

Keystone Metals Reduction Company

(aka, United States Metals Reduction Co.)

Cheswick, PA - Radium Producer circa 1920

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THE MINERAL INDUSTRY

ITS

STATISTICS, TECHNOLOGY AND TRADE

DURING
1921

FOUNDED BY RICHARD F. ROTHWELL

EDITED BY

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VOLUME XXX

SUPPLEMENTING VOLUMES I TO XXIX

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1922

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RADIUM¹

By RICHARD B. MOORE

Notwithstanding the fact that the demand for radium in 1921 was not nearly so strong as in 1920, the production in 1921 was slightly greater than in 1920. The total amount of radium produced in the United States last year was 36 grams, calculated as element. This production was divided among six companies, namely, The Standard Chemical Co., of Pittsburgh, Pa., The Radium Co. of Colorado, Denver, Colo., the U. S. Radium Corporation, of New York and Orange, N. J., the W. L. Cummings Chemical Co., of Lansdowne, Pa., the Keystone Metals Reduction Co., of Cheswick, Pa., and the Carnotite Reduction Co., of Chicago, Ill. The latter company, although it went out of business some time ago, produced some radium in its cleaning-up operations. This makes a total production in the United States up to date of approximately 151 grams of radium element. Allowing 40 grams as the approximate production abroad up to the end of 1921, the world's production of radium has been approximately 190 grams. This means that during the last year nearly as much radium was produced in the United States as the rest of the world has supplied since the discovery of radium up to the present time.

No pitchblende was mined in this country during 1921: all of the production came from carnotite.

A new company produced some radium during 1921, namely the Keystone Metals Reduction Co., of Cheswick, Pa. The old plant of the National Radium Institute in Denver, under the control of W. A. J. Bell, was operated to some extent on a coöperative basis with one of the other companies.

TECHNOLOGY

No radical changes in technology were developed during 1921. In general, the methods used were the same, namely, acid leach, alkali leach, or alkali fusion. There was, however, more of a tendency to using sliming methods than previously. If carnotite ore ground to 30 or 40 mesh is agitated with water, and then allowed to settle, the heavy silica grains settle to the bottom first, and if the supernatant liquor carrying in suspension the very fine material present in the ore is slimed off, most of the carnotite carrying the radium, uranium, and vanadium goes over with the liquor. A concentrate can be obtained in this way, and the concentrate is then available for treatment by any of the above

¹ Published by permission of the Director of the Bureau of Mines.

://books.google.com/books?id=IpcRAAAIAAJ&pg=RA1-PA955&lpq=RA1-
A955&dq=radium+%22Cheswick,+PA%22&source=bl&ots=g1JPfF0zbh&sig=Kh0eBx02z5iM1H8WnsJsQ-
MwrQ&hl=en&ei=m1F2StrcK8WFtgMod2WCQ&sa=X&oi=book_result&ct=result&resnum=7#v=onepage&q=radium%20%22Cheswick%2C%20PA%2
2&f=false

RADIUM, URANIUM, AND VANADIUM.

By FRANK L. HESS.

PRODUCTION.

In 1917 there were produced and shipped, sold, or reduced in the United States 33,404 short tons of uranium and vanadium ores carrying 103 tons of uranium oxide (U_3O_8), or 87.4 tons of uranium and 26.4 grams of radium. There was actually isolated 11.96 grams of radium (Ra) contained in salts, mostly, if not all, chloride. The vanadium contained in the carnotite ores and in the roscoelite-bearing sandstone mined in southwestern Colorado amounted to 484 tons. In 1916 the figures were: Ores, 20,300 tons containing 10 grams of radium, 33.7 tons uranium (77,600 pounds U_3O_8), and 460 tons of vanadium.

The uranium ore was mostly carnotite (hydrous potassium-uranium vanadate) largely from the west side of Montrose and Mesa counties, Colo., with a little from the La Sal Mountains in the adjoining part of Utah (Grand County). The ore also included some uvanite (hydrous uranium vanadate) from Temple Rock, Emery County, 45 miles southwest of Green River, Utah. Most of the ore was mined by the companies isolating radium salts or by their representatives, but a small part was produced by prospectors and others who sold their ore to the companies.

The following companies were engaged in the isolation of radium during the year:

- Carnotite Reduction Co. (Dr. H. N. McCoy), 2600 Iglehart Court, Chicago, Ill.
- Chemical Products Co., 618 Majestic Building, Denver, Colo.
- Colorado Radium Co., P. O. Box 1316, Denver, Colo.
- W. L. Cummings Chemical Co., Lansdowne, Pa.
- Radium Luminous Materials Corporation, 55 Liberty Street, New York, N. Y.
- Standard Chemical Co., Pittsburgh, Pa.

Of these by far the largest is the Standard Chemical Co. The Chemical Products Co., of Denver, started work during the year on the uvanite ores from Temple Mountain and had radium salts ready for crystallization. The United States Metals Reduction Co. shipped a carload of ore from its mine in the Dolores River valley, Utah, northeast of the La Sal Mountains, to an experimental plant at Cheswick, Pa. The Radium Co. of America did no work at its plant at Sellersville, Pa., during the year.

INDUSTRIAL NOTES

The Industrial Potash Corporation has been chartered at Salt Lake City with \$30,000,000 capital to develop the alunite deposits in the Mount Baldy, Ohio, and Durkec districts.

