart and supported by expansion pins in the back. The beams support small crawls carrying air cylinders. From the piston rod of the cylinder is suspended a hook arrangement that clamps on both sides of the jumbo frame. With this arrangement the jumbo is easily and quickly shifted from the main track. The mucking machine is shifted in the same manner.

The surface plant consists of an office, change room, fan house, compressor plant, blacksmith shop and powder magazine.

▼ Firing a round from the Locomotive Battery.

▼ Overhead "Cherry Picker" in operation.

The average daily and total monthly footage is as follows:

Month	Daily	Monthly	Total Advance
July	21.5	345	345
August	38.7	1,201	1,546
September	48.8	1,367	2,913
October	49.5	1,534	4,447
November	49.1	1,474	5,921
December	47.8	1,387	7,309
January	46.3	1,438	8,746
February	52.3	1,518	10,264
March	56.0	1,735	11,999
Average for 258 days	46.5		

Some Statistics During March:

219 rounds were shot or an average of 7.06 rounds per 24 hours, pulling 7.9 feet per round.

The powder consumption was 38.6 lbs. per one foot.

Average drilling time per round was 1 hour 56 minutes.

Average drilling time per foot of tunnel was 14.6 Min.

Average mucking time per round was 1 hour 36 minutes.

Average mucking time per foot of tunnel driven was 11.0 minutes.

Average number of cars mucked per foot of tunnel was 1.69 cars.

Average time for mucking one car was 6.5 minutes.

Average number of holes drilled per round was 34.6.

Average number of caps used per foot was 4.9.

The greatest footage made in 24 hours is 70 feet made on April 1, 1940 and 40 feet is the lowest that has been made since September 4, 1939. Four complete rounds have

(Continued on page 251)

STATISTICS FOR MARCH, 1940

Date	L. A. STILES					A. E. STILES					MERRICK					Adv. for 24 Hr.	Daily Adv. for Mo.	Adv. for Mo.	Tot. Dis. Portal Heading
	TIME		No. Cars	Ft. Adv.	Tot. Adv.	TIME		No. Cars	Ft. Adv.	Tot. Adv.	TIME		No. Cars	Ft. Adv.	Tot. Adv.				
	Drlg.	Mkg.				Drlg.	Mkg.				Drlg.	Mkg.							
1	4.30	3.30	35	19	19	4.50	3.10	33	18	18	3.45	4.15	26	17	17	54	----	54	10318
2	4.25	3.35	31	17	36	4.15	3.45	25	20	38	4.40	3.20	23	16	33	53	53.5	107	10371
3	4.15	3.45	36	21	57	4.30	3.30	34	19	57	4.35	3.25	28	18	51	58	55	165	10429
4	4.10	3.50	26	15	72	5.00	3.00	24	12	69	4.30	3.30	26	17	68	44	52.5	209	10473
5	4.50	3.10	28	16	88	4.25	3.35	29	16	85	5.05	2.55	28	17	85	49	51.6	258	10522
6	4.35	3.25	28	17	105	5.45	2.15	21	14	99	5.30	2.30	23	14	99	45	50.6	303	10567
7	5.00	3.00	24	16	121	4.30	3.30	34	18	117	5.20	2.40	23	15	114	49	50.3	352	10616
8	4.55	3.05	26	18	139	3.55	4.05	34	17	134	5.10	2.50	24	17	131	52	50.5	404	10668
9	5.00	3.00	23	16	155	4.50	3.10	28	15	149	4.40	3.20	31	18	149	49	50.3	453	10717
10	4.30	3.30	26	18	173	3.30	4.30	42	20	169	4.40	3.20	27	16	165	54	50.7	507	10771
11	3.50	4.10	43	21	194	4.40	3.20	34	22	191	4.50	3.10	28	20	185	63	51.8	570	10834
12	4.20	3.40	30	17	211	3.50	4.10	40	20	211	4.25	3.35	37	21	206	58	52.3	628	10892
13	3.30	4.30	45	21	232	4.45	3.15	30	22	233	5.05	2.55	28	19	225	62	53.1	690	10954
14	3.55	4.05	23	18	250	5.00	3.00	27	17	250	4.30	3.30	28	16	241	51	53	741	11005
15	4.45	3.15	31	17	267	4.20	3.40	28	19	269	5.00	3.00	28	18	259	54	53	795	11059
16	4.35	3.25	28	17	284	4.45	3.15	23	16	285	4.00	4.00	37	18	277	51	52.9	846	11110
17	4.30	3.30	34	18	302	4.45	3.15	27	15	300	4.30	3.30	31	20	297	53	52.9	899	11163
18	4.45	3.15	28	18	320	4.20	3.40	24	14	314	5.15	2.45	20	15	312	47	52.5	946	11210
19	4.10	3.50	35	18	338	4.00	4.00	36	19	333	5.00	3.00	35	19	331	56	52.7	1002	11266
20	5.20	2.40	28	20	358	5.00	3.00	28	16	349	4.20	3.40	40	22	353	58	53	1060	11324
21	5.00	3.00	29	18	376	4.30	3.30	31	16	365	4.45	3.15	34	20	373	54	53	1114	11378
22	5.00	3.00	29	18	394	5.00	3.00	28	17	382	4.45	3.15	36	23	396	58	53.3	1172	11436
23	4.40	3.20	31	18	412	5.00	3.00	25	18	400	4.50	3.10	33	22	418	58	53.5	1230	11494
24	4.25	3.35	33	19	431	4.40	3.20	29	18	418	4.30	3.30	33	19	437	56	53.6	1286	11550
25	4.30	3.30	32	19	450	5.00	3.00	27	18	436	4.45	3.15	32	19	456	56	53.7	1342	11606
26	4.20	3.40	37	20	470	4.00	4.00	37	20	456	4.25	3.35	40	24	480	64	54	1406	11670
27	4.40	3.20	34	21	491	3.20	4.40	45	19	475	4.25	3.35	31	23	503	63	54.4	1469	11733
28	4.10	3.50	41	25	516	3.55	4.05	38	17	492	4.50	3.10	36	24	527	66	54.8	1535	11799
29	4.20	3.40	37	24	540	4.05	3.55	41	21	513	4.25	3.35	44	23	550	68	55.2	1603	11867
30	4.05	3.55	44	22	562	4.50	3.10	29	22	535	3.45	4.15	46	20	570	64	55.6	1667	11931
31	4.20	3.40	31	23	585	4.30	3.30	38	20	555	4.35	3.25	41	25	595	68	56	1735	11999
	8360	6520	986	18.7	585	8385	6495	969	17.9	555	8690	6190	977	19.1	595	1735	56	1735	11,999

L. A. STILES	A. E. STILES	MERRICK	TOTALS
DRILLING TIME:			
Total per Month 139 Hr. 20 Mi.	139 Hr. 45 Mi.	144 Hr. 50 Mi.	MONTHLY TOTAL 423 Hr. 55 Mi.
Total per Foot 14.3 Mi.	15.1 Mi.	14.6 Mi.	MONTHLY AVERAGE 14.6 Mi.
MUCKING TIME:			
Total per Month 108 Hr. 40 Mi.	108 Hr. 15 Mi.	103 Hr. 10 Mi.	MONTHLY TOTAL 320 Hr. 5 Mi.
Total per Foot 11.1 Mi.	11.7 Mi.	10.4 Mi.	MONTHLY AVERAGE 11.1 Mi.
AVERAGE CAR PER FOOT 1.68	1.74	1.64	MONTHLY AVERAGE 1.69
POUNDS POWDER USED:			
Per Month 22,433 Lb.	20,811 Lb.	23,756 Lb.	MONTHLY TOTAL 67,000 Lb.
Per Foot 38.3 Lb.	37.5 Lb.	39.9 Lb.	MONTHLY AVERAGE 38.6 Lb.
NUMBER CAPS USED:			
Per Month 2,729	2,839	2,932	MONTHLY TOTAL 8,500
Per Foot 4.7	5.1	4.9	MONTHLY AVERAGE 4.9
ROUNDS DRILLED 75	69	75	MONTHLY AVERAGE 219
FEET PER ROUND 7.8	8.0	7.9	MONTHLY AVERAGE 7.9
ROUNDS PER DAY 2.4	2.2	2.4	MONTHLY AVERAGE 7.06

Tahiti

AN ISLAND PARADISE OF THE SOUTH SEAS

By
ROBERT G. KENT

Since my return from the South Sea Islands, many friends have asked, "Well, what about Tahiti?"

I try to describe and attempt to explain, but I feel that my efforts have been completely futile. No words seem adequate, no colors seem true; the attraction is undefinable. There is a singular lure, an intangible quality, there is not only beauty but something more; atmosphere one must experience and feel; a haunting ever-elusive charm, that one cannot definitely name or describe. That is Tahiti!

Ten days from San Francisco without seeing land, with each day the water becoming calmer and bluer, we sailed into the tropical South Seas.

The last night on the boat before arriving in Tahiti, I slept up on the bow of the ship where it was cool, and was awakened at daybreak by a warm tropical down-pour of rain. Beneath the clouds and on the distant horizon I could faintly see the island. As we drew closer in the next hour I could make out jagged mountain peaks clothed in heavy, dark clouds, then becoming more and more distinct groves of giant coconut palms growing down to the water's edge. Bursting through the clouds came the bright sunshine bringing out the hundreds of shades of green covering the mountains, hues of green I had never seen, splashed here and there with brilliant magnolias. Flamboyant color held me spellbound, all thoughts of dry clothing and breakfast completely forgotten.

EDITOR'S NOTE:

The author, Mr. Robert G. Kent, is a young civil engineer employed by the Los Angeles County Road Department. He recently took a "vagabond trip" to the South Seas, Australia and New Zealand, mingling freely with natives in out of the way places. A second article by Mr. Kent will appear in an early issue of Mines Magazine.

My first sight of Tahiti I shall never forget! Beautiful beyond the power of words to describe; unreal, unearthly, truly a Paradise.

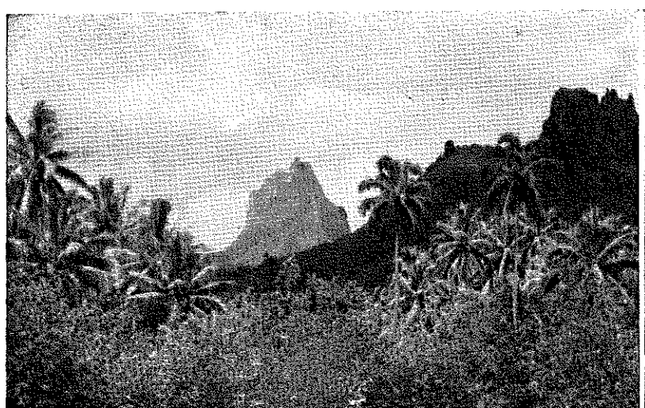
The boat was skillfully piloted through the narrow gap of coral reef into the natural harbor and glided to the wharf of the town that is Papeete; a little city such as would be impossible to imagine. Crowds of people swarmed along the tree lined waterfront to the dock. A more varied conglomeration of human beings one would have to search far to find. And such a riot of color! Women dressed in the gaudy material of "pareo" cloth, the French police in their showy uniforms and odd little hats. Polynesians, Chinese, Half-castes, whites "gone native", and tourists of all nationalities. The sweetish odor of copra stored in long warehouses along the waterfront was almost sickening.

The first to come up the gangplank were the French Government officials followed by native girls with armsfull of "leis" for the passengers. Then came the native stevedores dressed only in khaki shorts and straw hats. With very little formality going through the French Customs we found ourselves at once on the main street of Papeete. There appeared to be only about a dozen motor cars but hundreds of bicycles. Men, women and children, natives and whites, on wheels. The honking of horns of the few cars, almost deafening. Stray mongrel dogs everywhere, moving lazily in front of everyone or dozing languidly under giant umbrella trees.

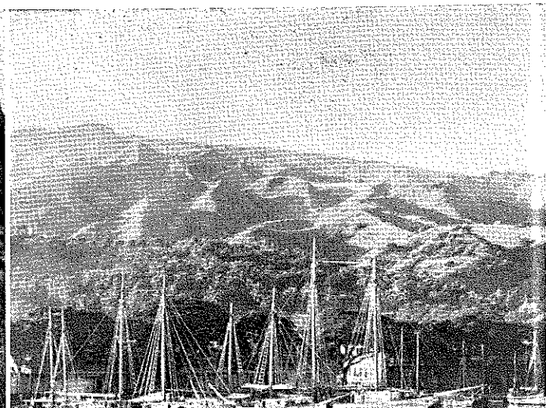
The stores are run by Chinese, the town policed by the French militia, and the natives do little but sell fish and fruit along the thoroughfares and in the market place. The entire population of Tahiti is composed of 8,000 natives, 4,000 French, 2,000

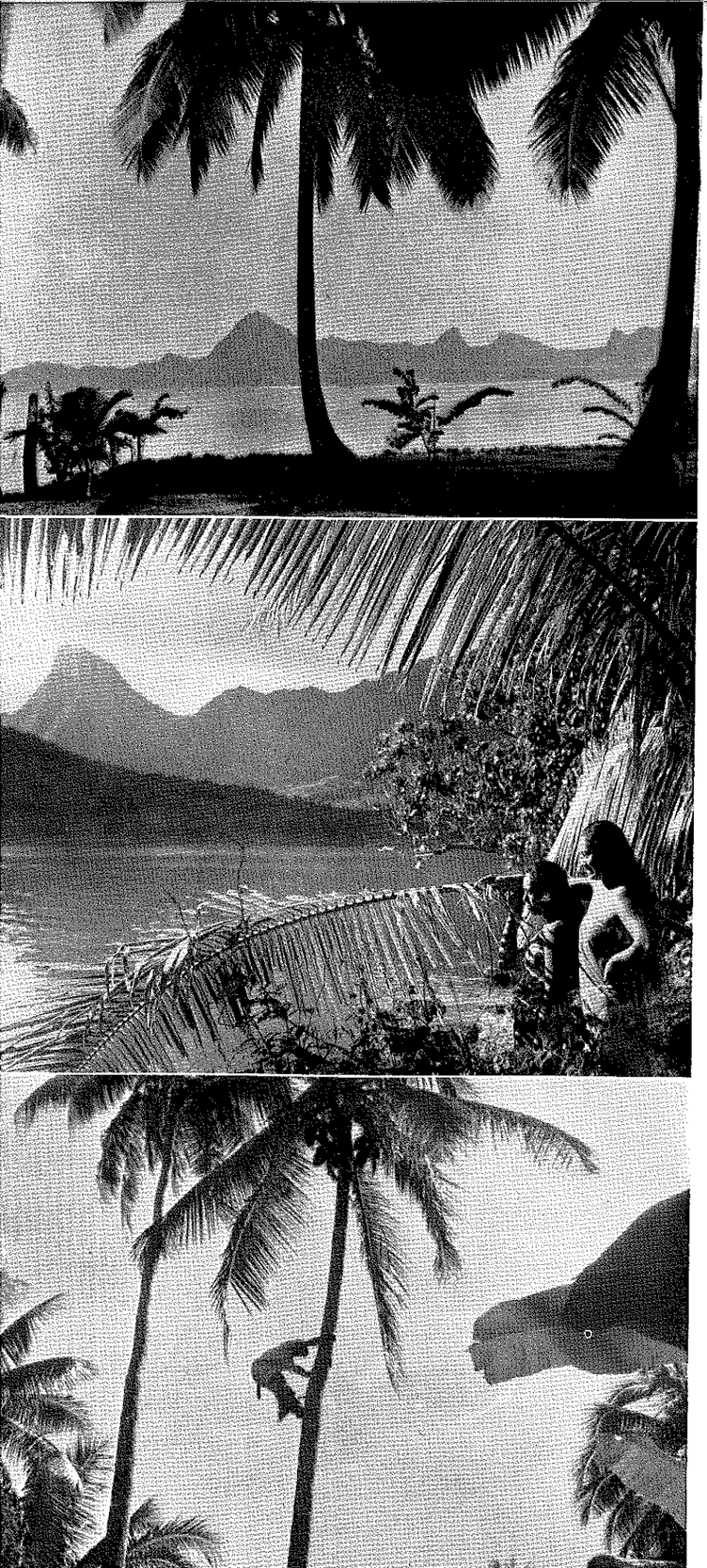
▼ Beautiful Papatoi. Bay Home of Turea.

Courtesy Southern California Alumni Review



▼ Papeete Harbor on the Island of Tahiti





Chinese and 2,000 miscellaneous nationalities; a total of 16,000 inhabitants.

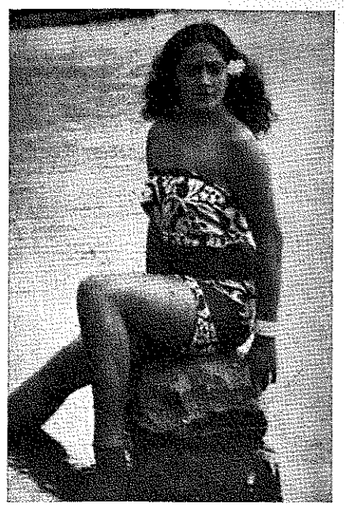
In Tahiti, under the French rule and according to French custom, there are no class or racial distinctions. The happy, joyous and child-like dispositions of the Polynesians make them as much a part of the social life of the island as the French officials and their families themselves.

The most popular meeting place on the island is "Quinn's Cafe", which is, I daresay, one of the renowned cabarets of the world. The attitude of the people who frequent this cafe is by no means the same as in this country. The sham and veneer of sophistication is entirely lacking, being replaced by the whole-hearted, spontaneous gaiety of the Tahitians. One soon catches the spirit of the occasion and if he so desires is accepted by the natives without question or formality.

After two hours of dancing and singing to the accompaniment of torrential rain beating on the corrugated iron roof of the building, one of the natives said "you-me-eat home". The clouds cleared away and the sun came out bright and hot, and so with a few of my Tahitian friends we started out on bicycles toward the "Districts" or country. Riding along the road, the trees forming overhead a canopy of green and scarlet, and among these brown skinned natives, it seemed that surely I was in a dream. After riding about six miles along the sparkling blue lagoon we turned toward the mountains into a veritable jungle of tropical trees and undergrowth. A few scattered huts in a coconut grove by a clear, rippling stream was "home", where I met more natives no less charming and beautiful than my friends. Tatu, one of the native girls, explained the social standing of her family, back of which were, apparently generations of Polynesian culture and traditions, and that her name was also that of a royal ancestress. All this she told in an English-French-Tahitian jargon of two and three word sentences. The natives asked innumerable questions about America; our cities, clothes, talkies, motor-cars and our mode of living. Our popular songs apparently do not very much impress them, however, if one does strike their fancy it must have some particular appeal of its own, and with that tune they seem never to part.

▼ Top to bottom: Moorea as seen from Tahiti. Native girls look out on picturesque Cooks Bay; gathering cocoanuts, main pastime of natives.

Courtesy of Southern California Alumni Review



▼ Tatu. "You—me—eat—home."

After hours of questions and talking we sat down to the most remarkable meal I had ever eaten. Mangos, avocadoes, breadfruit, fish soaked in oil, yams, and a mixture of coconut with ginger.

Most of the afternoon was spent swimming and playing in a little pool formed by the stream. The natives brought me a bright blue and white "pareo" and took great delight in showing me how to wear it. The amount of pure joy derived by them from romping and shouting like children was amazing.

The task of getting the coconuts was a fascinating procedure. With the use of a strong bark from the pandanus tree tied around each foot and forming a strap about eight inches between the feet, and with the use of his hands, the native boy hoisted himself up the tree at lightning speed. The coconuts once on the ground, he cut off the strong, tough husk by holding a huge, sharp knife between his feet and pointed toward his head, bringing the coconut down two or three times on the sharp blade. The entire operation of husking taking only about a half minute.

The evening meal was much the same as the noon meal, with the addition of baby octupus meat of which I did not partake. After dinner the thought of leaving this lovely spot and my hospitable friends never occured to me and I am sure they would have protested strongly had I suggested it. Any misgivings or fear never came to me among these strange people and so far from the ship and my friends.

With the coming of darkness other natives strolled into the clearing by the stream, it seemed from nowhere. Slowly and in an atmosphere of perfect peace and quiet, the strumming of ukeleles and guitars began, and the singing of that sweet, haunting Tahitian tune,

Ave, ave, te vahini upipi,
E ratia tona, e pareo repo,
Away, be free, away to fish by torch light,
Take up your spear, leave your dancing—

The faint, sweet scent of jasmine and hibiscus; truly the magic of the South Seas.

Shy at first but with ever increasing absorption in the singing and playing the natives began to dance. First to a slow rhythmic chant started by the men, then joined in by the high sweet, almost plaintive voices of the women. From this slow, mesmerizing strain the singing increased in speed and volume and finally broke into wild shouting and hand-clapping. The dancing became faster and faster, first the men in the center, the women circling around, and then the men on the outside circling around the girls. A never to be forgotten scene! Brown arms, legs, shoulders; beautiful bodies all in perfect rhythm with the music. After about three hours of singing and dancing couples and groups gradually drifted away and disappeared into the darkness.

That night the natives made a bed for me in the corner of a large veranda, and lying there on my mat looking up at the tropical sky, tracing out the Southern Cross, I marveled at the simple hospitality of these Polynesians.

Three weeks passed in which I lived a lifetime of perfect contentment, and to which I am not sure I would return for fear that the spell of Tahiti would be gone.

When the day of departure arrived I rode into Papeete with a feeling of sadness and regret. I wondered how far, or how little, I had really penetrated into the lives and customs of these people.

At the departing ship among many good-byes, and tears that no one tried to hide we left our friends, I was loaded with "leis" about my neck and had many gifts of fruit, beads and souvenirs. The boat pulled away from Papeete into a sunset of a thousand shades of lavender and purple. Somewhere on the deck below an accordion was playing,

Ave, ave, te vahini—

and a lump rose in my throat as it always will when I hear that tune.

With the fading of the tropical sunset, Tahiti was left behind, and with me I carried away a beautiful memory.

Carlton Tunnel—

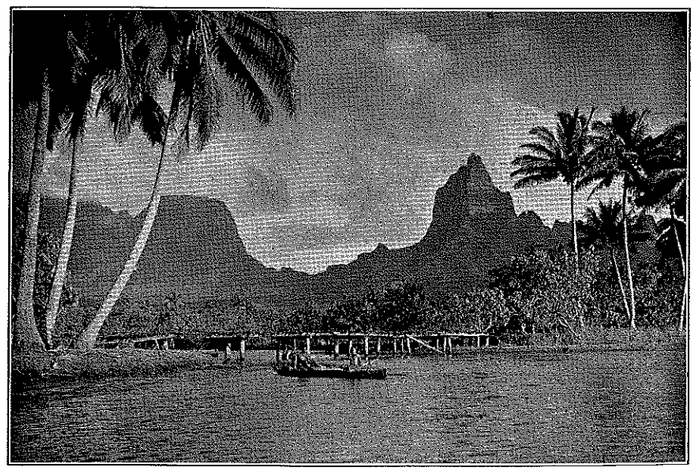
(Continued from page 248)

been shot and mucked in one eight hour shift with an advance of 24 feet.

On March 20th, 1¼" starting bits were placed in the tunnel instead of the 2⅛" starters, that had been used up to this time. This change resulted in a surprising increase in speed, due to much faster drilling. The bit sizes now run 1¼" for the starter bit, to 1⅜" for the 11 foot steel. Experimental work is still being carried out along this line and, to date, we have had no trouble on breaking the ground, if the holes are properly placed and care is used in loading.

The above change should make a saving on drill repairs, steel and powder. The average speed for the 10 day period since this change was made is 67.1 feet per day.

(Continued on page 276)



▼ Tahiti. Jagged Mountain Peaks Clothed in Clouds.

RECOVERY OF NICKEL, COPPER AND PRECIOUS METALS FROM DOMESTIC ORES

BY THE COMBINED ELECTROTHERMAL AND ELECTROLYTIC METHOD

By
J. KOSTER[2],
R. G. KNICKERBOCKER[3],
O. C. GARST[4], T. R. EVANS[5],
and W. E. CODY[6]

Introduction

In 1938 the Electrometallurgical Section of the Metallurgical Division, Bureau of Mines, began an active investigation of methods for recovering nickel, copper, and precious metals from ores of the Bunkerville district in Clark County, Nev.

The Bunkerville ores are of a type of mineralization similar to that of the Sudbury, Ontario, Canada, nickel deposits. At present, only a small tonnage of ore has been exposed in the Bunkerville region, and there is decided need for organized prospecting and development work there. It was believed, however, that the deposits were sufficiently significant to warrant an investigation into their metallurgical possibilities.

A 500-pound sample of the 300-foot level of the Key West property in this district was taken by one of the authors[7] and B. Shean, mining engineer, International Smelting & Refining Co., in December 1936. The analysis of this sample showed 1.65 percent nickel, and 2.90 percent copper.

A previous 45-ton sample of the ore taken from the Key West property in 1903 was reported[8] to contain 1.8 percent nickel, 2.3 percent copper, and 0.13 ounce platinum-group metals per ton.

The geology of the Copper King mining district, Bunkerville section, has been reported.[9, 10, 11, 12, 13, 14]

The second largest nickel-producing organization in the world at this date is the Falconbridge Nickel Mines, Ontario, Canada. A brief resume of this company's (1916-34) operations is given here because it may be of value to the development of similar nickel-copper deposits. The Falconbridge deposit, which is 1½ miles long by 10 to 150 feet wide, was covered by a deep mantle of glacial sand and gravel. The mineralization was indicated originally by magnetic surveys and was proved by extensive diamond drilling in 1916 to a depth of 580 feet.

In looking over the records of the initial diamond-drilling of this ore body, it was found that in the 29 holes reported at depths of 50 to 587 feet, the nickel-copper content ranges from 0.20 to 5.0 percent. There are a striking number of core samples that contain no copper and 12 to 15 samples that contain only traces of nickel. The ratio of nickel to copper varies much more than the total content, even in the same hole; that is, hole 154 at 53-foot depth shows a trace of nickel and 0.45 percent copper, while at 56-foot depth the same hole shows 2.38 percent nickel and no copper, but in only 3 core samples out of more than 200 are both values nil.

These records resulted from the preliminary or exploratory ventures and are mentioned herein only because at this time the Bunkerville district is in the same stage of development.

In 1928-30, the Falconbridge Co. started its first ore-reduction plant, which consisted of one blast furnace and one converter. The daily charge (24 hours) was 100 tons of ore. This was probably high-grade ore selected from its mining development, reported to be 5 percent combined nickel-copper. Ore reserves and values are tabulated in table 1.

It is to be noted that from 1928 to 1935 the reduction-plant capacity was increased from 100 to approximately 1,000 tons per 24 hours. The ore-reserve figure increased 1.4 times in the same period. An ore reserve of 3 million tons of 3-percent nickel-copper ore was considered an economic basis for investment in a reduction plant of 1,000 tons daily charge capacity. This was increased substantially in 1939. By 1935 the reduction plant had grown to consist of a flotation concentrator, sintering plant, and smelter. The refining is being done in Norway, thus taking advantage of the low Norwegian power cost, the European market, and the low ocean freight rate on converter white metal, from which all constituents are finally marketed; that is, freight is paid on a very low valuation of the contained nickel-copper-sulfur and precious-metal contents.

The Sudbury ore analysis in table 3 is given to show the variation in nickel-copper ratio in different parts of the same mineralized "basin."

[1] Reprinted from Bureau of Mines Report of Investigations 3483.
[2] Supervising engineer, Electrometallurgical Section, Metallurgical Division, Bureau of Mines.
[3] Engineer in charge, Boulder unit, Electrometallurgical Section, Metallurgical Division, Bureau of Mines.
[4] Junior chemical engineer, Bureau of Mines.
[5] Senior machinery operator, Bureau of Mines.
[6] Senior machinery operator, Bureau of Mines.
[7] R. G. Knickerbocker.
[8] Hewett, A. P., Callaghan, Eugene, Moore, B. N., Nolan, T. B., Rubey, W., and Schaller, W. T., Mineral Resources of the Region Around Boulder Dam: Geol. Survey Bull. 871, 1936, 197 pp. and maps, p. 37.
[9] Schrader, F. C., Stone, R. W., and Sanford, S., Useful Minerals of the United States: Geol. Survey Bull. 624, 1917, 412 pp.
[10] Lincoln, Francis C., Mining District and Mineral Resources of Nevada, Nevada State Bureau of Mines, 1923.
[11] Lundgren, W., and Davy, W. M., Nickel Ores from the Key West Mine, Nevada: Econ. Geol., vol. 19, No. 4, June 1924.
[12] Longwell, C. R., Geology of the Muddy Mountains, Nevada, With a Section Through the Virgin Range to the Grand Wash Cliffs, Arizona: Geol. Survey Bull. 798, 1928, 152 pp.
[13] Carpenter, J. A., Mineral Resources of Southern Nevada: Nevada State Bureau of Mines, vol. 1, No. 1, November, 1929.
[14] Bancroft, Howland, Platinum in Southeastern Nevada: Geol. Survey Bull. 430, Contrib. to Econ. Geol., part 1, 1910, pp. 192-199.

TABLE 1.—FALCONBRIDGE ORE RESERVES

Date	Ore reserves, tons (2,000 lbs.)	Nickel, percent	Copper percent	Ratio Ni:Cu
Dec. 1932	2,920,457	1 to 5 percent nickel-copper		
Dec. 1934	2,960,238	2.04	0.90	2.2
Dec. 31, 1935	4,059,475	1.93	.91	2.1

The Canadian Falconbridge reduction plant annual report for 1935 is summarized in table 2.

TABLE 2.—SUMMARY OF OPERATIONS OF FALCONBRIDGE REDUCTION PLANT, 1935

	Short tons
Total ore treated, plant operated 95.3 percent of possible time	302,510.0
Matte produced	10,029.5
Nickel in matte produced	5,651.55
Copper in matte produced	2,597.26
Metals per ton of ore:	Pounds
Nickel	40.97
Copper	19.71
Metallurgical losses per ton of ore:	
Nickel	3.43
Copper	2.54

TABLE 3.—ANALYSES OF SUDBURY ORES

	Nickel percent	Copper, percent
Creighton mine:		
West body (granite)	2.0	3.5
North body (norite)	3.5	1.0
Levack and Garson mines mixed	1.57	1.55
Frood mine upper levels, 1925-27	1.50	1.40
Frood mine, 1930, estimated mill heads	2.20	4.40
Falconbridge mine	1.93	.91
Cuniptau mine, massive sulfide	4.18	4.12
Cuniptau, disseminated ore	1.02	.67

Most of the above information and data on the Sudbury nickel field have been taken from the various publications.[15, 16, 17, 18, 19]

[15] Burrows, A. G., and Rickaby, H. C., Sudbury Nickel Field Restudied: Forty-third Ann. Rept. Ontario Dept. of Mines, vol. 43, part II, 1934.
[16] Ontario Department of Mines, Mines and Metallurgical Works of Ontario in 1935: Bull. 105.
[17] Royal Ontario Nickel Commission: Report and Appendix, 1917.
[18] Engineering and Mining Journal, Nov. 10, 1930.
[19] Roberts, H. M., and Longyear, R. D., Genesis of the Sudbury Nickel-Copper Ores As Indicated by Recent Explorations: Trans. Am. Inst. Min. Eng., vol. 59, 1918, pp. 27-67.

Sampling, Concentrating, Electric-Furnace Smelting, And Converting of Bunkerville Low-grade Nickel-Copper Ores

PRESENT WORK

Sampling of Bunkerville Nickel-Copper Ore

Since the lower-grade Bunkerville nickel-copper ore has a total approximate value per ton equal to a 2.5-percent copper ore, it was decided to mine a quantity of this type of Bunkerville ore for flotation, smelting, and refining investigations; consequently, a 55-ton sample was mined under the supervision of P. T. Allsman.[20] Messrs. Baker, Thompson, and Darling, claim owners, kindly granted permission to mine this ore.

Before the pilot-plant-size sample was transported to the Boulder City plant, a 300-pound grab sample of the ore mined was taken for the small flotation-cell tests. The consistency of distribution of the sulfides in the ore is demonstrated in table 4, which gives analyses of the 300-pound grab sample together with the maxima, minima, and averages of the head sample for each day's run during ore dressing of the 55-ton sample.

The above analyses are not to be taken as representative of the entire ore body but represent simply the ore taken from the particular location described by Allsman, upon which the experimental work described in this report was done.

Concentration of Bunkerville Nickel-Copper Low-Grade Ore

The purpose of this work was to prepare enough concentrates to carry on subsequent smelting and refining investigations.

The base-metal minerals of value in this ore consist of chalcopyrite ($CuFeS_2$), pentlandite $(FeNi)_nS_{nx}$, and nickeliferous pyrrhotite. The pyrrhotite (Fe_nS_{n+1}) is intimately associated with the pentlandite, but it can be partly liberated from the chalcopyrite. Advantage is taken of this characteristic in the Sudbury district, where in one instance one-third to one-half of the total copper values in the ore was floated selectively from the remaining nickel-copper values. This selective copper concentrate contains a 15-to-1 ratio of copper to nickel. It is also reported in the Sudbury flotation fields that the cleanest pyrrhotite yet separated has an average nickel content of 1 percent but a low copper content.

No attempt was made to float selectively any portion of the copper values from the nickel values at the Boulder City pilot plant; but it is necessary to mention that in the electrolytic separation of copper from nickel there are definite indications that a certain percentage of selective flotation of copper concentrates, from which iron-free oxide copper could be made, would reduce the cost of sintering and leaching in producing copper sulfate electrolyte. This saving would have to offset the cost of a separate copper concentrate-smelting and oxide-converting unit as well as a slight increase in the selective flotation costs.

When an average mill head is made available by further development of the low-grade ore tonnage and of the high-grade ore tonnage in the Bunkerville district, additional work is anticipated on the selective-flotation phase of the problem. Representative analyses of the two grades of ore are given in table 5.

[20] Allsman, P. T., Cost of Mining 55 Tons of Copper-Nickel Ore at the Great Eastern Prospect, Bunkerville, Clark County, Nev.: Bureau of Mines Inf. Circ. 7029, 1938, 8 pp.

TABLE 4.—ANALYSES OF NICKEL-COPPER ORE SAMPLES

	Nickel, percent	Copper, percent
300-pound grab sample	0.51	0.52
Head samples, maximum	.68	.60
Head samples, minimum	.41	.42
Head samples, average	.50	.49

TABLE 5.—REPRESENTATIVE ANALYSES OF BUNKERVILLE ORE

	Nickel, percent	Copper, percent
Bunkerville low-grade	0.50	0.50
Bunkerville high-grade	1.65	2.90

TABLE 6.—pH OF WATER USED IN FLOTATION TESTS

	pH	
	As received	After grind
Boulder Reservation water	7.6	8.6
Baker mine water	7.7	8.9

Several tests were made to float the preliminary grab sample. The mine-run ore contained less than 2 percent minus 1 inch. It was crushed and ground in a pebble mill for 1 hour. Tap water from the Boulder Reservation mains and mine water from the source of the 55-ton sample were used in the tests. The Boulder Reservation water frequently contains soluble salts in amounts as high as 700 parts per million. Table 6 shows the pH of the two waters before and after grinding with the ore in the pebble mill for 1 hour.

A typical screen analysis of the flotation-cell feed after 1 hour of grinding in the pebble mill is given in table 7.

On the basis of preliminary tests of this nature, the 55-ton sample was run through the pilot mill outlined on flow sheet 1, (fig. 2). The pilot plant shown requires approximately 25 tons of this type of ore to fill the circuit and give a uniform return-tails thickener overflow with consequent reagent control.

Data on representative pilot-plant daily runs are given in table 9.

For comparison, data on Sudbury flotation on similar types of mineralization, as reported by MacDonald,[21] are given in table 10.

The ignition chamber of this small Dwight-Lloyd sintering furnace is heated by a Globar resistance element. Temperatures at the top, or igniting surface, of the 3- or 4-inch bed can be maintained at 700° to 1,000° C., as desired. The speed of the flexible, steel-pallet belt can be varied by means of a reducing gear and variable-speed motor from 1 inch per minute up to any practical speed of the steel belt. The maximum down-draft suction is 10 inches of water.

A representative concentrate sinter run is described as follows: The ignition chamber was brought up to a temperature of 700° C.; 300 pounds of raw concentrate well-mixed with 45 pounds of water and 15 pounds of minus ¼-inch coke breeze was "fluffed" onto the moving belt grid. The belt speed was set at 1 inch per minute.

The sulfur content of the raw concentrate was 17.6 percent. The sinter contained 6.9 percent sulfur, thus showing a 60-percent extraction of sulfur for the operation. The sinter analysis is given in table 11.

A preliminary crucible smelt of the above sintered concentrate was made in a clay graphite crucible in the Globar furnace.

The crucible charge consisted of 12 ounces of the above sinter and 2 ounces of auriferous quartz containing 85 percent silica. The slag was poured at a temperature of 1,440° C. Analytical data for the smelt are given in table 11.

The matte contained over 95 percent of the copper and nickel, and the concentration ratio for the operation was 3.7 to 1.0.

A tilting, single-phase, electric furnace was built in the laboratory and used for smelting and converting the concentrates to nickel-copper white metal. The furnace was lined with magnesite. The electrodes were supported by a movable three-way joint system, which permitted the hearth to be used as either a direct-arc, indirect-arc, or slag-resistance furnace.

Air or air-oxygen mixture for blowing was supplied through ¼-inch copper tuyeres backed up by copper ball valves. Blowing with oxygen prevented the use of iron fittings. The air at 30 pounds per square inch passed through an ejector, which drew oxygen into the air stream from tanks maintained at a pressure of 8 to 10 pounds per square inch. The volume ratio of air to oxygen could be varied

[21] Macdonald, Wm. T., Selective Flotation Mill at Copper Cliff: Eng. and Min. Jour., Nov. 10, 1930.

TABLE 7.—Typical screen analysis of flotation heads

Mesh	Percent	Cumulative percent
+ 65	1.86	—
— 65 + 100	10.82	12.68
— 100 + 150	10.05	22.73
— 150 + 200	8.42	31.15
— 200	67.81	98.96

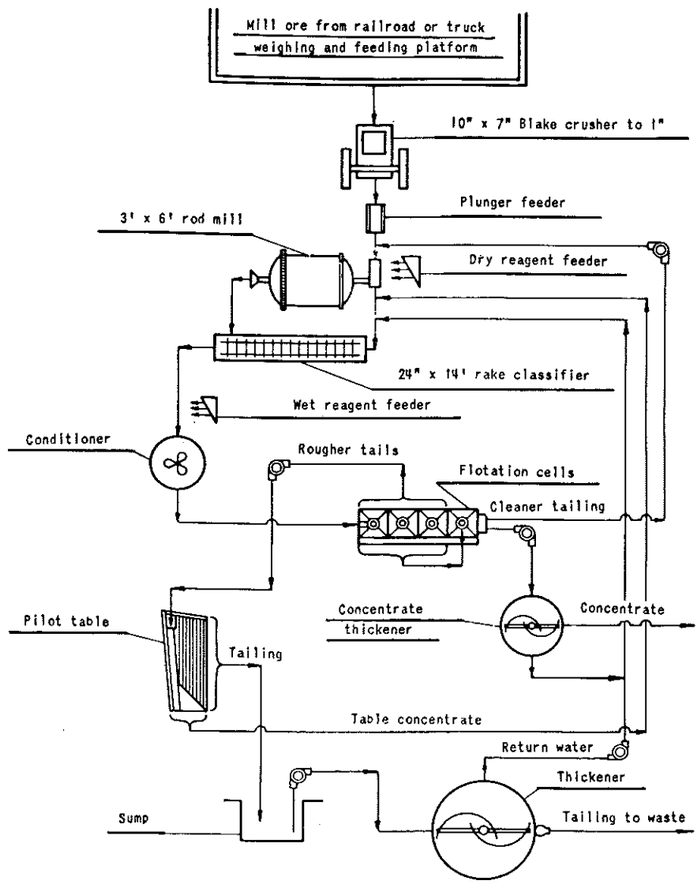
The results of a representative flotation test on the 300-pound grab sample are given in table 8.

TABLE 8.—Preliminary flotation tests on nickel-copper ore

1,000 grams of ore.
Grind 1 hour in 500 cc. of Lake Mead water.
pH of pulp: 8.6.
Reagents added to mill:
Copper sulfate, sodium xanthate.
Barrett No. 4, Aerofloat No. 15.
Water used in cells: 2,450 cc.
R.p.m. of impeller: 1,660.

	Analysis, percent Cu	Ni	Weight of products, grams	Recovery, percent Cu	Ni	Cumulative recovery,[1] percent Cu	Ni
Heads	0.52	0.51	1,000.	—	—	—	—
First froth (15 min.)	5.27	4.07	82.5	86.0	67.7	88.0	67.7
Second froth (10 min.)	.27	1.31	59.3	3.2	15.7	89.2	83.4
Third froth (10 min.)	.31	.21	66.5	1.8	2.8	91.0	86.2
Fourth froth (9 min.)	.01	.11	39.9	—	.8	91.0	87.0
Tails	.01	.06	724.2	1.4	8.7	[2]92.4	[2]95.7

[1] The above recoveries are based on the assumption that the unaccounted-for values are lost.
[2] Based on the recalculated heads (972.4 grams containing 0.52 percent Cu and 0.51 percent Ni).



▼ Fig. 2. Flow Sheet No. 1

TABLE 9.—Flotation pilot plant daily run, March 1938

Date	Pounds ore treated	Heads Cu	Ni	Tails Cu	Ni	Concentrates Cu	Ni	Ore feed, lb./hr.	Reagents, grams per minute: Pine oil	Barrett No. 4	Aero-float	Xan-thate	Copper sulfate	pH
23	3,000	0.51	0.49	0.14	0.14	1.80	1.60	1,000	2.25	1.25	0.45	0.83	1.5	8.7
24	3,500	.60	.68	.05	.06	7.91	5.80	1,000	([1])	([1])	([1])	([1])	([1])	8.8
25	4,000	.50	.51	.05	.07	2.87	2.75	1,000	1.03	.31	.24	.87	3.0	8.9
28	3,500	.50	.45	.04	.08	7.28	5.70	1,000	.65	.40	.10	1.7	1.5	8.9

[1] Reagent feeders off. Surplus from last run only.
All runs were on 65-mesh rod-mill grinding in closed circuit with classifier.

by diaphragm reducing valves. The gas flow was measured by a Foxboro flow meter.

The only reason for converting and smelting in the same furnace was the small amount of concentrate available and the consequent relatively large loss of metal and sulfides in the furnace lining. Under the circumstances, the use of two furnaces would double this loss. As it was, with only one furnace the lining absorbed 20 percent of the total metallic sulfide values in the total concentrate charged. A separate matte furnace for smelting and producing waste slags is of prime importance in industrial operation because of the inability to produce low-value waste slags from a hearth that contains low-sulfur, high-grade metal. The brick lining from this furnace analyzed as follows after the smelting and converting experiments were completed:

	Percent
Nickel	5.4
Copper	6.2
Iron	11.7
Sulfur	5.2

Most of the rest was MgO. The presence of this grade metal in the converter lining would also prevent the economic production of less than 0.5 percent Fe in the converter product.

When operating as a smelting furnace, 750 kilowatt-hours were used per ton of charge. Approximately 400 pounds of charge fluxed with 16 percent of auriferous quartz was smelted per hour.

Preliminary experiments showed that the low sulfur content of the sintered concentrates retarded ignition of the matte in the small converter; consequently, it was decided to smelt raw concentrate.

Mattes produced by the electric-furnace smelting of raw concentrates were compared with sintered concentrates. The data are given in table 12.

The blowing temperatures ranged from 1,000° to 1,500° C. It was necessary to use an indirect arc at times during the blow to maintain the bath temperature. The convenience of the three-way joint on the support for

(Continued on following page)

TABLE 10.—Sudbury flotation practice

	Heads	Concentration ratio	Recovery Cu	Ni
Frood, upper levels, 1925 (50-ton pilot mill)	1.5 percent Ni 1.4 percent Cu	3.2 to 1	95.7	90.9
Frood, September 1930 (4,000-ton concentrator)	3.0 percent Ni 3.4 percent Cu	2.04 to 1	97.0	95.0

Electrothermal Reduction of Bunkerville Nickel-Copper Flotation Concentrates to White Metal

The flotation concentrates produced by the pilot plant were of the following composition:

Percent of—	By Ledoux & Co.	By Boulder Laboratory
Nickel	4.66	4.60
Copper	6.12	6.00
Iron	25.85	25.88
Sulfur	17.63	16.9
Silica	—	21.2
Lime	—	1.4
Magnesia	—	13.0
Alumina	—	2.9
	Ounce	
Silver (per short ton)	0.29	—
Gold (per short ton)	.001	—
Platinum (per short ton)	.135	—
Palladium (per short ton)	.192	—

Several charges of this concentrate were sintered on the sintering machine.

TABLE 11.—Analyses of sinter, matte and slag, crucible smelt, percent

	Ni	Cu	Fe	S	FeO	SiO_2	MgO	CaO	Al_2O_3
Sinter	4.32	5.45	—	6.95	35	23.9	16.2	1.4	2.0
Matte	14.86	18.3	49	18.5	—	—	—	—	—
Slag	.05	.11	—	—	—	—	—	—	—

TABLE 12.—Electric-furnace nickel-copper mattes

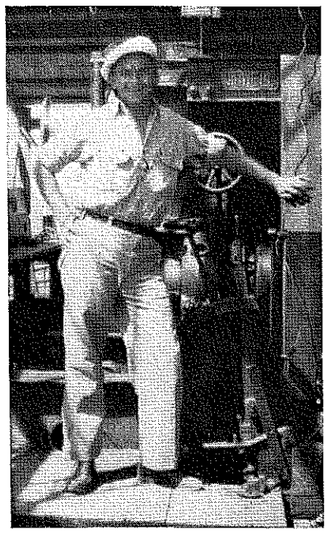
Analysis, percent	Raw concentrate smelt	Sintered concentrate smelt
Cu	11.61	17.51
Ni	9.15	14.17
Fe	47.4	53.0
S	32.4	15.5

TABLE 13.—Analyses of materials involved in electrothermal treatment of nickel-copper ores

Analysis, percent	Low-grade ore	Float concentrates	Float tails	Matte furnace waste slag	Matte	Converter white-metal anode
Ni	0.51	4.66	0.07	0.10	9.15	28.42
Cu	.52	6.12	.04	.15	11.61	44.01
Fe	9.63	25.85	—	18.35	47.4	2.95
S	—	17.63	—	.30	32.4	21.75
CaO	7.20	1.40	—	.25	—	Nil.
Al_2O_3	5.80	2.90	—	3.44	—	Nil.
MgO	22.0	13.00	—	22.44	—	Nil.
SiO_2	39.0	21.2	—	46.60	—	.21
Oz./2,000 lb.						
Ag	—	.29	—	—	—	3.93
Au	—	.001	—	—	—	1.12
Pt	—	.135	—	—	—	.65
Pd	—	.192	—	—	—	1.32

KANSAS
THE ANSWER AND SALVATION OF THE INDEPENDENT OIL OPERATOR

By
JOHN T. PADDLEFORD, '33
Wichita, Kansas



JOHN T. PADDLEFORD

Geologically speaking, the entire State of Kansas may be considered an oil province. This is said without reservation as sedimentation has been kind to Kansas, inasmuch as all types of sedimentation conducive to oil origin and accumulation is present. While the 47 sister states were more richly endowed with surface beauty, Kansas can justly boast that beauty is only skin deep and take heart that more fundamental basic industries will be hers as soon as her potential beauty is discovered.

Major companies and operators have long considered Kansas as a potential oil reservoir with mild possibilities of developing into another Oklahoma. It has not been until recent years that any serious thought in regard to development of the suspected reserves in Kansas has taken place.

Due to heavy investments in the neighboring mid-continent states, major companies have been reluctant to spend comparable sums in Kansas until the time comes where their present investments have either paid out or they become economically unprofitable. Kansas crude will never have an equitable outlet to the oil markets until the oil states surrounding her have depleted their reservoirs to such an extent that present development costs, pipeline investments and political racketeering can no longer make a profit. Looking South and East from Kansas, there seems to be some of these symptoms already apparent, and the rainbow with the pot of gold at the end may finally be found in Kansas.

The possibilities for the Independent Operator in Kansas is unbounded. The operator who has the foresight, experience and personal enthusiasm for an active part in the development of a great oil country will be rewarded at his own figure.

The affluence of oil and gas horizons in Kansas include beds dating from the Pre-Cambrian to the Cretaceous. Various types of traps are present in Kansas, ranging from stratigraphic pinch-outs to major structural features. The ever present topographical conditions on the top of producing horizons are conducive to many a headache, but this feature alone may be considered an attribute to Kansas; for as long as this condition exists, no geologist can safely condemn a vast amount of acreage. This condition alone allows the Independent Operator who is on his toes an opportunity to locate an oil pool which was overlooked.

The cost of development does not in any way compare to the costs necessary in the surrounding states, with possibly one exception, Illinois. This also should be an inducement for the Independent.

Much has been said and theorized regarding the ultimate recoveries to be expected in the various oil horizons of Kansas. Probably a little adverse propaganda has been in order. The underlying reason for this should be easily understood. With due regard to the great amount of research done by various companies through their technical staffs in the work of compiling data on the recovery problem, I contend that only time will tell what the ultimate recoveries will be. With reasonable regard to production methods and withdrawal rates, the recoveries to be expected in Kansas as a whole will far exceed many of the figures placed on it.

Investors rightfully shun investing great sums in Kansas under the present proration set-up, as the return of their investment is slow. However, the picture is slowly changing and the fellow who buys when everyone else sells is the fellow who has something to sell when everyone else wants to buy.

The complexities underlying the so-called flat plains of Kansas offer the pioneer and energetic type of man all the thrill and reward necessary to keep him busy and thanking God that he is an American.

Recovery of Nickel—

(Continued from preceding page)

the electrode holder aided this practice.

Typical analytical results for the entire process from ore to white-metal anodes are given in table 13.

Conclusions on Flotation, Electric-furnace Smelting, and Converting of Bunkerville Low-grade Nickel-copper Ore

1. Concentrates of 10-percent nickel-copper can be floated with 97-percent recovery of the copper and 90-percent recovery of the nickel (bulk sulfide flotation).

2. Waste slags from the electric matte-furnace smelting of these concentrates can be made as low as 0.11 percent copper and 0.05 percent nickel, with a kilowatt-hour consumption of 750 per ton of 2,000 pounds, dry charge. The Boulder area has an abundance of free quartz for fluxing purposes. Some of this quartz is auriferous.

(Continued on page 277)

GEOLOGICAL ASPECTS OF THE COLORADO-BIG THOMPSON PROJECT

By
ROSS L. HEATON
Geologist
Bureau of Reclamation

The Colorado-Big Thompson Project presents a great diversification of conditions for consideration by the engineering geologist. Not only is there a variety of engineering features but many kinds of geological phenomena are involved. Among the engineering features are short tunnels in sedimentary or metamorphic rocks and the transmountain tunnel in metamorphic and igneous rocks. The dam site foundations consist either of pre-Cambrian granites, gneisses and schists, Mesozoic sedimentary rocks, a combination of igneous and sedimentary rocks in a laccolithic intrusion, Tertiary tufaceous clays, or glacial moraines.

It is the purpose of this paper to summarize the general geology of the various features of the project, with emphasis on the geologic factors as they affect design and construction. The location of the reservoirs, tunnels, etc., is shown on the general layout map (Fig. 1).

CONTINENTAL DIVIDE TUNNEL

Three possible routes for the tunnel were included in the original investigation. The two northern routes, designated as the Big Thompson and Cub Lake tunnels, were abandoned mainly on account of engineering considerations and not for geological reasons. All three are shown on the accompanying geological map (Fig. 2), which shows the surface distribution of the rocks and the areas covered by glacial drift.

Kinds of Rock:

Nearly all of the rocks to be encountered in the tunnel will be of pre-Cambrian age and will consist of Longs Peak granite and associated pegmatites and the gneisses and schists of the Idaho Springs formation. The latter are the oldest rocks of the area and consist mostly of biotite-sillimanite and quartz-biotite schist and gneiss and injection gneiss. The Idaho Springs formation is probably the result of metamorphism of ancient sedimentary rocks which were predominantly shaly beds with minor amounts of limestone and sandstone.

The Longs Peak granite is a coarse to medium grained porphyritic rock with large tubular crystals of microcline in a finer grained groundmass of quartz, phagioclase feldspar and biotite. It is usually pink to gray in color, sometimes quite red as in the Wind River area.

In the eastern part of the area a large dike of dark colored igneous rock, probably diabase, trends northwest and southeast. It is known as the "Iron Dike" and is 30 to 50 feet wide. West of this dike and south of the tunnel course, two other dikes of similar rock occur. They disappear beneath the surface toward the tunnel line and may or may not be encountered during construction. These dikes are considered to be of late Cretaceous or late Tertiary age.

All of the main drainage courses on both sides of the Continental Divide were filled by glacial ice to depths of 1000 to 1500 feet during the Glacial Period. These glaciers carried much rock debris of varying sizes from fine rock flour to huge boulders and, when they receded, left it high upon the sides of the valleys as lateral moraines. Much material which was carried in or on the body of the glaciers was dropped as ground moraines. Practically all of the lakes of the district resulted from glaciation, either by a scouring out of high valleys or a damming of the valleys by terminal moraines as at Grand Lake.

Rock Relationship:

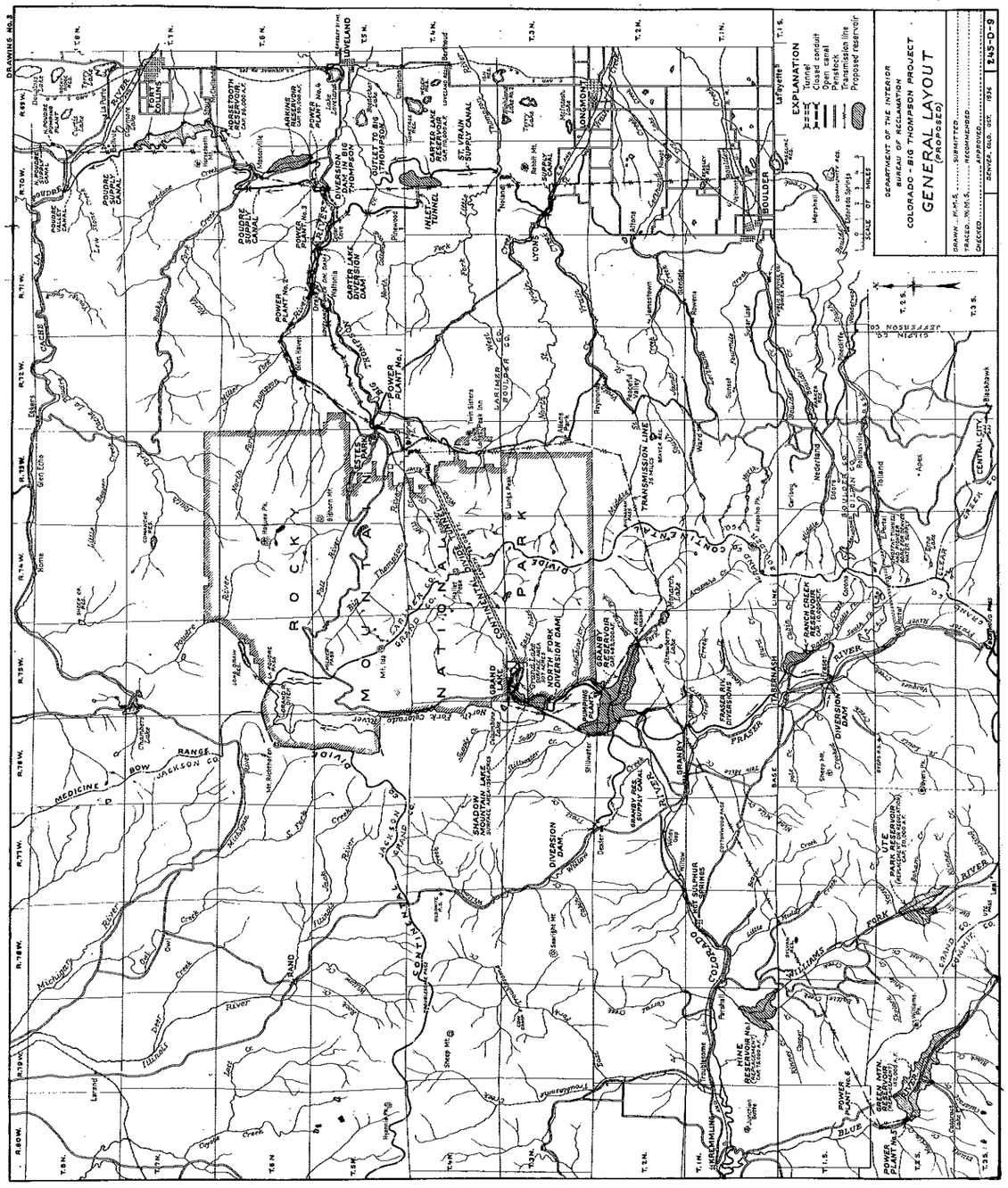
The granite is much younger than the gneisses and schists and was intruded into them as molten rock. The main center of intrusion was east and south of Estes Park from the region of Mt. Olympus to the Longs Peak and St. Vrain Creek areas. From this central mass of the Longs Peak-St. Vrain batholith[1], sills and sheets of the molten rock were forced between and across the layers of sedimentary rocks and were probably the major influence in recrystallizing them into the schists and gneisses as we now see them. Other minor centers of intrusion doubtless existed to the west and southwest of the main batholith. Sills of granite from these centers thin out to the east and northeast and, with the associated schists, occupy most of the distance to be traversed by the Continental Divide Tunnel. These sills range from a few feet to several hundred feet in thickness. Near the eastern end, the tunnel will be in the edge of the main batholith. Most of the rock will be granite but some bodies of schist and gneiss will be present as inclusions in the granite mass.

An estimate of the proportions of granite, gneiss and schist was made by projecting the surface geology and structural relations downward and from each side into the plane of a profile cross section. The shape and continuity of the bodies of granite, gneiss and schist are so variable, however, that only very rough estimates are possible. It is believed that granite will be the principal rock throughout 70 to 80 per cent of the tunnel length.

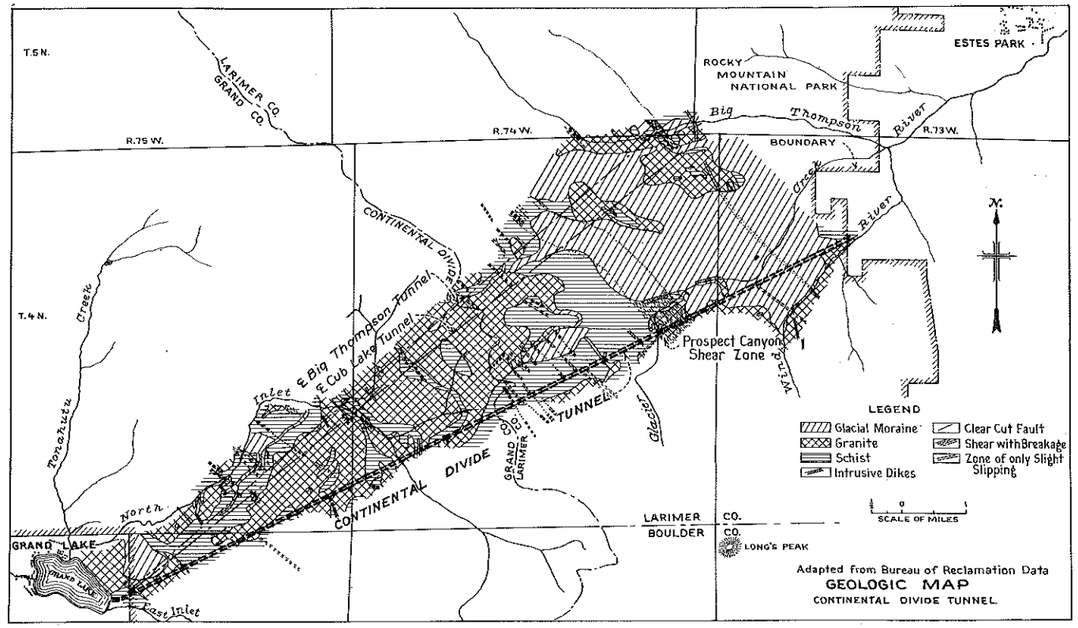
Shear Zones and Faults:

Shear zones are faults in which the movement has been spread over considerable widths. The result is a network of innumerable minor fault planes in many directions, the formation of which causes minute granulation and weakening of the rock structure and alteration of the feldspars to clay minerals. The latter are the cause of the most serious situations to be found in tunneling. They have the property of absorbing water,

[1] "Granites of the Front Range—The Longs Peak-St. Vrain Baholith". Margare Fuller Boos and C. Maynard Boos. Geol. Soc. Am. Bull., Vol. 45, 1934.



▼ Fig. 1. Layout map showing location of main engineering—features of the Colorado-Big Thompson Project.



▼ Fig. 2. Reconnaissance geological map covering routes of three proposed courses of the Continental Divide Tunnel.

both physically and chemically, and are thereby given lubricating qualities which cause the whole mass to behave as a viscous liquid under great pressures.

Minor shear zones, from 20 to 50 feet wide, are quite numerous along the tunnel line. From 2½ to 3 miles east of the west portal there is a zone of quite closely spaced narrow shear zones alternating with solid rock. Crushed rock and altered feldspars, as well as gouge material, were noted in several places. Prospect Canyon fault zone, 3 miles west of the east portal, is a quite severe zone of shearing for more than one-half mile. It will nearly all be in granite. Much crushing, alteration of feldspars and mineralization are present in the portions exposed at the surface. There are also considerable widths of fairly solid rock with no more serious deformation than closely spaced jointing. In an effort to determine the effect of the faulting at depth, two core holes were drilled to tunnel level. They were inclined 20 degrees from vertical. The core established the presence of the disturbed zone without question but there was only a very small percentage of badly altered rock. The percentage of core recovery was high. The two holes were drilled to depths of 1100 and 1150 feet and tested a horizontal distance of approximately 800 feet which was, of course, only a small portion of the total width of the zone. The conclusion was reached that no serious trouble should be encountered in the 800 feet tested but that this was no reason for being too optimistic regarding the remaining 2000 feet.

Engineering Aspects:

The tunnel will be 13.06 miles long, of circular section, nine feet nine inches in diameter inside the concrete lining. The gradient will be eight and one-third feet per mile.

The engineer is, of course, interested in many factors not strictly geological such as the accessibility of portals, costs of materials and their transportation, number of adits, time limit for completion, labor conditions, etc. Since the Continental Divide tunnel will be through the area of Rocky Mountain National Park, it must be driven entirely from the two portals at Grand Lake on the west and Wind River on the east. This is the only tunnel of this length to be driven without shafts and unusual problems of spoil transportation, ventilation and other factors are involved.

The engineer is interested in the kind of rock only as regards its properties of strength, drilling conditions, powder requirements, tendency to air-slake, etc. Rocks to be penetrated in the Continental Divide tunnel, if unaltered by faulting, shearing or underground solutions, are strong and would present little difficulty. Interest must therefore be centered on the extent to which the rocks have been affected by these processes.

Little criteria exist for the correlation of observed conditions on the surface with those encountered in tunnels. Advantage was taken of limited opportunities which were presented for making such comparisons at Moffat, Jones Pass and Twin Lakes tunnels. At the Moffat tunnel, the Ranch Creek fault zone was examined on the surface at Rifle Sight Notch and the same zone was examined where exposed in the tunnel during the relining process by the City of Denver. At Jones Pass tunnel a careful examination of the surface conditions was made and periodic trips were made to the tunnel during construction. These observations influenced the estimates of conditions

▼ Fig. 3. Green Mountain dam site looking upstream. Talus slopes on left, glacial drift on right. Shows stripping operations in glacial drift and Morrison-shale. Scaffolding on left is on axis of dam and marks top of gate chamber shaft which starts in upper porphyry sill and ends at tunnel level in Morrison shale.

to be expected in the Continental Divide tunnel.

From surface mapping, 5200 feet of the course of the tunnel were estimated to have been affected by faults and shear zones. Allowing for additional faults which may not show at the surface plus ground on each side of fault zones that may have been affected, a total of 6900 feet was the figure used as an estimate of the distance requiring strong support plus that to be classified as "heavy ground," capable of necessitating extreme measures for control. From experiences in Jones Pass, Moffat and Twin Lakes tunnels, it was estimated that an additional 17,000 feet would need light support. It has been found that surface observations are not of much value in determining distances likely to need light support since they include areas in the vicinity of fault zones, areas affected by closely spaced jointing or occasional slip planes and areas in which there may be splitting along cleavage planes in schists. Estimates must therefore be based on past experience in other tunnels. Much of the light support is necessary only as a safety factor in protection from rock falls, etc., in ground where little, if any, pressure is exerted against the timbers or steel ribs.

Seismic Survey:

In Glacier Basin near the east portal, two miles of the tunnel line are covered by a thick mantle of glacial drift. The ground surface is 450 to 550 feet above tunnel level. In order to be certain that the drift did not extend to those depths a seismic refraction survey was made with stations every 500 feet. The resulting bedrock profile showed a minimum of 225 feet of rock above tunnel grade. The profile was later tested by three borings. The results are tabulated as follows:

	Seismic depth to bedrock, feet	Actual depth to bedrock, feet
Hole No. 1	250	246
Hole No. 2	310	321
Hole No. 3	125	238

It will be seen from this table that the results were remarkably close in the first two holes. Some large boulders were encountered in the third hole at about the depth designated on the seismic profile as bedrock. It is unlikely, however, that a layer of boulders would be present in glacial drift of sufficient extent to constitute a high velocity medium for seismic waves. On account of surface topography the seismic station at this point was located 50 feet south or up the slope from the tunnel line. The tunnel line was later changed to the north to accommodate the change in location of the east portal. Hole No. 3 was drilled on this new line at a distance of 160 feet from the seismic station diagonally across the old profile line. Since there are many steep or vertical cliffs in the vicinity, the most logical explanation seems to be that the seismic determinations were on top of such a cliff, buried under glacial drift, and that the hole was drilled at its foot. In any event there is ample rock roof above tunnel grade.

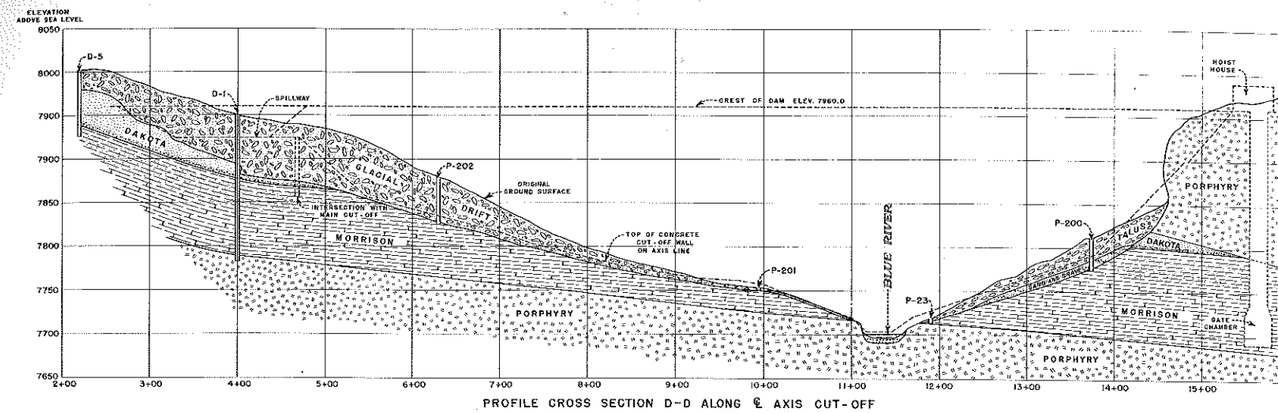
GREEN MOUNTAIN DAM

Green Mountain dam is the only one now under construction in the Colorado-Big Thompson Project. It is proposed to outline the geology of the site and to describe the part geology has played in the original investigations and in the construction to date. A more complete description of the regional and local geology may be found in the Bulletin of the Colorado Society of Engineers for the months of November and December, 1939.

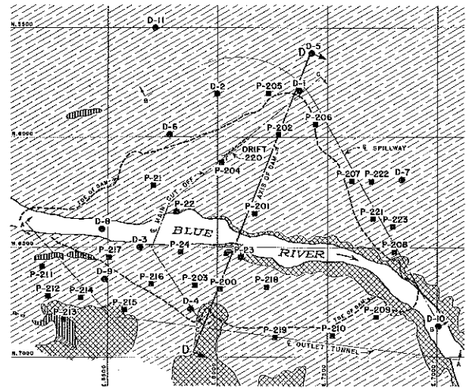
The dam will be a rolled earth and rock-fill embankment with a height of 270 feet above stream bed and will form a reservoir with a capacity of 152,000 acre-feet. The crest elevation will be 7960 feet above sea-level. The engineering features of the dam and power plant are described in detail by S. F. Crecelius in the October and November issues of the Bulletin of the Colorado Society of Engineers, 1939.

Geology:

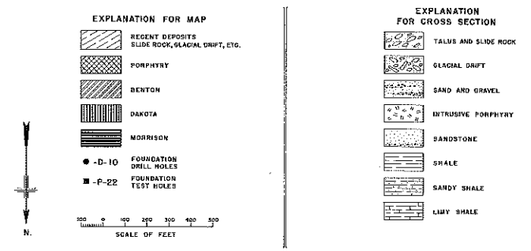
The Green Mountain Canyon was cut by Blue River through a laccolith, leaving Green Mountain on the east and Little Green Mountain on the west. The intrusive porphyry, which forms the core of the laccolith, extends continuously across the river between the two mountains. Both up and down the river the porphyry is in the form of sills which have been forced into the sedimentary rocks for various distances. Such is the situation at the dam site which is near the upper end of the canyon (Fig. 3). The formations involved are the Middle and Lower Dakota and the upper Morrison with large sills of porphyry both above and below (Fig. 4). Both the sills and the sedimentaries dip at low angles upstream. The lower sill emerges from the river bottom approximately on the axis of the dam and rises downstream, forming a box canyon (Fig. 5). The base of the upper sill rises upstream because of the thinning of the sill away from the central laccolithic mass. The rock is a trachyte porphyry with large albite phenocrysts (Fig. 6). The thickness of sedimentary rocks between the two sills varies from 100 to 250 feet.



PROFILE CROSS SECTION D-D ALONG ℄ AXIS CUT-OFF



LOCATION MAP SHOWING SURFACE GEOLOGY



▼ Fig. 4. Geological cross section along axis of Green Mountain dam, looking downstream.

Overburden:

The amount and character of overburden is a very important item, especially in the case of an earth and rock-fill dam. The overburden must be stripped to bedrock from the upstream half of the dam in order to provide a surface on which to lay the impervious zone of the dam and in which excavations may be made for the footings of cutoff walls. The material removed must be tested and classified and if suitable for use in the dam it is stockpiled. If not, it is wasted. The amounts of each class of material have a direct bearing on the costs. The impervious, semi-pervious and pervious zones of the dam may be variable in size, depending upon the amount of each class of material available.

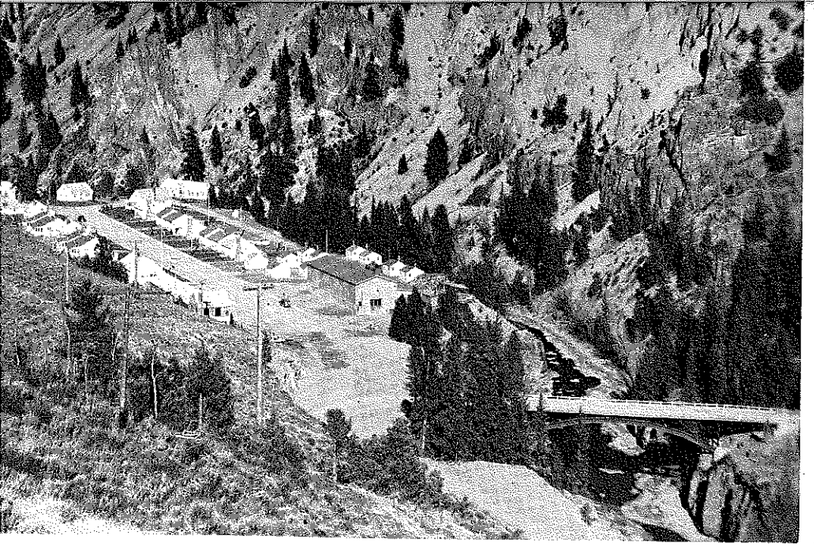
On the left (south) abutment the overburden ranges in thickness from a few feet in the river bottom to 65 feet near the extremity of the axis of the dam and as much as 100 feet at points under the proposed spillway. It consists of glacial till, a mixture of materials ranging in size from rock flour to huge boulders. The content of fine material is such as to give the material compaction qualities, rendering it suitable, with the exception of the boulders, for the compacted, rolled-fill section of the dam.

On the right (north) abutment the overburden consists of porphyry talus mixed with soil which covers large deposits of glacial gravels. The latter are especially abundant near the trashrack excavation (Figs. 8 and 9), where the thickness of the glacial material is as great as 70 feet and the layer of talus only 8 or 10 feet. At other places on the right abutment the overburden is nearly all talus and is as much as 40 feet thick. Thin layers of the gravels have been reworked by stream action and were erroneously identified as river deposits when found in test pits.

In the river bottom the gravels are only six to eight feet thick where they lie on Morrison shales and even less where erosion has cut into the lower porphyry sill.

Investigation:

Green Mountain Canyon is two and one-half miles long and there were four possible dam sites to be considered. Topography was taken in the bottom of the canyon with cross sections at the most promising looking sites and the whole canyon was mapped geologically. A site was selected near the upper end of the canyon because it was more favorable than the others from the standpoint of yardage and accessibility, proximity to materials, higher elevation of stream level and geological structure. All of the strata dip upstream. This site was mapped in detail, both topographically and geologically, the latter being on a scale of 100 feet to the inch. Twenty-five pits and drifts were dug to determine the thickness and nature of overburden and the kind and condition of bedrock. Geologic cross sections were then constructed along the lines of the axis, the outlet tunnel, the spillway and the main cutoff wall, showing the results of testing. After a visit by Bureau engineers it was decided to continue the investigations farther downstream. Some of the pits had



▼ Fig. 5. Government camp below Green Mountain dam. Shows Rough, craggy appearance of upper porphyry sill. Box canyon is in lower porphyry sill. Talus on slope below upper sill covers a layer of Morrison shale.

shown excessive overburden. Two of the drifts had encountered bedrock at 45 and 69 feet and another went to 89 feet without getting through the overburden. Twenty-four more pits were dug at the lower site and although the overburden was heavy in spots there was bedrock at the surface on the axis in the bottom of the canyon and rock at the surface in which to begin the excavation for the gate chamber shaft. This site was finally chosen and 12 diamond drill holes were put down to test the foundation materials along the spillway, at the power house site and in the river bottom and to explore the line of the outlet tunnel.

During the investigation a geologist was stationed at the site at all times. He logged the holes, sampled the material and prepared daily reports which were sent to the Design Division. He also prepared final logs and located new holes or test pits when necessary.

The results of testing, together with all surface information, were assembled and used in preparing new cross sections along the spillway, outlet tunnel, main cutoff and axis cutoff. The latter is shown on Figure 4. These were submitted with a final report covering all the known geological data on the site. The report and accompanying drawings are being used extensively during construction.

Construction Materials:

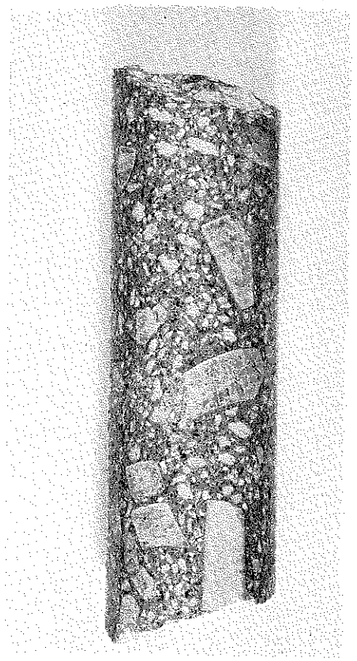
Above the left abutment the surface slopes gently upward to the southwest and is covered by a thick mantle of glacial till similar to that described on the abutment. This was explored by 22 test pits at roughly 500 foot centers. The material was screened, weighed, and sampled, and the samples were tested in the Denver laboratory. It was found very suitable for use in the impervious zone of the dam except for the necessity of screening. Materials for the pervious and semipervious zones will be taken from the gravels of the right abutment and from the overburden at the power plant and outlet channel excavation, and if necessary, from other sources. Rock for rockfill and riprap will be secured from the screened boulders of the embankment borrow area, and from the porphyry excavation of the power plant and outlet channel sites.

Many gravel and sand bars occur in and along the river. There are also at least three higher levels of river terraces containing large gravel deposits. These were sampled and tested, but were found to contain excessive amounts of shale fragments, a condition not surprising in view of the fact that Blue River runs in a shale valley for 25 miles above the dam site. These deposits were, therefore, rejected as concrete aggregate. In some of the higher (older) terraces less shale was present, but there were considerable amounts of rotten pebbles and boulders. Deposits of sand and gravels in a terrace of the Colorado River valley, near Kremmling, were tested and found very excellent. They were processed and hauled to the dam site for use as aggregate in all concrete work.

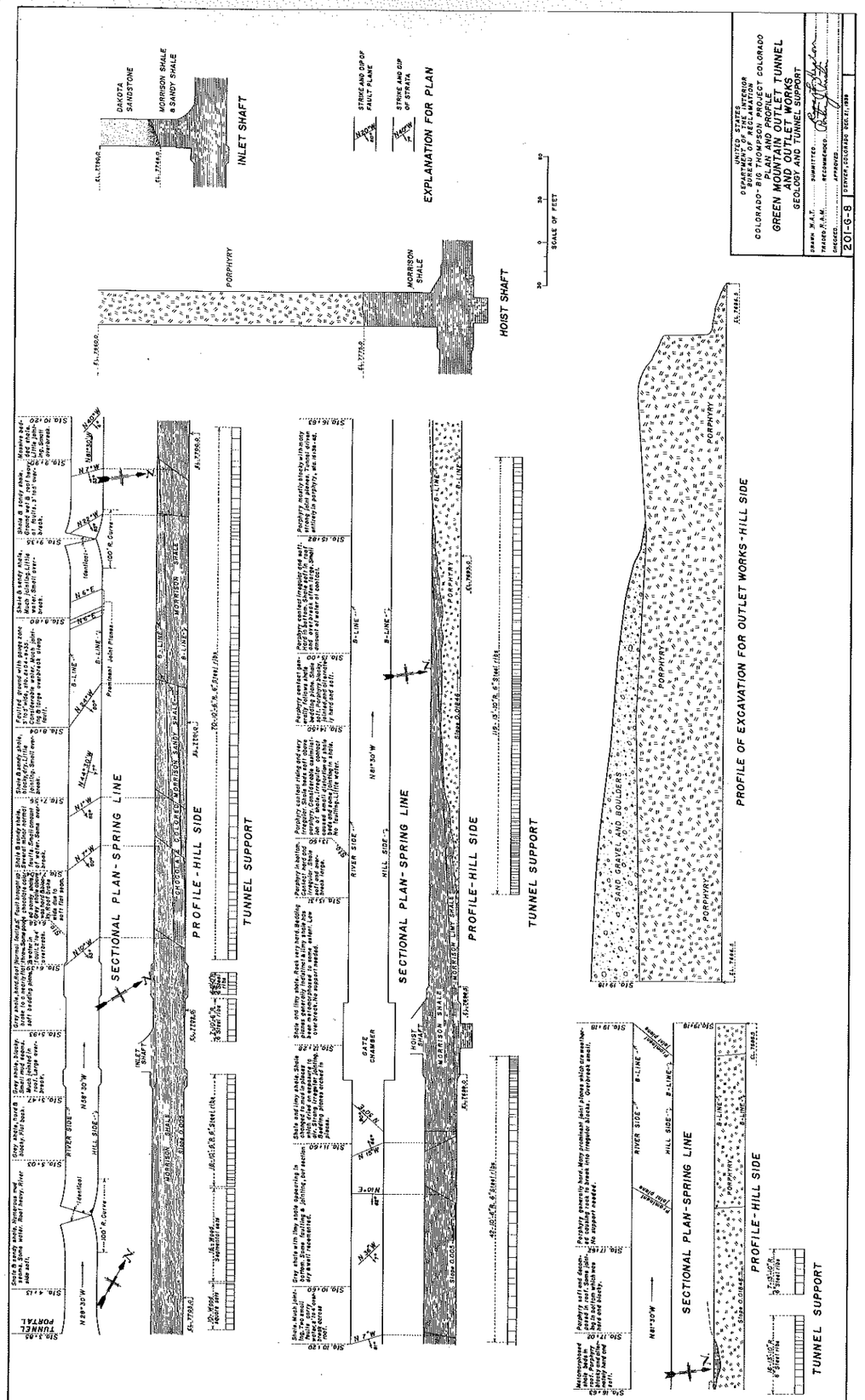
Construction Features:

During construction an effort has been made to record all geological data disclosed by stripping or excavation. A map is to be prepared showing the distribution and structure of all rocks in the foundation which have been uncovered by stripping as well as in excavations for spillway, outlet works, power plant and cutoff walls. A drawing has been completed showing the geological plan and profile in the outlet tunnel and shafts, geological description and a record of the support found necessary (Fig. 7).

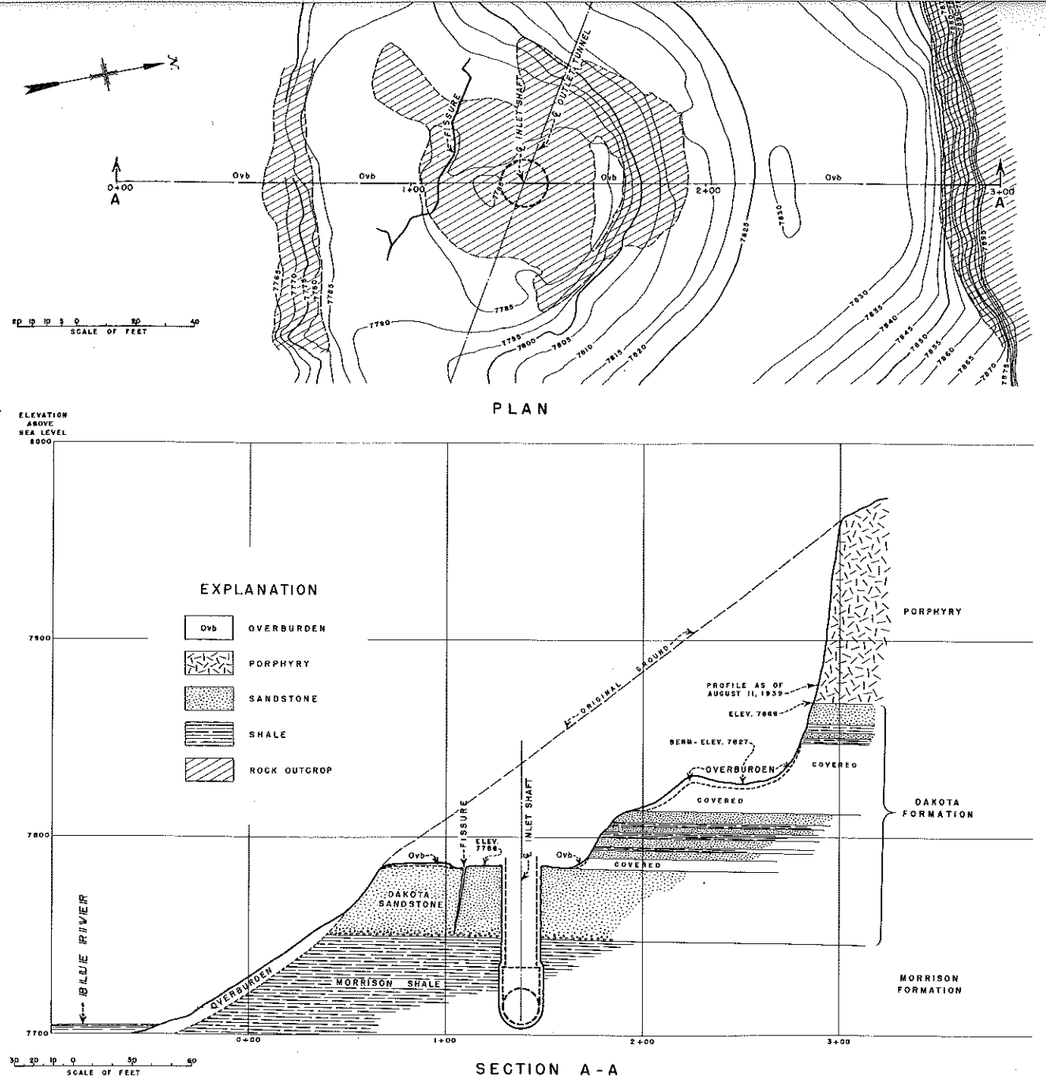
The object of this work is threefold. First, to assist in determining any changes in design or construction made necessary by unforeseen conditions which may have been disclosed by excavation but not by pre-construction testing; second, to preserve such information as a part of the permanent record of construction in order to facilitate repairs or alterations made necessary by possible structural weakness; and third, to aid the geologists and engineers in their interpretation of observed conditions in future investigations. In the case of Green Mountain dam this is especially important because the formations involved here, the Morrison and Dakota, are the same as will be found in the foundations of five other dam



▼ Fig. 6. Core of Green Mountain porphyry at depth of 100 feet in bottom of box canyon.



▼ Fig. 7. Geologic plan and section of outlet tunnel showing record of tunnel supports.



▼ Fig. 8. Geologic plan and cross section across excavation for trash rack structure.

sites on the eastern slope of the Continental Divide.

Descriptive matter in the tunnel drawing (Fig. 7) makes further comment unnecessary except to mention that the geology agrees very closely with the original cross section which was prepared upon completion of the testing program. This cross section, however, showed the upper porphyry sill at a lower elevation than was found to be the case at the location of the trashrack structure. This was due to the fact that a huge boulder of porphyry, with a surface coinciding with the projection downward of the cliff above, was taken for bedrock. As a matter of fact the alternating sandstones and shales above the basal Dakota sandstone extended up to elevation 7869 as shown in the profile cross section (Fig. 8). Figure 9 is a view showing the line along which the profile was taken. Several fissures were found in the Dakota sandstone between the inlet shaft and the outcrop in addition to the one shown on Figure 8. These were filled with a sand-cement mixture and, after setting, the whole mass was grouted under light pressures to further insure its stability and water tightness.

On the left abutment, near the upstream toe of the dam, there was an ancient slide area in the glacial overburden which was originally thought to be due to the clay content of the drift itself. Excavation for the cofferdam cutoff caused a recurrence of this slide and it was found to be due to the presence of a decomposed layer of shale under the overburden.

During the stripping operations on the left side of the main site the alternation of hard and soft layers made necessary the removal of much more of the Morrison shale than had been anticipated and left the surface as a series of steps, sloping with the bedding as shown in Figure 10. Another unforeseen condition was an elongated depression in the surface of the lower porphyry sill 10 to 15 feet deep and extending diagonally into the hill, the position of which is also shown on Figure 10. The shale above had slumped into this depression and was very much broken up and decomposed, necessitating complete removal and adding considerably to the waste material on that abutment (Fig. 11).

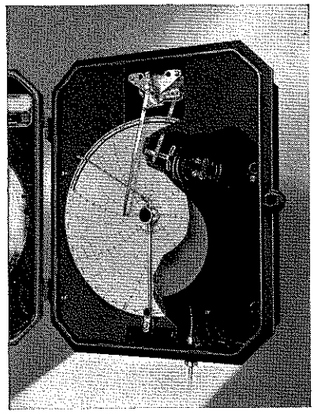
(Continued in June Issue)

WITH THE *Manufacturers*

EQUIPMENT NEWS

Complete New Line of Taylor Recorders

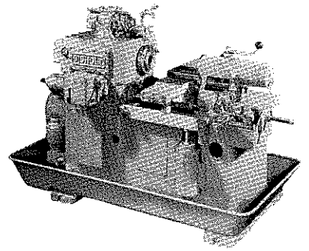
To provide companion recording instruments for their redesigned line of Fulscope Controllers, the Taylor Instrument Companies, Rochester, New York have just released their new recorders for temperature, humidity, pressure, load, rate of flow, liquid level, and receivers for pneumatic transmission systems. Exclusive of the controller mechanism, the recorders and recording controllers are identical.



▼ New Taylor Recording Thermometer.

The new universal case is for both face and flush mounting. It can be mounted on panels side by side with previous Taylor recorders. Dust and moisture are sealed from the case by Neoprene door gaskets and a positive bayonet-action latch. The chart may be removed and replaced with one hand. Available with 10″ or 12″ charts, and with one, two or three pens.

An improved sub-base permits more accurate calibration and assures precise location of replacement systems in the field. 18-8 stainless steel is used in links, pivots and pen arms, thus reducing vibration and increasing life and accuracy.



▼ The new Gisholt Number 12 Hydraulic Automatic Lathe for between-centers and chucking work.

Details of the machine as well as many typical installation jobs are shown in a new illustrated folder, Form 1080, copies of which are obtainable from the Gisholt Machine Company, 1265 East Washington Avenue, Madison, Wisconsin.

New Office Building Robins Conveying Belt Company

The old Park Row Building in New York, for many years the tallest building in the world, has had its upper floors and towers occupied for more than forty years by Robins Conveying Belt Company.

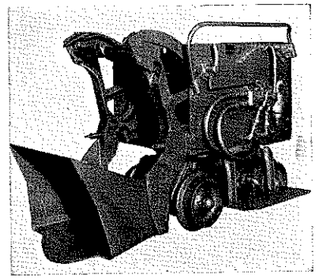
This concern, under the leadership of Thomas Robins, pioneered the Belt Conveyor in this country and many other countries and has through the years developed into one of the leading designers and manufacturers of material handling machinery.

The factory in which this equipment is manufactured is located at Passaic, New Jersey where the company has now built a three story brick office building to house its Executive, Engineering, Sales and other Departments, where they can be in closer touch with the manufacturing facilities to the advantage of clients, as well as themselves.

The new address, Passaic, New Jersey, will be effective for all correspondence with the company on May 1st, 1940. A New York Sales Office, located at 70 Pine Street, will be maintained for the convenience of friends within the city.

Eimco-Finlay Loader

The simplicity and ruggedness of the Model 12-B and Model 21 Eimco-Finlay Loaders minimizes the number of wearing parts and reduces maintenance expense to unbelievably low figures. Records of many users show that the cost of replacement parts is less than that of the shovels, picks, and turnsheets required for doing the same amount of mucking by hand. Air consumption for the Model 21 is about the same as for a "drifter" drilling machine, and correspondingly lower for the Model 12-B. Direct mucking costs average less than half of hand mucking costs, without taking into account the much greater saving in overhead due to greatly speeding up the work. Total savings usually pay for the loader in a few months.



▼ Eimco-Finlay Mine Car Loader Model 21

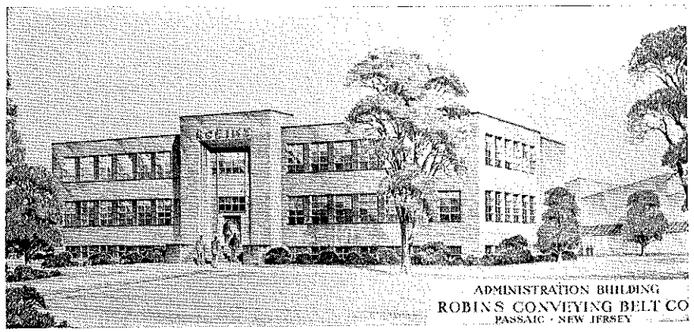
At a famous gold mine in Canada the average time required for loading 35-cu. ft. cars is less than a minute—at the largest copper-mining property in Montana 65-cu. ft. cars (with flash boards) are loaded in less than two minutes—at the Carlton Tunnel, now being driven to dewater a group of gold mines near Cripple Creek, Colorado, 87-cu. ft. cars are loaded in less than three minutes. Nine 6½-ft. rounds (10′x11′ section) are being mucked out every 24 hours at the Carlton Tunnel—with daily advances as high as 74 ft., thereby breaking all world's records.

For complete information write to Eimco Corporation, Salt Lake City, Utah.

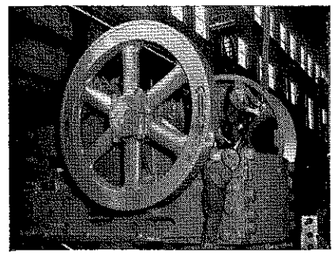
Hydraulic Automatic Lathe

A new hydraulic automatic lathe for between centers and chucking work has been announced by the Gisholt Machine Company. This machine, known as the Number Twelve, finds wide application on production turning jobs such as gear blanks, cylinder-liners and pistons, small impellers and flywheels, etc.

This lathe provides for a swing of 16¾″ over the bed or 12″ over the front carriage, with a length between centers of 22″. Features of the machine include a simplified hydraulic control system which permits the handling of all functions of the machine by means of a single lever. The front carriage, as well as the rear slide, has independent hydraulic feed. This machine is equipped with a hydraulically operated main clutch and an automatic spindle brake.



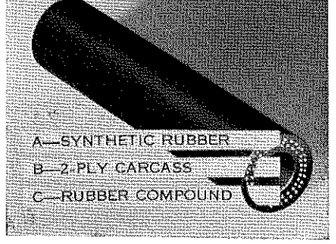
Huge Jaw Crushers For Far East



Shop erection view showing the first of three huge all steel jaw crushers with 84" by 60" openings now under construction in the shops of Allis-Chalmers Mfg. Company, Milwaukee, Wisconsin. These crushers are being built for export to the Far East and will be used on iron ore. Each crusher weighs 450,000 pounds. The flywheel in the foreground is over 12 feet in diameter and weighs 14 tons. The large V-belt drive sheave shown on the other side has 23 grooves. It has a pitch diameter of 147 inches and weighs approximately 18 tons.

New Hose

New hose, Style B. T. Solvent, for use on equipment for spraying paints, Duco, lacquer, other solvent fluids, is announced by Mechanical Goods Division, of The Goodyear Tire & Rubber Company, Akron, Ohio.



The hose is especially adapted for handling of benzol, carbon tetrachloride, drying oils, lacquer thinners, turpentine, gasoline and for use on service station greasing equipment. The Style B. T. Solvent hose is of lead press, cured, braided construction. It is extremely flexible, with a smooth outside cover, is of light weight and is available in long continuous lengths.

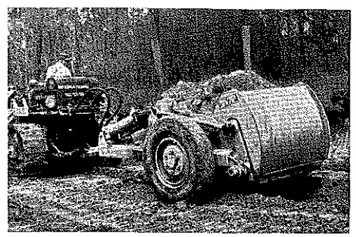
The tube is of synthetic compound, impervious to the action of the solids it is designed to carry. Reinforcement is provided with plies of braided cotton yarn, giving a high safety factor against working pressures, tow-rope action and shock blows.

The cover is of high tensile, abrasion and age resisting, black rubber compound. The hose is available in the following categories:

Size	No. of Braids	Average bursting strength lbs. per sq. in.	Working pressure safety factor 5 lbs. per sq. in.	Nominal Outside diameter inches	Approx. weight per 50' in lbs.	Approx. length of reels in feet
¼	2	1200	240	39/64"	7.4	500
⅜	2	1000	200	11/16"	9.8	500
½	2	1000	200	7/8"	11.9	500

Bucyrus-Erie Announces New H-28 Scraper

The new Bucyrus-Erie H-28 is a 2-wheel hydraulic scraper built for use with tractors rated at 25 to 35 horsepower. It has a struck capacity of 2½ cubic yards but will, according to the manufacturer, heap to loads of 3 or 4 cubic yards. Since the H-28 with its tractor can be loaded on a regular truck and hauled within usual dimension and load limits, no special permit is needed to haul it over the highways; thus it becomes especially handy for work involving fast moves from job to job. The H-28 can also be used with a rubber-tired tractor, making a complete dirt-moving and traveling layout and a high speed all-on-rubber hookup that will not damage hard-surfaced roads.



Like all Bucyrus-Erie scrapers, the H-28 can be hauled by a tractor equipped with a Bucyrus-Erie bullgrader or bulldozer to make a combination unit. Write to this magazine or to Bucyrus-Erie Company, South Milwaukee, Wisconsin, for the complete story on this unusual dirt-moving tool.

Spaders and Trench Diggers

The Sullivan M-2 spaders are built for the toughest jobs, including shaft sinking, tunnel and trench work and also light demolition. They are easy on the operator. Handle grips fit the hand, an air cushion at the end of the cylinder relieves jar, and exhaust ports are arranged to deflect exhaust away from the operator. They are easy to dismantle.

They are ruggedly constructed with strong, well protected joint connection to maintain perfect alignment and a special heat-treated steel retainer to resist wear from the spade.

Ask for Bulletin 87-K—Sullivan Machinery Company, Michigan City, Ind.

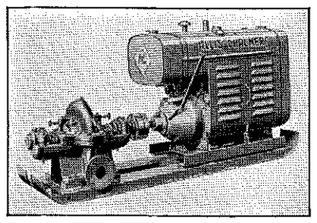
Hayes Parsons is Appointed Link-Belt Speeder Sales Manager

T. M. Deal, President, Link-Belt Speeder Corp., shovel-dragline-crane manufacturers, 301 West Pershing Road, Chicago, announces the appointment of Hayes Parsons as Sales Manager for the corporation. For the past several years, Mr. Parsons has represented Speeder Machinery Company—and (after the consolidation), Link-Belt Speeder Corp.—in the Seattle district.

To his new position, Mr. Parsons brings an unusual background of manufacturing, management and marketing experience, having served successively as shop mechanic, rivet crew foreman, factory service man, West Coast resident service supervisor, West Coast factory representative, and Assistant Sales Manager, since joining the old Speeder Machinery Company in 1924. Mr. Parsons is well known in the equipment field, both in the United States and Canada.

Allis-Chalmers Adds New Engine-Driven Pumps

To provide independently powered pumps for drainage, irrigation, gravel and coal washing plants, construction jobs, and similar applications, the Allis-Chalmers Mfg. Co. has introduced a line of centrifugal pumps driven by gasoline power units. Since these units are entirely independent of any outside source of power, municipal and private water suppliers use them as standby units in emergencies when other sources of power fail.



Power units in five sizes (18 to 110 H.P.) assure economy in operation with a choice of fuels: gasoline, kerosene, distillate, natural gas, or butane. All power units have valve-in-head medium speed engines, with removable cylinder liners, efficient cooling systems, force feed lubrication and a variable speed governor.

The centrifugal pumps are horizontal shaft, single stage, single or double suction pumps designed for handling liquids at normal temperatures with maximum

(Continued on page 280)

CATALOGS AND TRADE PUBLICATIONS

(899) MODERN TURBINES. Bulletin GEA-2869 by General Electric Co., Schenectady, N. Y. Eleven pages explaining why and how steam turbines are designed depending on exhaust and intake temperatures. This pamphlet should be placed in your files.

(900) LOW CURRENT WELDER. Bulletin B6049 by Allis-Chalmers, Milwaukee, Wis. Description and illustrations of a new low-current welder using currents as low as 5 amperes that will weld sheets as thin as 32 gauge. The machine is portable and will weld things usually repaired by brazing or soldering.

(901) TUGGER AND UTILITY HOISTS. Tugger and Utility hoist catalog by Ingersoll-Rand, 11 Broadway, New York, N. Y. This catalog describes over 275 sizes and types of one, two and three drum tugger hoists electric, gas and air powered with illustrations and construction details. Denver office, 1637 Blake St.

(902) SHORTWALL COAL CUTTER. Bulletin M-384 by Goodman Mfg. Co., 48th and Halsted St., Chicago, Ill. Description and construction details of type 612, short compact machine designed especially for conveyor mining with two planetaries and reversible cutting direction. Denver office, 704 Denver National Bldg.

(903) REDUCTION CRUSHER. Bulletin B6006A by Allis-Chalmers, Milwaukee, Wis. Description and construction details of the new type R reduction crusher which has a manganese steel mantel, one-piece concave ring and rubber curtain dust seal.

(904) 7 MINUTES WITH SEVEN METALS. Pamphlet by International Nickel Company, Inc., 67 Wall Street, New York, N. Y. A general guide to the uses and properties of nickel and high nickel alloys with material on Nickel, Monel, Inconel and associated alloys.

(905) ROPE DOPE. Educational Bulletin Vol. 1 No. 7 by Union Wire Rope Corp., 21st and Manchester, Kansas City, Mo., distributed by J. M. Moore, U. S. National Bank Bldg., Denver, Colo. Illustrations of the abuses of wire rope in use with table of strength and stretch for ropes with one or more strands broken.

(906) MECHANICAL TOPICS. Vol. 4 No. 1 by International Nickel Company Inc., 67 Wall Street, New York, N. Y. This number contains articles about the steering gear required to turn a 51-ton ship's rudder, a new tension meter that tests by tone and human lives saved from typhoid at 1 cent each.

(907) WELDING IN PIPE LINE CONSTRUCTION. Reprint from March, 1940, issue the Petroleum Engineer "Electric-Arc Roll-Welding and Stove-Pipe Welding in Pipe Line Construction" by Harold C. Price Pres. H. C. Price Company. Description of Stove-pipe welding an 8 inch line in Wyoming and suggestions for stove-pipe welding depending on conditions.

(908) DIESEL TRACTORS. Issue 78 of Caterpillar Magazine by Caterpillar Tractor Co., Peoria, Ill. Illustrated articles about the various and unusual duties performed by diesel tractors such as placing a pipeline across a stream and pulling stakes.

(909) HYDRAULIC AUTOMATIC LATHE. Pamphlet Form 1080 by Gisholt Machine Co., 1265 E. Washington Ave., Madison, Wis. Construction features and illustrations of the Gisholt No. 12 hydraulic automatic lathe and uses for which it is designed.

(910) ELECTRICAL EQUIPMENT. "Quick Selector" catalog 30-000 by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 64 pages facilitating the user of electrical equipment to select the proper apparatus for motor, lighting or feeder circuit.

(911) CENTRIFUGAL PUMPS. Engine Driven Centrifugal Pumps leaflet Form MS 253 by Allis-Chalmers, Milwaukee, Wis. Illustrations of engine driven centrifugal pumps with tables of pump selections depending on head and capacity.

(912) STEEL VALVES. Bulletin 5-7000 by Manning, Maxwell & Moore, Inc., Bridgeport, Conn. Catalog of 40 pages on Hancock Steel Valves with construction details, specifications and tables on service ratings and pipe flanges and fittings.

(913) ALL WHEEL DRIVE VEHICLES. All-Wheel-Drive News by Marmon-Herrington Company, Inc., Indianapolis, Indiana. 16-page magazine telling the story of the ability of all wheel drive trucks and passenger cars to traverse desert sands, deep mud and snow, steep hills, streams and forests. Illustrations of all wheel drives on the job are shown.

(914) ELECTRICAL CHARACTERISTICS OF ALUMINUM CABLE. Electrical Characteristics of Aluminum Cable Steel Reinforced, Revised Nov. 1934 by Aluminum Company of America, Pittsburgh, Pa. 24 pages of tables on physical characteristics, resistance per mile, inductance, current density and capacitance. This is for your engineering notebook.

(915) MANUFACTURING METHODS. Manufacturing of Dorr equipment by the Dorr Co., Inc., 570 Lexington Avenue, New York, N. Y. 12 pages of illustrations showing foundry practice, machining, loading and testing of Dorr products.

(916) PUMPS COMPRESSORS AND ENGINES. Bulletin QP 10 by Gardner-Denver Co., Quincy, Ill., 48 page catalog with illustrations and descriptions of all types of stationary and portable compressors, centrifugal and reciprocating pumps, rotary drills and accessories.

(917) PNEUMATIC TOOLS. Catalog No. 12,100 Sixth Edition by Ingersoll-Rand, 11 Broadway, New York, N. Y. Denver, Colo. branch 1637 Blake St. 87 page catalog with illustrations and construction details on pneumatic drills, spike drivers, impact wrenches, grinders, bit grinders, riveters and accessories with specifications tables.

(918) DIAPHRAGM PUMPS. Bulletin No. 5001 by the Dorr Co., Inc., 570 Lexington Avenue, New York, N. Y. Denver, Colo. branch Cooper Bldg. Illustrations and construction details of the V-type diaphragm pump with table of capacities and listed advantages such as headroom, stroke adjustment while running, and lack of gear reducer.

(919) MANGANESE STEEL EQUIPMENT. Amsco Bulletin, April, 1940 by American Manganese Steel Division, 370 E. 14th St., Chicago, Ill. Descriptions and illustrations of machine parts, castings, manufacturing equipment and alloys using manganese.

(920) ORE TESTING. Bulletin No. T4-B3 by Denver Equipment Co., 1400 Seventeenth Street, Denver, Colo. An illustrated pamphlet telling why you should have your ore tested before you build a mill or make a new milling set up. Contains a form sheet for the information needed when sending in a sample to be tested. Information and flow sheets for most types of recovery. This should have a place in your engineering notebook.

(921) MOTOR COMPRESSOR. Motor compressor bulletin by Ingersoll-Rand, 11 Broadway, New York, N. Y. 29-page catalog with illustrations describing compressors with motors as a single unit. The units are two stage, intercooler and cylinders are air cooled and channel valves are used. Branch office, 1637 Blake St., Denver, Colo.

(922) DRILL STEEL SHARPENERS. Instructions for Installing and Operating Sharpeners, Punches and Oil Forges, by Gardner-Denver Co., Quincy, Ill. and Denver, Colo. 28 pages describing this equipment and its construction with information on accessories, furnaces, heat treating, resharpening and shank forming. This should help you with your drill steel problems.

(923) LOW-VOLTAGE POWER CABLE. Bulletin GEA-3280 by General Electric Co., Schenectady, N. Y. A condensed guide to aid in the selection of insulated cable for low-voltage requirements. Illustrations and construction of the various types, how to select size and tables on current capacities and voltage drop.

(924) PHOTO-MICROGRAPHS. Catalog E-21 by Bausch & Lomb Optical Company, Rochester, N. Y. 28-page catalog with illustrated articles on factors in photomicrography, the different styles of equipment and their use, accessories and low power equipment.

(925) VACUUM FILTERS. Bulletin No. 910 by Morse Bros. Machinery Co., Denver, Colo. Illustrations, descriptions and construction details of various sizes of drum and disc filters with specification tables. Ask for bulletin No. 80 on Organization & Manufacturing Facilities of this company.

(926) STORAGE BATTERY LOCOMOTIVES. Catalog by Mancha Storage Battery Locomotive Division of Goodman Manufacturing Co., 4850 S. Halsted St., Chicago, Ill. Illustration and descriptions on frame, motor, transmission, etc., with tables of specifications and draw bar pull for 2 to 19 ton storage battery locomotives. Denver office, 704 Denver National Bldg.

FOR YOUR CONVENIENCE

Send your publications to Mines Magazine, 734 Cooper Building, Denver, for review in these columns. Readers will please mention Mines Magazine when requesting publications from the manufacturer. Readers may order publications from this office by giving index number.

(927) ORE FEEDERS. Pamphlet by Hardinge Co., Inc., York, Penn. Illustration and description of a machine that feeds by weight with reprints of letters by operators using them.

(928) ROCK DRILLING EQUIPMENT. Bulletin GP-Eleventh Edition by Gardner-Denver Co., Quincy, Ill. and Denver, Colo. Illustrations and descriptions of hand held drills, drifting machines, quarry machines, stopers, clay diggers, compressors, wagon drills and accessories with specification tables and information on construction details.

(929) SCRAPER LOADER ACCESSORIES. Pamphlet L351 by Goodman Manufacturing Co., Chicago, Ill. Sketches and specifications on hoe type, open end, solid type and hinged types scoops. Wire rope blocks and floor jacks.

(930) ELECTRICAL EQUIPMENT IN OIL REFINERIES. Bulletin GEA-2360 by General Electric Co., Schenectady. Article by V. R. Chadbourne on Selecting and Maintaining Electrical Equipment in Oil Refineries covering possible power failures, explosion-proof motors, switches and circuit breakers.

(931) FLOTATION MACHINES. Leaflet by Morse Bros. Machinery Co., Denver, Colo. One page leaflet describing "Weinig" flotation machine showing hand regulated weir control.

(932) SHAKER CONVEYORS. Bulletin C-330 by Goodman Manufacturing Co., Chicago, Ill., Denver office 704 Denver National Bldg. Leaflet describing the Goodman Duckbill self-loading feeder head for shaker conveyors and illustrations of other shaker conveyor accessories and equipment.

(933) V-BELT DRIVES. "Industrial News" by The Gates Rubber Company, Denver, Colorado, May 1940. Illustrates several Vulco Rope Drive installations which you may take advantage of and increase your efficiency.

(934) PNEUMATIC COAL CLEANING. Folder 1821 by Link-Belt Company, 300 W. Pershing Road, Chicago, Illinois, illustrates and describes the cool cleaning problems—"X" type double-deck and "Twin-Dex" type tandem-deck pneumatic separators are illustrated.

(935) EIMCO-FINLAY LOADERS. Bulletin 104 by the EIMCO Corporation, Salt Lake City, Utah, illustrates, describes and gives specifications on the model 21 loader that is making records in the Carlton Tunnel and other places.

(936) MOLYBDENUM STEELS. March 1940, "Molymatrix" by Climax Molybdenum Company, 500 Fifth Avenue, New York contains specifications and descriptions of Molybdenum steel for modern locomotives. The index of "Molymatrix", 1934 through 1939 is included.

(937) BUILDERS HARDWARE. H. & B. Bulletin March-April 1940 by Hendrie & Bolthoff, Denver, Colorado shows Builders hardware and many equipment items handy for use around the mine or mill—32 page publication full of ideas to increase efficiency.

(938) FLOW METERS. Bulletin 110 by Republic Flow Meter Co., 2240 Diversey Parkway, Chicago, Ill., illustrates Republic Mechanical Ring—Balance Meter for measuring the flow of all types of fluids. Mine & Smelter Supply Company, Denver, Colorado are Sales Representatives.

(939) HEAVY DUTY STATIONARY DIESELS. Bulletin 768 by Chicago Pneumatic Tool Company, 6 East 44th Street, New York, contains 16 pages of salient features and important design features. Rating curves and dimensions are given for three, four, six and eight cylinder engines are given.

(940) SILVER ANALYSIS. May 1940 "DECO TREFOIL" by Denver Equipment Company, Denver, Colorado contains 4 pages, "Gay-Lussac Method of Silver Analysis," "Strategic minerals," "Acid Tester," Laboratory notes and other valuable information.

(941) CONTINUOUS VACUUM FILTERS. Bulletin 402 by EIMCO Corporation, Salt Lake, contains 28 pages illustrating various types of continuous filter equipment, showing typical arrangements, sizes of filters and auxiliary equipment—capacity tables are given.

(942) THE SPADER. Bulletin 87-K by Sullivan Machinery Company, Michigan City, Md., shows an air driven machine for heavy work in trenches containing hard pan, broken shale and frozen ground. Specifications are given. Denver Office is 1815 California St.

(943) 4 & 6 ALL WHEEL DRIVE TRUCKS. Bulletin Form 400,307 by Marmon-Herrington Co., Inc., Indianapolis and illustrates "Heavy Duty" all wheel drive trucks with gross capacities to 70,000 lbs. Full specifications are given for 4-wheel and 6-wheel Drive.

(944) STRUCTURAL STEEL HANDBOOK. Catalog No. 201 of Colorado Fuel & Iron Company, Denver, Colorado is really an Engineer's Loose Leaf Handbook containing 192 pages of Engineering Data and General Information for Architects—Engineers—Designers—Fabricators and Manufacturers pertaining to Hot-Rolled Steel Sections rolled by C. F. & I. at Pueblo. 82 pages are devoted to sections and properties of structural shapes while the balance of the book contains a collection of tables and data most useful to the engineer. The whole is bound in a flexible cover with tabular index, making a very convenient reference book.

Alumni Business

OFFICERS OF ALUMNI ASSOCIATION

EDWARD J. BROOK, '23
President

FRANK C. BOWMAN, '01
Vice-President

FRANK J. NAGEL, '03
Secretary

GEORGE W. THOMAS, '26
Treasurer

FRED C. CARSTARPHEN, '05
Denver, Colo.

M. EDWARD CHAPMAN, '27
Tulsa, Okla.

CHARLES O. PARKER, '23
Denver, Colo.

✦

COMMITTEE CHAIRMEN

BRUCE B. LaFOLLETTE, '22
Publications

JAMES W. DUDGEON, '13
Athletic

ALLAN E. CRAIG, '14
Capability Exchange

KEPPEL BRIERLY, '34
Instruction

RUSSELL H. VOLK, '26
Membership

T. C. DOOLITTLE, HON. '27
Budget and Finance

C. LORIMER COLBURN, '07
Alumni Foundation

A. GEORGE SETTER, '32
Legislation

DONALD DYRENFORTH, '12
Public Relations

HUGH M. CONNORS, '22
Research and Investigations

KENNETH E. HICKOK, '26
Nomination

W. A. WALDSCHMIDT, Faculty
Junior Membership

✦

PUBLICATION COMMITTEE

BRUCE B. LaFOLLETTE, '22
Chairman

J. HARLAN JOHNSON, '23
Vice-Chairman

CHARLES W. HENDERSON, HON. '30
FRED C. CARSTARPHEN, '05
JOHN H. WINCHELL, '17
CLAUDE L. BARKER, '31
RUSSELL H. VOLK, '26
ARTHUR W. BUELL, '08
W. A. WALDSCHMIDT, Faculty

MEETINGS

Executive Committee Meetings

3rd Monday of each month, Alumni Office, 7:00 P.M.

Alumni Council Meetings

4th Thursday of each month, Argonaut Hotel, 6:30 P.M.

Publication Committee Meetings

2nd Tuesday of each month, Alumni Office, 7:00 P.M.

Magazine Staff Meetings, Alumni Office on call.

NEW ASSOCIATION MEMBERS APRIL, 1940

Alumni

WILLIAM V. BEGGS, '37
Los Angeles, Calif.
N. F. GALLUCCI, '20 - Long Beach, Calif.
A. J. HIESTER, '12 - - - Denver, Colo.
RALPH C. JENSEN, '32
Battle Creek, Mich.
HOWARD R. KEIL, '39
Colorado Springs, Colo.
FRANK H. STORMS, '24
Caracas, Venezuela

Associate

RAYMOND W. ABPLANALP, Ex-'41
Albany, Oregon
JOHN J. CLIFFORD, Ex-'18
Pachuca, Hgo., Mexico
LEVERETT DAVIS, Ex-'12
Salt Lake City, Utah
RAYMOND B. FRANK, Ex-'24
Watertown, N. Y.
HARRY MADER MACK, Ex-'33
Ft. Thomas, Ky.

REPORTS

Executive Committee Meeting

The regular meeting was held in the Alumni office on Monday, April 15, 1940, 7:00 P.M.

Members of the Executive Committee present: Frank C. Bowman, George W. Thomas, Frank J. Nagel, Charles O. Parker. Committee Chairmen: C. Lorimer Colburn, Bruce B. LaFollette, Donald Dyrenforth, Russell H. Volk, T. Court Doolittle, A. George Setter, Hugh M. Connors. Guest: Dent Lay.

Members absent: Edward J. Brook, Fred C. Carstarphen, M. Edward Chapman. Committee Chairmen: James W. Dudgeon, Allan E. Craig, Kenneth E. Hickok, Keppel Brierly.

TREASURER'S REPORT. Treasurer Thomas reported that for the first time in many months the treasury shows a substantial cash balance. In view of the fact that we had a very heavy deficit to face at the first of the year this is encouraging news. He also said that even though this condition is very encouraging that we have a very heavy program ahead of us, necessitating increased expenditures so that it will take a great deal of effort on the part of everyone to keep our business on the right side of the ledger throughout the remaining part of the year.

ALUMNI ENDOWMENT FUND. Chairman Colburn reported that the committee had plans in mind for inaugurating a campaign for the Alumni Endowment Fund, but they would not put these plans in action until a little later.

Mr. Colburn suggested that the record of the personal and professional history of all Mines men should be collected with the idea of publishing it in book form. The motion was passed as follows: That the Alumni Association investigate the advisability of compiling such a life history of the Alumni to be published in book form and that a questionnaire be prepared for the collection of such information and submitted to the committee for consideration at a later meeting.

CAPABILITY EXCHANGE. The report was read from Chairman Craig, showing that seven positions had been received by the committee, six of which could be filled by Mines Men, the other was turned over to the Colorado Society of Engineers with whom we are cooperating on employment service.

MEMBERSHIP COMMITTEE. Chairman Volk presented applications for membership from five Ex-Mines men which were examined by the Executive Committee and all were found eligible and favorably acted upon by the committee.

A letter from the newly installed Arizona Local Section was read. Secretary Nagel was instructed to send a letter of welcome and congratulations.

Mr. Volk reported that the first meeting for the organization of the new Pacific Northwest Local Section, including Idaho, Washington and Oregon had been arranged and the progress made by Mr. Axel E. Anderson, '04, who has taken this matter actively in hand, was very satisfactory.

The Membership Committee appreciates the fine cooperation that is being received from Mines men all over the world in support of our active campaign for increased membership in the Alumni Association.

PUBLIC RELATIONS COMMITTEE. Chairman Donald Dyrenforth reported that the football films were in very active demand by different groups and Local Sections, and that he was very desirous of obtaining these requests far enough in advance so that he might be able to route the films without too much interference.

He reported that very satisfactory progress was being made in preparing for one of the finest and best attended Alumni Banquets given in the history of the Association. Announcements will be sent out within the next few days covering these arrangements in detail.

PUBLICATION COMMITTEE. Chairman Bruce B. LaFollette reported that the work of the Publication Committee in securing material for publication is making better progress than in previous months, however, the committee will welcome any additional material as the more we can get on hand the better balanced magazine we will be able to publish.

Financially the position of the magazine is much better than for the same period in previous years.

The Special Alumni Number will be one of the finest issues we have ever attempted to publish and while it will be a little late in getting into the mails Mr. LaFollette is quite sure everyone will be pleased when it reaches them. The cooperation of advertisers and alumni members has been the finest ever shown toward any issue of the magazine that has been published.

Material for the Fifth Annual Petroleum Number is being actively solicited under the direction of Arthur W. (Pop) Buell, who states that he is very much encouraged over the outlook up to date, however, he would appreciate hearing from many others who are actively engaged in petroleum work and most certainly have material that would be valuable for publication.

(Continued on following page)

President's Message

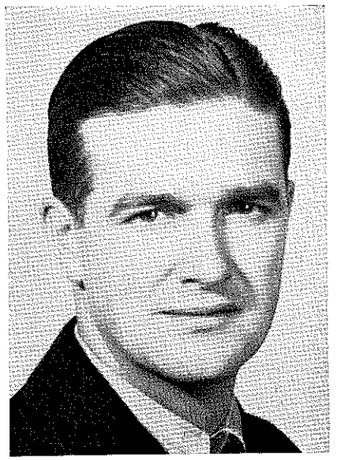
A number of letters from members to your president have arrived from Miners "all over the globe." Among them is one which seems to crystallize into a central theme the sentiments expressed in the majority of them.

"Perhaps the things we grow accustomed to, the ones we take for granted, are the ones to which we give the least thought. That has been my relation to the Alumni Association. I begin to realize the job ahead of you after reading the President's Message and Association Activities sections of the magazine. I hope that our officers will get full cooperation from the members, and I believe they will. Situated rather remotely from the center of things, I am personally anxious to help in the work. It will give me great pleasure in helping in any way within the limits of my ability to serve if you can suggest the ways and means by which I may individually be of assistance."

A general answer to this letter may be found in a message by William Reid, President of C. U. N. A., to his organization. "God did not make this world in jest; no, nor in indifference," and a passable or tolerable interest in our affairs will not suffice to bring into being any marked excellence.

"No community of interests can be a complete success unless each individual can be induced to participate and take a share in its activities and be concerned about its operations. Being interested will some times be painful, other times pleasant, but if being interested and active brings about marked improvement in those things we daily come in contact with, the victory is well worth the effort."

Specifically, there are a number of ways our members can be of individual assistance. First of all give your alumni association a "par" rating



E. J. BROOK

with your favorite fraternal organization, service club, professional society or other group activity, rather than relegating it to a subordinate position. All of these organizations are, of necessity, financed thru dues paid by the members. Your alumni association is as worthy of this support on your part as any other group with which you may be affiliated.

The Alumni Association from time to time will endeavor to conduct surveys of the membership, to obtain factual data and information vital to our activities. At other times certain information or requirements will be presented, or brought to your attention thru the medium of circular letters. Our work will be much more effective if our members consider these to be business letters rather than "ads" from a "gold brick" concern or the neighborhood grocer. It is good business as well as courtesy to answer business correspondence. Our members can individually aid in association work in adopting a cooperative attitude toward these matters.

Our interested members can become Association Salesmen in endeavoring to "sell" the Association to those Miners in their territories, who are unfortunate in not being members. They can aid our publication committee in obtaining articles and advertising for our official publication. When a job arises in your vicinity an air mail letter to our Capability Exchange advising it as to particulars may mean a real service to some Miner out of work.

Our interested member can join his local section, if one exists in his neighborhood, and take an active part in helping to make it an active integral part of the Association. If he desires more work, a letter to the Committee Chairman of the activity in which he is particularly interested, will, no doubt result in some interesting assignment. We need players on the field, not rooters in the grandstand.

Our individual member, if he has a philanthropic urge, can contribute in a tangible manner to help erase our deficit. He can feel the accomplishment of a worthwhile purpose in aiding some worthy boy thru Mines by a contribution to Student Help Fund.

There is no ceiling to the activities our individual members can perform for our organization. No damper will be placed on these efforts, provided they are part of the coordinated plan to benefit the entire organization.

The letters from our members are an encouraging sign that the Association is accomplishing its purpose. It will achieve worthwhile objectives when the sentiments expressed in the letter at the beginning of this page, "I am personally anxious to help in the work," are transformed into the activities I have mentioned.

Alumni Business—

(Continued from preceding page)

INSTRUCTION COMMITTEE. Letter was read from Chairman Keppel Brierly in which he stated that on account of his connection with the Opportunity School which required night work four nights in the week, that it had been impossible for him to attend Executive Committee Meetings and he, therefore, thought that it would be better to appoint another chairman in his place. However, the Executive Committee, after giving the matter due consideration, decided that in view of the fact that it was not essential for Mr. Brierly or his committee to attend regular meetings of the Executive Committee, that his committee could carry on their work by correspondence and report progress as conclusions were reached from time to time.

RESEARCH AND INVESTIGATIONS. Chairman Connors stated that he had nothing to report at the present time.

LEGISLATION AND NOMINATION COMMITTEES made no reports at the present meeting.

Alumni Council Meeting

The regular monthly meeting of the Alumni Council was held at the Argonaut Hotel, 6:30 P.M., Thursday evening, April 25th, 1940. Those who attended the meeting were Mr. Frederick C. Steinhauer of the Board of Trustees; Messrs. Dean Jesse Morgan, W. C. Cramer, J. Harlan Johnson, W. A. Waldschmidt and George W. Thomas of the Faculty; Mr. George Yeager, former President of the Student Body; Mr. Joe Berta, newly elected President of the Student Body; Messrs. Frank C. Bowman, Bruce B. LaFollette, A. E. Perkins, Donald Dyrenforth, James W. Dudgeon, C. Lorimer Colburn, Russell H. Volk, Anton G. Setter, Dent Lay, Frank J. Nagel, members of the Alumni Association, and Mr. Neil Bosco, a visitor.

Matters discussed at the meeting included Alumni Association Endowment, conferring of Honorary Doctors Degrees, Athletics at Mines, Commencement Program and the active interest in the formation of new Local Sections.

FROM THE *Local Sections*

W. T. Graham, Ex-'26, President; C. W. Berry, '36, Secretary, Box 249, Baguio, P. I. Dinner meeting, first Wednesday each month, Pines Hotel, Baguio.

Tenney C. DeSollar, '04, President; W. C. Chase, Ex-'05, Vice-President; Hubert E. Risser, '37, Secretary, Flat Creek Alabama. Meetings upon call of secretary.

Frank Hayward, '32, President; William J. Rupnik, '29, Secretary-Treasurer, 714 Hillgirt Circle, Oakland, Calif. Four meetings por year, 2nd Monday, March, June, September and December.

The Bay Cities section held its spring meeting on April 18th at the Engineers' Club in San Francisco. The meeting commenced with a lively "bull" session and reunion with old friends, many of whom had not seen each other for years. Everyone commented upon and enjoyed the excellent meeting place and delicious dinner.

The meeting was called to order by Frank Hayward, President of the section group. Since new officers will be elected at the next meeting, C. K. Viland, '29 and D. J. Lyons, '31 were appointed to act as Nominating Committee to select candidates for the year 1940-41.

An advertising committee was created for the purpose of obtaining advertisements for the Mines Magazine. Men were selected who are in a position, through their daily business, to make contact with advertising prospects. Those chosen for this committee were: P. J. McGuire, '15; R. S. Coulter, '19; G. W. Schellenberg, '12; and G. G. Goodwin, '20. It is planned to extend this committee in the near future, with the objective of placing Mines men in every section of the widely scattered district represented by the Bay Cities Alumni. The superior quality of Mines Magazine, in relation to comparable publications, was mentioned. It was brought out that, through the procurement of an advertisement, the advertiser, the magazine, and the local section all profit; a good way to make friends for the School of Mines!

A drive will be launched to initiate the establishment of a Bay Cities Scholarship Loan Fund. Some headway has already been made in this direction through the contribution of surplus treasury funds at the end of each year. So far the funds have been most insignificant, therefore, contributions are to be solicited. The members of the Bay Cities Section are going to give until it hurts for this very worthy cause.

R. S. Coulter, '19 introduced as our guest Russ Travis of Forestville, California, as a prospective Mines man for the Bay Cities Section to sponsor for a scholarship. No one conversing with this boy could help realizing that he would certainly be a credit to Mines, as he is interested from an educational as well as an athletic standpoint. Credit should certainly be given Coulter and Schellenberg of our Athletic Committee, as they have gone to the bat for us, one hundred percent.

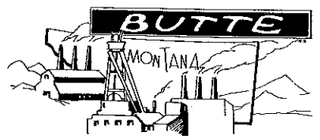
Following the above mentioned business, Mr. Ben S. Allen, the guest speaker of the evening, was introduced by Frank Hayward. Mr. Allen, a Stanford University graduate was a former A. P. War Correspondent (World War I), Belgian Relief Commissioner, and member of the U. S. Food Administration under Herbert Hoover, and is present chairman of the Finnish Relief Fund. Allen spoke on "War Censureship and Propaganda." His speech was timely and highly interesting, coming straight from the shoulder from a man who knows. Everyone present will agree that those who failed to hear this speech certainly missed an opportunity rarely presented. Incidentally Mr. Allen has been of great aid to us in obtaining the Murals, of which he was a trustee, from the Treasure Island mining exhibit, which now hang in our new Geology Building in Golden. He's a great booster for Mines and we'd like to have him speak for us again.

In the future, we will try and have one of our own members present a paper as speaker of the evening. Judging from the large and varied selections of talent available in the Bay Cities Section, we should be able to obtain some extremely interesting talks.

Steve Dettman, '31, has already promised to start the ball rolling by presenting some very interesting mining films at our next meeting. Steve really has a wide selection of interesting films, as it is a hobby with him. His selections include many variations, such as, the New York World's Fair, to—let us guess—"A Miner Takes a Holiday." Anyhow, we can be sure that Steve's films will be extremely entertaining.

Well, fellows, let's get going and make the Bay Cities Section a real credit to Mines as well as ourselves; we'll never regret it.

Those present at the meeting were: Clyde M. Eye, '95; W. A. Funk, '03; Ben T. Wells, '04; Wm. H. Friedhoff, '07; A. C. Norton, '07; G. W. Schellenberg, '12; W. G. Swart, Hon., '17; Ron. S. Coulter, '19; V. J. Lynch, '20; Quenton F. Brewer, '26; Leslie E. Wilson, '27; C. K. Viland, '29; George Bartholomees, '29; W. J. Rupnik, '29; D. J. Lyons, '30; Steven S. Dettman, '31; Percy Gribben, '31; Frank Hayward, '32; W. H. Breeding, '39; Ben S. Allen, guest; Russ Travis, guest; Jess Wilson, guest; and G. M. Whitney, guest.



E. S. McGlone, President; H. M. Strock, '22, Secretary, 1309 Platinum St., Butte, Mont. Meetings upon call of Secretary.

A. L. Lynne, '06, President; M. E. Frank, '06, Secretary, 4537 Drexel Blvd., Chicago. Meetings upon call of secretary.

K. D. True, '35, President; R. J. Maloit, '37, Secretary-Treasurer, 9701 Lamont Ave., Cleveland, Ohio. Four meetings during year, 4th Friday, March, June, September and December.

Dent L. Lay, '35, President; R. J. McGlone, '27, Vice-President; A. L. Mueller, '35, Secretary, 430 E. 11th Ave., Denver, Colo. Luncheon meeting, third Friday each month.

Clark W. Moore, '32, President; R. J. Schilthuis, '30, Secretary, 1410 Gustav, Houston, Texas. Dinner meeting, second Friday of month. 6:00 P. M., Lamar Hotel, Houston, Texas.

The Houston Chapter held its regular monthly meeting on Friday, April 13, at 6 P.M. in the Cafeteria of the Lamar Hotel. The attendance was as follows:

D. H. Ball, Ex-'42; J. F. Dieckman; P. C. Dixon, '31; C. D. Hier, '31; C. W. Maguire, '36; C. W. Moore, '32; Ralph J. Schilthuis, '30; C. H. Stewart, '25; A. G. Wolf, '07.

Doug. Hier is a newcomer to our group, having recently opened an office in Houston for the Seismograph Service Corp.

Mr. Ball is a student who is getting experience with the Universal Exploration Co. here.

We are planning on having our next meeting, which will be on May 10, in conjunction with the dinner party we are planning for the visiting Senior Class of Petroleum Engineers.

R. S. Brummett, 26, President; William Dugan, Ex-'12, Secretary, 315 West 9th St., Los Angeles, Calif. Four meetings during the year, 2nd Monday of month, January, April, July and October.

A. F. Duggleby, '15, President; Ralph Keeler, '31, Secretary, Box 297, Manila. Dinner meeting, first Friday each month.

C. L. French, '13, President; Ben W. Geddes, '37, Secretary, 1112 University Terrace, Linden, N. J. Meetings upon call of secretary.

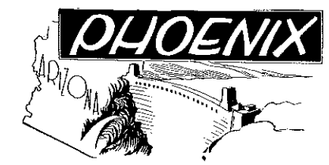
The New York section appears to have had a relapse after the big February meeting. The March meeting, held at noon on March 12, only drew a "crowd" of three members, namely, Harry Wolf, C. L. French, and John McAnerney. Moreover, the April meeting was only slightly more promising as regards attendance, there being seven men present. It is hoped that more Miners will come out for future meetings.

After an excellent dinner in the main dining room at the Western Universities Club, an informal business meeting was held. The most important item of general interest was a proposal to make the New York Section Loan Fund more widely available. The money in this fund has not been used extensively over the last ten years and it is disappointing that more students have not made application for use of this money. We were unable to make a definite decision as to any change in the administration of the fund because of the limited number of men present.

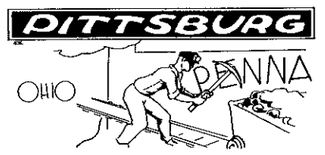
Those present at the April meeting were: Harry J. Wolf, '03; C. L. French, '13; Alex. Carver, '25; M. L. McCormack, '26; B. W. Geddes, '37; George Whitaker, '39; and Abdon Centeno.

Otto Herres, '11, President; Kuno Doerr, Jr., '27, Secretary, 700 McCormick Bldg., Salt Lake City, Utah. Meetings upon call of secretary.

Officers to be elected.



Two meetings in year, second Saturday in April and October. T. E. Giggey, '34, President; A. F. Hallett, '09; Percy Jones, Jr., '08, Vice-Presidents; E. M. J. Alenius, '23, Secretary-Treasurer, Box 2751, Phoenix, Ariz.



S. L. Goodale, '04, President; A. M. Keenan, '35, Secretary, Box 146, Pittsburgh, Pa. Meetings upon call of secretary.

(Continued on page 274)

"Award Day"

at Mines was revived this year and was held in Guggenheim Hall the afternoon of May 1st. George Yeager, president of the Student Council, presided.

Certificates were presented to members of the Board of Publications and of the "Prospector" staff and awards to outstanding men on the football, basketball and baseball teams and for intramural sports. Coach Mason commended the football team on their splendid record and made the statement, "This is the finest bunch of men I have ever worked with in my fifteen years of coaching football."

The Grant Scholarship Cup, donated by former Dean Lester S. Grant, was presented by Dean Morgan to the Beta Theta Pi fraternity for having the highest scholastic rating of the fraternities, their average being 82.02.

The Tau Beta Pi award to the outstanding sophomore the last scholastic year was presented to John Seeman by Randall Taylor, president. The prize was a membership in the American Chemical Society.

The program ended with the introduction of Joe Berta, president-elect of the Student Council, a selection by the Glee Club and the showing of movies of Mines football team in action.

Experimental Plant

is soon to be provided with complete new flotation equipment which will enable another graduate student to make research in this field. At present there is sufficient equipment for only one student in research. This man has been working on new reagents supplied by the Dow Chemical Company which, each year, awards six fellowships thruout the United States. One of these fellowships has been awarded the School of Mines each year for the past several years.

Two new flotation machines for recleaning flotation concentrates are also to be purchased.

The Special Problems course, Met. 411 and 412, which was started last year, has proven very successful so far. In this course, the student may carry on any metallurgical investigation in which he is interested. Some of the subjects for research are ore dressing, hydrometallurgy, and metallography. The course gives the student valuable practical experience in metallurgical work. At present, the American Cyanamid Co. is supplying flotation reagents. Included with these is the new wetting reagent. This reagent will increase the wetting ability of water, when added to it in small quantities, to such an extent that even a duck will sink in the mixture.

Pittsburgh Coal Company

is establishing a training course for students as well as graduates. In recent years they have undertaken aggressive programs of plant modernization, mechanization of underground operations and development of modern and underground methods which have accentuated the need for technical graduates in the coal industry. The primary objective in employing young engineers is to develop operating men, principally foremen and superintendents.

Graduate men will work for several months as underground laborers, under this training program. Later they will be trained in supervision methods, operating and mining technique, maintenance and use of mechanical equipment, cost control and analysis of operating problems. These men will also be given opportunity, through class room work, to train themselves to pass the State examination for foreman's papers. Upon completion of the program, men will be assigned to semi-permanent jobs pending the time they receive their foreman's certificates, after which they will be placed in positions for which they are qualified.

Undergraduate men, preferably men who have completed their freshman year, will be given underground work during their first summer vacation. If they wish to work for the company during their other vacations with the objective of joining the company upon graduation, they will move along to other jobs as planned for graduates.

Pittsburgh Coal Company's training course is designed to cover a period of 119 weeks and is divided into eight principal groups, which are as follows:

Introduction—1 week.
Underground Mining Operations—27 weeks.
Coal Preparation—24 weeks.
Inspection and Mechanical Maintenance —31 weeks.
Engineering—16 weeks.
Industrial Relations—12 weeks.
Operating Analysis—8 weeks.
Foreman's Training—

Undergraduates will normally complete the training course thru Section 2 during their summer vacations. The balance of the course will be completed following graduation, provided their work has been satisfactory.

Three freshmen and their alternates have been selected by Dean Morgan and Professor J. Burns Read who will begin their training course with the Pittsburgh company at the close of Plane Surveying next July. In addition to these undergraduate men, two seniors, Logan Caldwell of Wheatridge, Colo., and Donald Dowlin of Westchester, Pa., are to enter the training course upon their graduation in May.

The Geology Department

has secured thirty airplane photographs of the Lyons region from the U. S. Forest service. These photographs will be made into an airplane mosaic for the junior field trip.

These photographs are part of those taken in the nation wide survey by the Forest Service. When the survey is finished the government will be able to construct a mosaic of the entire nation. At the present time the survey of Colorado is almost completed.

When the mosaic of the Lyons region is completed the geology department plans to make several photographs of it, and mount them on stiff cardboard. The junior geology students will use them for orientation purposes when they get to the Lyons region.

Robert K. Johnston

graduating senior in Petroleum refining, has been awarded the Junior membership in the American Chemical Society by Professor Baxter for meritorious work in chemistry.

The prize which Professor Baxter awards each year is based on the quality and quantity of work a student has done at the institution as indicated by the total of quality points earned in the subject of chemistry.

The work of Mr. Johnston has been unusual in that he has had a straight "H" record in Chemistry except for two courses in which he received "A" grades.

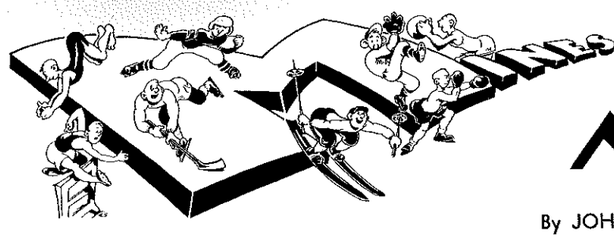
Head of Tau Beta Pi,

Mr. C. H. Spencer, was a guest on *Mines'* campus last month. He was entertained by a dinner-meeting with the *Mines'* chapter and faculty members at the A.T.O. house. At that time he gave an address upon campus matters and other topics pertinent to the organization as a whole.

Harry Chinn, '30,

has been appointed as assistant in the Chemistry department as announced by Dr. Ward recently.

Mr. Chinn's duties will consist of some laboratory supervision and instruction and taking care of the stock room. His main work in the stock room will be in preparing solutions and reagents for laboratory use by the students. Between the time of his graduation from *Mines* as a Petroleum Engineer and his return to Golden, he had charge of an analytical laboratory of the Shell Petroleum Corporation which experience will be of value to him in this work.



Sports MARCH

By JOHN A. BAILEY

With over three hundred students working in minor sports during the year, intramurals, fencing, and golf teams held a renewed interest. The greater number of these students took part in the intramural athletic program.

The Sigma Alpha Epsilon fraternity took the crown in three of the intramural sports. They won in basketball, boxing, and wrestling. The ATOs won titles in touch football and in the intramural rifle matches. The Kappa Sigs won in swimming and the Sigma Nus grabbed winter sports honors and the cross country race. It was a barren year for the Barbs, who were unable to garner a victory but had to be satisfied with second and third places in intramural sports. Despite a forelorn lack of first the Barbs have managed to keep up in the middle of the team ratings bracket by means of those place wins. The results of the final three sports, softball, track, and volleyball are not in yet, so that it's still almost any one's year so far as total points go.

The ATOs have piled up a thirty point majority over the Sig Alphs by winning a large number of second and third place wins. The Kappa Sigs in third place and the Barbs in fourth place still are in the running for top honors, but they must come through in the final sports to climb into the top position.

The Sig Alphs made striking victories in wrestling and boxing. They were fifty points ahead in the two sports over the second place ATOs. Tillotson, S.A.E. 115 pounder, beat his room mate, Scott, for the title at that weight, and Scott entered in the wrestling bouts to win first place for the SAEs in the 115 pound class. Burwell, another SAE, scored a technical knockout over Art Heiser in the 125 pound match. Clint Edwards, a football luminary, made a clean sweep in both the heavyweight boxing and wrestling titles for the ATOs.

The boxing and wrestling champs for the 1939-40 season are as follows:

Boxing
115-lb., Tillotson, S.A.E.
125-lb., Burwell, S.A.E.
135-lb., Dunn, K.S.
145-lb., Wood, A.T.O.
155-lb., Fusselman, Beta
165-lb., Lauver, Barb
175-lb., Creager, Stray Greek
Heavyweight, Edwards, A.T.O.

Wrestling
115-lb., Scott, S.A.E.
125-lb., Mariacher, Sigma Nu
135-lb., Milyard, K.S.
145-lb., Aubrey, K.S.
155-lb., Deneke, S.A.E.
165-lb., Maxwell, S.A.E.
Heavyweight, Edwards, A.T.O.

The Kappa Sigs presented a formidable group of swimmers to place in every event of the intramural swimming meet. They placed first in the medley relay and second in the 6 length breast stroke and in the Six-man relay. Their strength was in having a well balanced team that was able to pick up points in the entire meet, and they were particularly strong in the team events. The Sig Alphs placed second and the Sig Eps in third place.

Due to the fact that they entered a large number of skiers with some ability, the Sigma Nu's easily won the intramural ski meet. Out-pointing all other teams in the field, the Sigma Nus won first place scoring in every event.

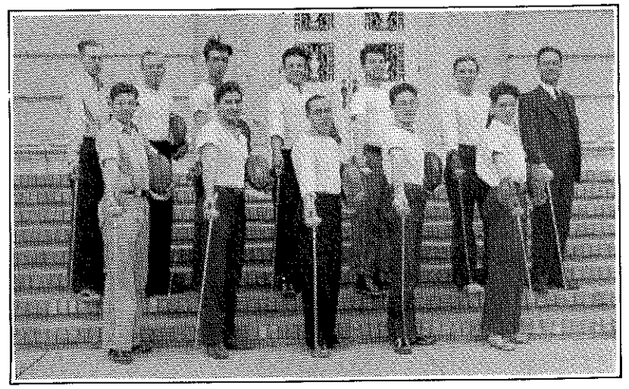
In many instances the intramural teams seemed very, very good when they were good, and very bad when they were bad. The fraternities seemed to shoot for a particular sport and bend every effort to win that particular sport and often to neglect building teams in others of the intramural sports.

Fencing

To add to the school's sports laurels for the year, Professor Oliver brought his fencing team through an undefeated season, and the team completed its fine record this month with the title of state fencing champions. With only one man, Julian Pawley, graduating this year, it seems to indicate that the Mines fencing team may repeat next year, if the new men in the novice class this year can continue to improve and a new crop of likely novices reports out for the team.

Professor Oliver has been building a stronger team year by year, and the fine team this year is the result of good coaching and unusual material together with consistent practice. The fencing team is not entirely in intercollegiate competition, but all of the teams in the state are organized into a league play for the championship.

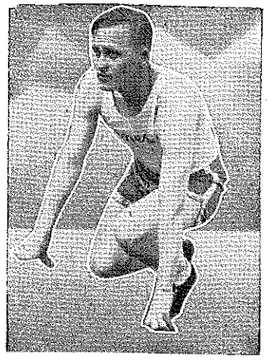
John Gableman cinched the state fencing team championship for Mines by winning the individual championships in both advanced and foil and sabre. Mataya won second in the foil



▼ The team from left to right, top to bottom: Wallace Shirley, Roger Patrick, Joe Woerner, John Wolfe, John Bernstein, Gale Crampton, Coach Oliver, Jack Mataya, Jim Athan, Lowell Shefelbine, Frank Adler, and John Gabelman.

and Crampton second in the sabre. The only other two events in the state tournament were also won by Mines, April 20, when Mataya won first in the epee and Pawley third. John Wolfe and Shefelbine turned in fine records for the season in the novice class. Wolfe won first in the novice foil match at the state meet and Shefelbine took third. The final scores were: Mines 69; East High 25; Boulder 17; and Greeley 14.

Major Spring Sports



LLOYD MADDEN

The track team under its new coach, Adam Esslinger, will complete its season this month with a record of fair success. The team has two more meets this month and will probably win a first or two and place several men, but if events cast shadows, they will be hindered in these meets by the yearly bugaboo to Mines track squads, and that is the lack of enough track athletes to make a well balanced team. The team has several men who win consistently, but it needs more athletes to pick up those second and third places necessary to win meets.

The team has one meet to its credit, a neat 67-30 win over Denver University. The school track men won all but one first place, and that first was won by Jurich in the shot put. Lloyd Madden won the 60 yard dash in 8.3 seconds. Madden's celebrated speed has made him a consistent first and second place man throughout the season. In the C. U. relays, he lost a heart-breaker to Learned of C. U., when he finished the 100 yard dash one step behind the C. U. man.

The only other place gained in the Colorado relays by the school team was a fourth in the 440 yard relay; C. U. won the event and Kansas State and D. U. placed second and third, respectively.

The team was defeated by Greeley in a relatively close game by a 63-49 point score held in the Mines field house. Mines was badly handicapped by an epidemic of leg injuries. Joe Berta, a point winner in the pole vault, was on the sidelines; Hueckel, winner of the broad jump in the D. U. meet, pulled a muscle in his leg on the first jump, but his one jump gave him a third; and three other men, Strasser, a distance runner, Moore, a hurdler, and Hensala, a high jumper, were all on the side lines with leg injuries of one sort or another.

Most of the trackmen on the team this year are underclassmen and should return next year with more experience and ability to threaten Big Seven teams in track supremacy.

Baseball

The baseball team has suffered all season from poor batting and too many errors in the field. To date the team has scored one win. They were out on the long end of a 17-16 point game with Regis college of Denver. The game was far from what could be termed a pitcher's battle, as both teams hit freely throughout. Three big innings gave the Orediggers their victory as Regis out-hit the Blasters 22 safeties to 20. The Miners batted three Regis pitchers out of the box while Moss and Roberts tried for control of the slab for the Orediggers. Dolega, English, Taylor, Flynn, and Hancock went on a batting spree to stay with a set of Regis sluggers.

In other games the scores were as follows: Greeley won two games over the school by 10-5 and 8-5 point scores. D. U. won two games by identical scores of 10-5. C. U. 4—Mines 0.

Local Sections—

(Continued from page 271)

John R. Evans, '23, President; D. H. Peaker, '32, Secy.-Treas., c/o The Carter Oil Co., Tulsa, Okla. Meetings upon call of secretary.

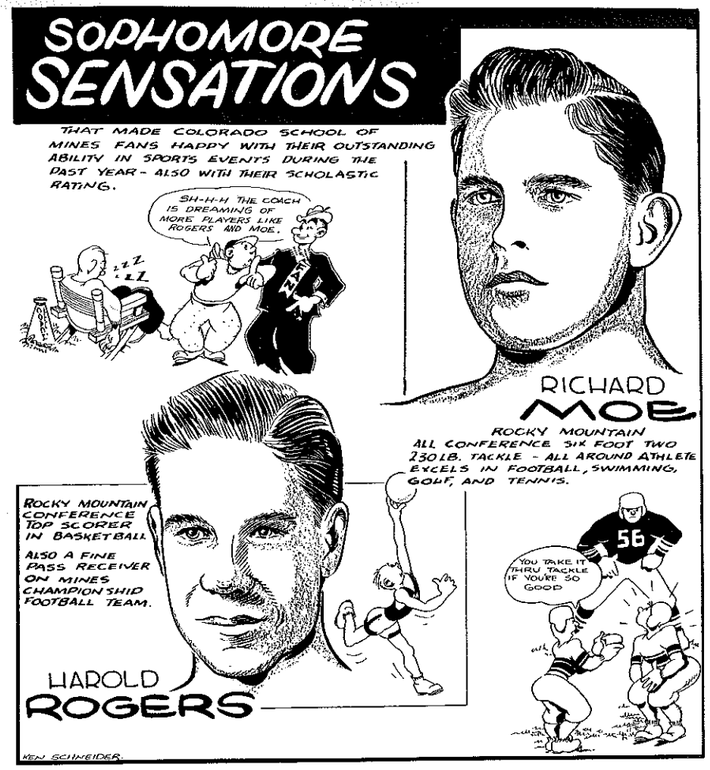
Bartlesville

Mines Men in Bartlesville, Oklahoma, have been holding monthly luncheon meetings recently. One of these days they will be sending in request for Charter and organizing their own chapter which will be a loss to the Tulsa group.

Those who have been in attendance are: A. J. Hintze, '31; N. E. Maxwell, '17; J. W. Baldwin, '21; O. L. Schmitt, '35; T. F. Kenney, '35; W. H. Courtier, '28; A. F. Beck, '25; R. H. Clarke, '17.

Thomas H. Allan, '18, President; John T. Paddleford, '33, Secretary-Treasurer, 429 First National Bank Building, Wichita, Kansas. Meetings upon call of secretary.

Moe and Rogers



Richard Moe and Harold Rogers excited considerable comment from the Colorado School of Mines fans during the past year because of their ability in sports events. When two men display such outstanding ability in their sophomore year the coach is encouraged to plan for the future. Moe and Rogers are the kind of men a coach longs to see on his team. Both men came to Mines with the background and practical experience so necessary in any engineering school and especially a school with the rating of Mines.

It was only natural that Moe should follow in the profession chosen by his family. His grandfather has been a mining man for many years, his uncle, Philip Cox, is a mining engineer with the Bradley interests on the West Coast, and his stepfather, J. E. Hare, is known in the petroleum industry and was formerly interested in the California Petroleum Company.

After he graduated from the Los Angeles High School, Moe attended Black-Foxe Preparatory and then Southern California University for a year. While at S. C. he began playing tackle under Coach Howard Jones. He came to Mines in 1938 and took his place on the football team as a tackle. The part he played in making Mines' 1939 football team champions is well known to followers of the team everywhere. He was selected as tackle on the first team of the Rocky Mountain Conference at the close of the season.

Moe's versatility is the envy of his colleagues. Six foot two and weighing two hundred thirty, he has every characteristic of a leader. An ace swimmer, Moe can also turn in a record game at golf and tennis. On more social occasions he can play bridge or a piano with the finish of an expert. It goes without saying that he is a popular man with the women, but this fact does not bother Moe too seriously at the present time.

Harold Rogers gained much of his ability and experience in the U. S. Navy. He was a member of the aviation unit attached to the U. S. Chicago for four years after he graduated from high school in Jonesboro, Arkansas, in 1934. During this time he received five advances in rating and for the last two years served as petty officer of the aviation unit. He came to Mines in the summer of 1938 and since that time has been busy building up records for himself at the School.

The amazing thing about Rogers is that he can back up every statement he makes of his ability by actual proof. He had never played football before coming to Mines yet displayed the natural ability of an expert. His pass catching proved one of the high spots of the season. At basketball his outstanding work earned for him a place on the first team of the Rocky Mountain Conference and the position of top scorer. Spring football practice has prevented Rogers from entering track competition, but here again he can excel.

Rogers has that pleasing personality so characteristic of the southern states. He has many friends among the faculty members and students at Mines. He is working for a degree in petroleum engineering and in all probability will do well in this field. He says he will and who can doubt his word?

These two men are typical of the kind of athletes you find at Mines. No snap courses are offered for athletes and the football player, basketball player, or track man carries a heavier load than the rest of the school. The fact that the latest figures from the office of the Dean showed the football players having an average higher than that of the entire student body is proof of their quality.

Summer School

Summer study in a vacation land has been the emphasis in the literature announcing the Colorado School of Mines summer session. Dean Jesse R. Morgan, director of the summer session, has announced that courses will be given during a seven-weeks period beginning July 15 and ending August 31.

Courses of collegiate grade in chemistry, civil engineering, descriptive geometry and engineering drawing, English, geology, mathematics, metallurgy, and physics are to be offered. In addition work in mathematics, chemistry, and physics to make up deficiencies in entrance requirements is to be given. Field courses will also be offered in plane surveying and mine surveying from July 29 to September 7.

Dean Morgan, who has been director of the summer session since 1926, says that indications are that next summer's enrollment will exceed last year's. The 1939 registration exceeded all previous enrollments and justified the description of the summer school at the Colorado School of Mines as "the world's largest engineering summer school".

Carlton Tunnel—

(Continued from page 251)

Average Costs per Foot thru February, 1940 on First 10,264 Feet

	Average Cost per ft. on 10,264 ft.
All Labor (Except Bonus)	$11.913
Bonus Paid	1.820
Power	1.511
Drill Steel	.991
Detachable Bits	.865
Pipe (Ventilation, Air, Water)	1.811
Track & Track Supplies	.884
Powder & Caps	3.873
Drill Machine Maintenance	.503
Mucking Machine Maintenance	.363
Taxes	1.980
Depreciation (based on 25,000 feet)	4.165

Wage Scale

	Per 8 Hour Shift
Machine Men	$6.00
Helpers	5.00
Motormen	5.00
Nippers	5.00
Track Men	4.75
Mucking Machine Operators	7.50
Outside Labor	4.50

Shift bosses, machine men, helpers, nippers and muck operators share in bonus, according to the rate of pay. Bonus amounts to $4.00 per foot on every foot made over 900 feet per month.

The progress made on the tunnel to date is due to the following:

Excellent mechanized equipment, with spares for any piece that is apt to break down. The longest delay from equipment failure has been about twenty minutes.

The organization built up by the tunnel superintendent, John Austin, whose many years of experience in driving tunnels, is responsible for a well organized, satisfied and smooth working crew of men.

The system for handling track, air, water and ventilation lines, with absolutely no lost time in the heading.

The bonus system is building up the morale of the individual men and creating a spirit of rivalry between the different heading crews. The more footage made the more pay.

IN MEMORIAM

George H. Heitz

As he does eventually to every man, so came the Grim Reaper to George Henry Heitz on February 29, 1940. He was taken ill last November, hospitalized, but returned to his home for Christmas, apparently on the road to recovery. A relapse occurred, followed by a major operation and—the end.

George was born and reared in Denver where he graduated from high school. He then entered the Colorado School of Mines from which he received degree of Engineer of Mines in 1906.

His first position was with F. J. McNair of Leadville, Colorado, with whom he worked as draftsman and surveyor and later entered into partnership with him. In 1911 he returned to Denver where he assisted his father for several years and then went back to Leadville as land and mineral surveyor for Mr. McNair and later became associated with Platt and Kleff.

In 1920 he accepted a position with the Amalgamated Oil Company, now the Tide Water Associated Oil Company. He started as draftsman, then was promoted to resident engineer at Huntington Beach and later was made construction engineer which position he held at the time of his death.

Mr. Heitz was married at Durango, Colorado in 1914 to Miss Winogene Nelson who survives him. Three children also survive, Robert, Lillian and Charlotte.

Obsequies under Masonic auspices were held at Forest Lawn Park on March 2.

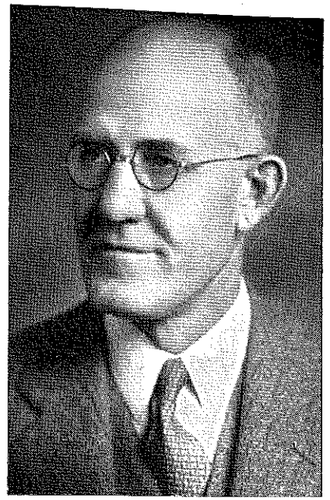
Those of us who knew him at school and who more recently met him at our local section meetings will always remember George as a quiet, unassuming man whose modesty could neither obscure his sterling character and ability nor allow his generosity to be broadcast.

Franklin P. Lannon, Jr.

Mines Men everywhere will be saddened to hear of the death of Franklin P. Lannon, Jr., '07, of an incurable throat ailment, at Long Beach, California, on April 18, 1940. He was born June 15, 1883 at Evanston, Wyoming, and graduated from Centennial High School, Pueblo, Colorado, in 1902.

Franklin or "Spike," as he was known to his classmates, graduated from Mines in 1907 with the degree of Metallurgical Engineer. For four years he was a star halfback on the Mines Varsity. He was a member of Beta Theta Pi, social fraternity, and Tau Beta Pi, honorary fraternity.

Mr. Lannon went to Leadville as mill superintendent for a subsidiary company of the A. S. & R. after graduation and was transferred to their Blende Smelter at Pueblo in 1909, where he remained for five years. He then moved to Sand Springs, Oklahoma, and, at the time he resigned from the company in 1930 was general manager of all the zinc



FRANKLIN P. LANNON, JR.

smelters of A. S. & R. in the United States and Canada.

In 1930 Mr. Lannon became president of the Pacific Smelting Co., Inc. at Torrance, California, which position he held until his death.

Services were held April 22nd at Mottell's Chapel, at Long Beach, and interment was at Pueblo, Colorado. He is survived by his wife, daughter, Frances Lang of Portland, Oregon, his mother, four sisters and three brothers.

In the passing of "Spike" Lannon, the Alumni Association loses a loyal and trusted member. For three years he was vice-president of the Southern California Section. His loyalty to *Mines* was shown by his unpublicised and unwavering support of every activity in which the Association is engaged.

"Spike" was as popular with the alumni group as he was with his classmates, and the number of his *Mines* friends who paid their last respects at his memorial service was a mute testimony of their regard and affection for a real "Miner."

Mrs. Henry Harris

Mrs. Faye Cox Harris, wife of Henry Harris, '39, was killed instantly April 29 in an automobile accident at Baguio, Philippine Islands.

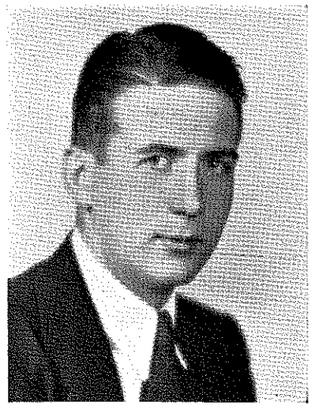
Following their marriage in 1938 Mr. and Mrs. Harris resided in Golden until his graduation last May when they left for the Philippines where he is mining engineer for the Big Wedge mine.

Mrs. Harris is survived by her husband, her parents, Mr. and Mrs. John H. Cox, Jr. of Denver, and twin children, a son and a daughter born February 2, 1940.

John M. Spitler

A short illness of flu which developed into pneumonia caused the death of Jack Spitler on April 23, 1940.

Since his graduation from *Mines* in 1937 he had been associated with the American Steel & Wire Company in Cleveland, Ohio, the past year holding the position of product metallurgist.



JOHN M. SPITLER

Jack was born and reared in Denver and was married in January 1939 to Miss Marion Woodward of Idaho Springs.

He was prominent in campus activities while at *Mines*. He was on the staff of the Oredigger for four years and during his senior year was business manager. The same year he was president of Blue Key and vice-president of the student council. His social fraternity was Sigma Phi Epsilon and he was a member of Sigma Gamma Epsilon, social fraternity.

Besides his wife, he is survived by his mother, Mrs. Mabel Spitler of Denver, and a grandmother.

Interment was in Mount Olivet cemetery in Denver.

Mines 1940 Class a Record Breaker

Dean Jesse R. Morgan, of the Colorado School of Mines, has recommended to the faculty one hundred forty-four men, the largest senior class in the history of the school, to receive degrees in engineering in the minerals industry this year. Included in the number are forty-two from Denver and seventy-five from Colorado.

The degree Engineer of Mines will be granted to forty-four; the degree Metallurgical Engineer to thirty-three; Geological Engineer to thirty-nine; and Petroleum Engineer to twenty-eight. In addition, seven advanced degrees will be granted: three doctor of engineering in geophysics; two master of mining engineering; and two master of metallurgical engineering.

"This year's senior class is not only the largest in the history of the Colorado School of Mines, but it also exceeds last year's, the largest previous, by nearly fifteen percent," said Dean Morgan who has seen sixteen senior classes graduate at the School of Mines.

In 1924 when Dean Morgan witnessed the first commencement at the School of Mines, after his joining the faculty, sixty-nine were granted degrees. The number has grown steadily and the present senior class is more than double that number.

"Indications now are that this year's graduates will be as successful as last year's in securing employment," Dean Morgan declared. Last year the Colorado School of Mines was the only college or university in America that scored one hundred percent in a survey conducted by a New York newspaper to determine the percentage of graduates obtaining positions in the fields for which they had prepared themselves.

Mines Museum Notes

During April slight progress was made on the museum collections. The following gifts were received:

1 spectacular Devonian trilobite from M. M. Aycardo, '42.

Several specimens of algal limestone, J. Monahan, '39.

Sediments and fossils, Wm. Strain, '38.

70 Cretaceous, Pennsylvanian and Mississippian fossils from J. M. Clauser of St. Louis.

56 Mississippian fossils from Dr. Courtney Werner of George Washington University of St. Louis.

A check from B. Golson of Los Angeles, California to assist Dr. Johnson in collecting needed material.

The museum needs many things. Any donations of minerals or fossils will be very welcome. Fossils of Cambrian, Triassic, Jurassic, or Miocene age are especially needed.

For growth the museum will have to depend on alumni and friends, as the School does not have funds for the purpose. Needed materials can be obtained by collecting, by purchase, and as gifts. The curator, Dr. J. Harlan Johnson, will gratefully receive any gifts of cash (one dollar to a hundred) or specimens. The cash will be used to collect and purchase specimens. All specimens so obtained will be credited to the donors on the specimen labels.

Recovery of Nickel—

(Continued from page 256)

3. Without applying an oxygen-air mixture and electrothermal energy, as used on the experimental electric converter, the production of white metal on such small quantities of molten matte would have been impossible. Additional electric converter work is anticipated and depends only on the availability of enough raw material (ore) to produce 1,000-pound molten white-metal baths.

(To be continued)

PERSONAL NOTES

(Continued from page 241)

Bit Company "drops in" on them occasionally.

Frank M. Stephens, '13, has been transferred by the A. S. & R. Company from Newfoundland to Tucson, Arizona, where he is serving as field engineer. His address there is 813 Valley Bank Building.

O. W. Swainson, '10, is assistant chief, Division of Terrestrial Magnetism and Seismology, U. S. Coast & Geodetic Survey, Washington, D. C.

L. S. Taylor, '26, who planned on returning to the States this summer has decided to remain as metallurgist for the North Camarines Gold Mining Company. His address is in care of the company at Paracale, Cam. No., P. I.

Charles H. Thurber, '39, has been promoted to junior observer for Stanolind Oil and Gas Company, Seismic crew, and is now residing in Stratford, Texas, where he receives mail in care of the company. He sends his best regards to "Miners everywhere."

William H. Volz, '39, is employed by the Phillips Petroleum Company and receives mail thru Box 801, Station A, New Orleans, La.

Robert M. Wheeler, '39, who is employed by the Bethlehem Steel Company, resides at 524 Spruce Street, Lebanon, Penna.

Edwin F. White, '36, resigned his position recently with Sullivan Machinery Company to become sales manager for Denver Machine Shop of 1409 Blake Street, Denver.

W. H. Zwick, '32, has a change of address to Morococha, Peru, as general mine foreman for Cerro de Pasco Copper Corporation.

Steve S. Dettman, '31, has recently changed his position from Chemist at Weimar Sanitarium, Weimar, California, to Mining Engineer, P. O. Box 792, Auburn, California.

G. G. Gallagher, '32, can now be reached at P. O. Box 500, Sutter Creek, Calif.

E. R. Richards, '05, now resides at 1028 Merced St., Berkeley, Calif.

R. Y. Karubian, '38, now resides at Tiheran, Iran, c/o Dr. Karubian.

F. A. Blankenberg, '34, seems to have "vanished" from earthly peoples; some fun, eh? *P. W. Cunningham,* '29, must be somewhere, but who knows? We hope Pete is O.K. anyhow!

Frederick L. Weigand, '39, accompanied by Mrs. Weigand, has moved to Lance Creek, Wyoming, where he is associated with the Minnelusa Oil Corporation. He writes that living conditions are not so good at the field at the present time because of the over-crowded populace.

L. E. Wichmann, '21, was recently moved to McPherson, Kansas as District Production Superintendent for Shell Oil Company. His post office address there is Box 143.

Frank J. Wiebelt, '16, Road Engineer for the Department of the Interior, U. S. Bureau of Mines, has been transferred to Port Angeles, Washington.

A. H. Wieder, '34, is now in Wichita Falls, Texas, as Senior District Engineer

of the North Texas area for the Shell Oil Company, Inc. His mailing address is 2129 Avenue H.

E. R. Wilfley, '14, is President of A. R. Wilfley & Sons, Inc., of Denver, manufacturers of the Wilfley Pump.

James C. Wilkerson, '31, has moved from Houston, Texas, to Alhambra, California, where he is being addressed at 829 No. Olive Ave. He is Sales Engineer for the Wilson Supply Company.

Ross Wilson, '31, Special Field Representative for the Atlas Powder Company with headquarters in Salt Lake City, was a Denver visitor the middle of last month.

Rolland H. Woods, '24, Land Man for the Louisiana Land & Exploration Company, resides at 2009 Shell Beach Drive, Lake Charles, La.

L. K. Worth, '17, became associated with the Midwest Refining Company immediately upon his graduation from *Mines,* doing work in the Salt Creek district until he was transferred to Wichita Falls, Texas, and placed in charge of production in that area. When the Stanolind Oil and Gas Company was organized, he was moved to Tulsa and made Assistant to the General Superintendent in charge of production which position he now holds.

Charles Nines, '38, is another Miner who has completed foreign contract and returned to the States. He is being addressed at his home, 1027 Bonnie Brae, Casper, Wyoming.

Vernon M. Peck, '23, Sales Engineer for Worthington Company, Inc., receives mail thru Box 312, Phoenix, Arizona.

John A. Poulin, '21, is Geologist for The Texas Company (Venezuela) Ltd., Apartado 267, Caracas, Venezuela.

(Continued on following page)

WEDDINGS

Hyder-Gibbs

Frederick B. Hyder, '03 and Mrs. Emma W. Gibbs of Omaha, Nebraska, were married at Las Vegas, Nevada on April 24th.

The couple are now at home at 909 Kemp Street, Burbank, California where Mr. Hyder is Consulting Mining and Metallurgical Engineer.

BIRTHS

Mr. and Mrs. B. W. Samz, '39 welcomed a young son into their home on March 17, 1940, whom they have named Fred Leland. His weight was 7 pounds, 12½ ounces. The family reside at 836 Sherman Street, Denver.

Mr. and Mrs. Phil Garrison announce the birth of a daughter at St. Anthony's Hospital, Denver, on April 27. The name chosen for the newcomer is Margaret Patricia.

Mr. Garrison, of the class of '39, is associated with Stanolind Oil and Gas Company and at present is located at Morgan City, La.

Max Scheble, Jr., '30, was in Denver the early part of this month to welcome a young son, Philip Carl, who arrived at St. Luke's Hospital on May 1st, tipping the scales at 7 pounds.

Mrs. Scheble, the former Winifred Dillon of Denver, and son will join Mr. Scheble in Columbia, Utah, later, where he is engineer for the Columbia Steel Company.

PERSONAL NOTES

(Continued from preceding page)

Donald D. Riddle, '18, Special Representative for the Diebold Safe & Lock Company, resides at 609 E. Central Ave., Orlando, Fla.

Eugene E. Ruley, Ex-'34, who is associated with the American Viscose Company, has a change of address to Box 532, Nitro, West Va.

K. C. Stansmore, '29, Metallurgical Engineer for the Dorr-Oliver Co., Ltd., returned to London recently after visiting the gold mines on the Gold Coast, West Africa.

Robert L. Thomas, '38, Engineer for the Magnolia Petroleum Company resides at 624 Bourbon Street, New Orleans, La.

New Equipment—

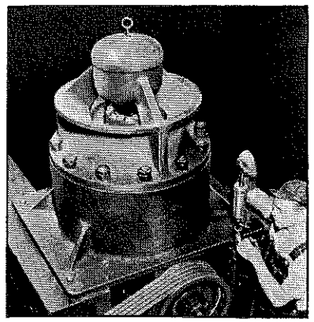
(Continued from page 266)

efficiency. To facilitate handling, the engines and pumps are mounted on a base and are available in many combinations to meet various requirements in quantity and pressure up to 5000 gallons per minute and 100 foot head.

A folder (Form MS 253) describing these engine and pump units may be obtained from the Tractor Division, Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.

New A-C Type "R" Reduction Crusher

Allis-Chalmers Mfg. Company, Milwaukee, Wisconsin, have announced their new type "R" all steel reduction crusher. Although working on the gyratory principle, it operates at higher speed than ever used before. This new crusher is of simple construction, the spider and top shell being cast integral, and readily removable for replacing of its manganese steel concave ring. Adjustment for taking up wear on this liner and on the special manganese steel mantle is easily accomplished by means of a simple oil filled hydraulic jack, located in the bottom plate of the



crusher and which supports the main shaft. This jack arrangement also provides product size adjustment and under normal operation firmly holds the head and shaft in position for maintaining a uniform product. A safety valve feature permits automatic adjustment for tramp iron. The drive is by means of high speed cut steel gears located in bottom shell and operated in bath of oil, cooled in an external cooling tank. Counter shaft is driven by flat belt or Texropes from electric motor or engine. New type dust seals keeps working parts clean and reduces wear. Bottom plate is of open type to prevent obstruction of crushed material. The unit is more completely described in brand new bulletin B-6006.

New Books

THIS FASCINATING OIL BUSINESS

By MAX W. BALL, '06

Reviewed by William S. Levings, '20

While describing "This Fascinating Oil Business" the author acts as a genial guide to the general reader on an exploratory trip through the far-flung and intensely interesting domain of the petroleum industry. At the outset, the explorer is introduced to "many men of many functions" of the oil industry and begins to learn to speak their language. The itinerary of the trip through the provinces of exploration, production, transporation, refining and marketing is indicated by the following incomplete list of chapter headings: Picking the Place to Drill; Acquiring the Right to Drill; Drilling the Well; Producing the Oil; Transporting the Oil; Refining the Oil; Disposing of the Products.

In the chapters treating of the geology of petroleum, the author leads the reader in delightfully easy stages to a clear realization of the rock, fluid and energy factors that constitute the geologic framework of an oil pool. The evolution of the technique of oil-finding including the field application of nearly all geophysical methods in current use is made clear.

The section on "Drilling the Well" should provide the general reader with a very clear picture of the detailed sequence of operations involved in the drilling of an oil well by the cable-tool and rotary methods. Coring, electric logging, the use of special muds are among the topics that are briefly but adequately described.

MAX W. BALL

In dealing with the mechanics of production and the general principles thereby involved, the author paints a vivid detailed picture of the movement of the oil and gas from the bottom of the well bore to the lease tanks and gas separators. The fact that the oil industry is set apart from other industries mainly by reason of the unique competitive necessity to produce its raw material is brought out by a discussion of the evils of the Law of Capture. The author outlines the principle of proration and comments briefly on its strong and weak points. The reviewer feels that the material relating to unitization could well have been expanded to include a description of the manner in which a unit plan is finally consummated. Maintenance of pressure, and secondary recovery methods including repressuring, gas, water and air drive and the mining of oil sands are shown to be indicative of the relatively new trend toward the conservation of a vital, irreplaceable natural resource.

Among the topics discussed under the heading "Transporting the Oil" are the gathering system, gathering and gauging, tankage, oil in storage, the pump stations, surveying and clearing, stringing the pipe, laying the line, testing the line, heaters, loading racks operation and maintenance and many others. In this chapter the author displays his capacity for attention to detail which is noteworthy elsewhere throughout the book.

Three chapters are devoted to the refining of crude oil and its products. In reviewing the chemistry and physics of refining, the author discusses the chemical makeup of crude oil, contrasts "straight-run" products with those obtained by cracking, "liquid-phase" and "vapor-phase" cracking, catalytic cracking, polymerization, and points out the enormous potentialities of hydrogenation. A section on the specifications and design of a refinery discusses the many factors that must be considered in such design. Another chapter is devoted to a description of the principal refinery units and concludes with a sketch of refining methods applicable to paraffin-base and asphalt-base crudes.

The chapter on marketing indicates the many ramifications of the distribution end of the industry and will enable the reader to appreciate the interplay of forces which determines the price he pays for gasoline at the filling station.

In addition to the topics treated under the headings listed above, the chapter on "New Worlds to Conquer" dealing with petroleum research in all its phases supplies interesting and stimulating reading. It leaves the reader with a feeling that many important discoveries are yet to come.

In view of current hostilities in Europe, the last chapter entitled "Oil and War" makes interesting reading. The oil needs and oil supplies of the belligerents are closely scrutinized and some interesting conclusions reached.

Errata in the book with one exception are represented by half a dozen misspelled words. To wit, the word "characteristics", p. 24, line 16; the word "advertise", p. 64, line 15; the word "yeoman", p. 71, line 14; the name "Eotovos", p. 72, line 5; the word "production", p. 205, line 10 from the bottom; the word "conquest", p. 208, line. 18. The illustration "A Closed Dome" on p. 58 is inverted.

The style reflects the personality of the author in being clear, direct, humorous and hence entertaining. The book is well illustrated and has a good index. The reviewer's impression on completing the book is that it represents a mine of accurate, interesting information evidently representing the fruition of a long term of unusually varied experience. The reviewer unqualifiedly recommends it to the attention of all those who are interested in obtaining a balanced picture of a great industry as a whole.

(The Bobbs-Merrill Company, New York, 1940.) 444 pages, 38 illustrations, 10 maps. Price, clothbound $2.50.

Internal Constitution of the Earth (Physics of the Earth—VII). Edited by B. Gutenberg. New York and London, McGraw-Hill Book Co., 1939. 413 pp., illus., diagrs., charts, tables, 10x7 in., cloth, $5.00.

This book is the seventh of a series of monographs upon the physics of the earth which is being prepared under the direction of various committees of the National Research Council. In the present volume, prepared by nine well-known geologists and geophysicists, the features of the interior of the earth are reviewed, including the origin of the solar system, the elastic properties of rocks and materials of the earth's crust, temperatures in the earth's crust, deep-focus earthquakes, density, gravity, pressure within the earth, etc.

Notes on Valuation of Oil and Gas Properties. By the Corpus Christi Geologists' Study Group, of whom L. W. Storm is the leader, have made available in mimeographed form bound in heavy paper a set of notes in which every petroleum geologist will find much of value. A limited number of copies are for distribution at actual cost of $1.00 per copy.

These notes comprise 47 pages, letter size plus a bibliography of 11 pages and represents an assemblage of data and information made available by the study group, revised and made up in a usuable form for members of the group without any idea of further distribution.

Properties are considered under three groups: Developed Properties; Properties Partly Developed or Practically Certain to be Productive at Least in Part; and Prospects, Interests in Development Blocks, Protection Leases, Spreads, Trend Plays, etc. Under each classification, problems are presented with all necessary data and information, different methods of attacking each problem are discussed and calculations carried through and a final analysis made of the results.

Science in Progress. With a Foreword by Harlow Shapley. Edited by George A. Baitsell, New Haven, Yale University Press, $4.00.

This clearly written and profusely illustrated series of National Sigma Xi lectures is a significant contribution to a panoramic view of science. It is virtually a report of progress in various fields of scientific research covering such diverse subjects as the breaking down of atoms, the functions of chromosomes, vitamins, hormones, and internal secretions, the measuring of animal metabolism, and the electric potentials of the human brain. The work of an eminent group of authors is assembled here, and is representative of the vast amount of scientific research now being carried on.

Two new numbers of the Colorado School of Mines Quarterly are now available for distribution according to an announcement by H. M. Crain, director of publications. These are number 3 and number 4 of volume XXXIV.

Number 3 is a paper by Dr. W. A. Waldschmidt, associate professor of geology, entitled "Table Mountain Lavas and Associated Igneous Rocks near Golden, Colorado". The author is especially competent to discuss the subject having done a great deal of specialized geologic work in that area. The Quarterly comprises 62 pages and includes 16 pages of reproductions of photographs and maps. Included is also a large map of the area reproduced in eight colors.

Number 4 is a thesis by J. Ross Reed, Jr. Its subject is "A Preliminary Study of Basic Open-Hearth Slag Characteristics and the Correlation Between Them and the Corresponding Baths". This number will have 21 pages of photographic plates, 19 of which include 57 reproductions of photomicrographs of thin sections of slag samples.

Both of these Quarterlies are available through the publication department at a price of fifty cents for each of the numbers.

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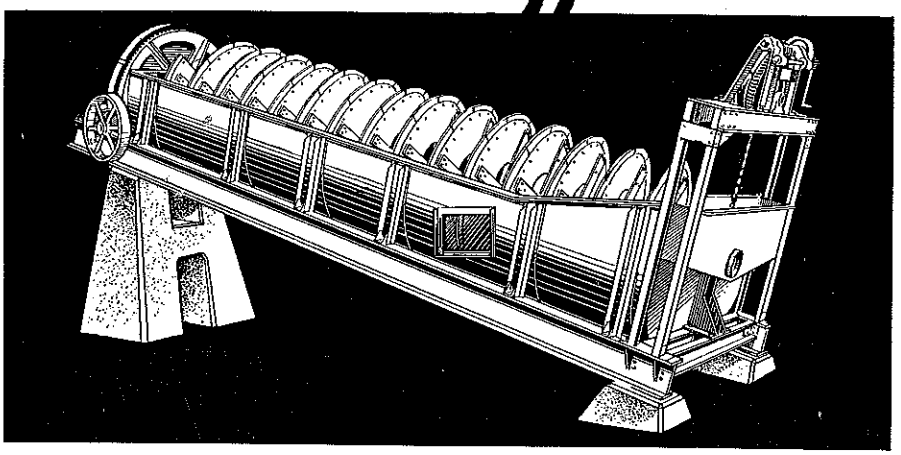

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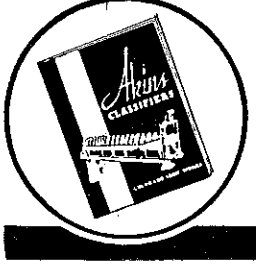

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