The Federal Trade Commission has cited the International Paint and Oil Company, of Peoria, Ill., in complaint of unfair competition in the manufacture of a coal-tar distillate called "tar-pentine," which can be used for some of the same purposes as turpentine. The complaint states that the name "tar-pentine" so closely resembles turpentine that the public might be deceived.

The Federal Trade Commission has cited the United Chemical Products Corporation, Jersey City, N. J., in complaint of unfair competition in the manufacture and sale of dyestuffs and chemicals. The company is charged with paying out approximately 10 per cent of its entire yearly business in cash commissions to dyers and other employees of its customers to influence the purchase of its products.

In the effort to prevent the Kali Syndicate of Germany from reestablishing a monopoly in the potash industry in the United

States, three men were injured by an explosion which wrecked the building occupied by the Keystone Metal Reduction Company, Cheswick, Pa., on March 5, 1921. The plant is one of the three radium-producing plants in the United States and turns out about one gram of radium a year, valued at \$120,000. The explosion was caused by the blowing up of an autoclave. The loss is estimated at \$10,000.

At the annual meeting of the National Aniline and Chemical Co., Inc., the following directors were elected: Wm. Hamlin Childs, Wm. H. Nichols, Wm. H. Nichols, Jr., Edward L. Pierce in place of C. S. Lutkins, H. Wigglesworth, T. M. Rianhard, F. M. Peters, and W. N. Mellravy. The remainder of the board was reelected.

The New York office of the Société Commerciale des Potasses d'Alsace has been opened at 25 W. 43rd St., New York City. Captain F. C. Doucet is director of the American Bureau, and will become general sales manager for the Société on the resignation of Mr. W. E. Howe, general manager of the Nitrate Agencies Company.

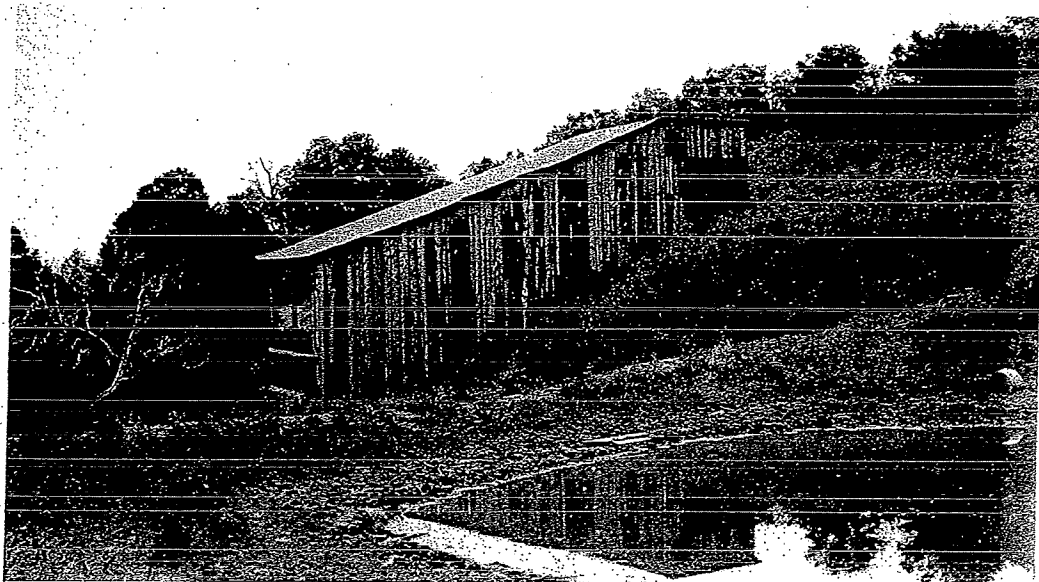
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U.S. Geological Survey Photographic Library

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[http://libraryphoto.cr.usgs.gov/cgi-](http://libraryphoto.cr.usgs.gov/cgi-bin/search.cgi?search_mode=exact&selection=Keystone+Metals+Reduction+Company)

[bin/search.cgi?search_mode=exact&selection=Keystone+Metals+Reduction+Company\Keystone+Metals+Reduction+Company](http://libraryphoto.cr.usgs.gov/cgi-bin/search.cgi?search_mode=exact&selection=Keystone+Metals+Reduction+Company)



1 photos found - click on photo for higher resolution

Image file: /htmllib/btch216/btch216j/btch216z/dch00375.jpg

Abandoned uranium ore treating plant of Keystone Metals Reduction Company on Polar Mesa. The pool in the foreground is run-off held by an earth dam. Grand County, Utah. July 1929. (ID. Dane, C.H. 375 dch00375)

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UT Mine Inspection Report circa 1920

http://books.google.com/books?id=FDEuAAAAYAAJ&pg=RA1-PA886&ipg=RA1-PA886&dq=%22Keystone+Metals+Reduction+Company%22&source=bl&ots=DpvpRW-VRb&sig=c6fvFxcPa5uJ745kD4emGwVEJM&hl=en&ei=gk52StjhAZWcMdrPmbEM&sa=X&oi=book_result&ct=result&resnum=1#v=onepage&q=%22Keystone%20Metals%20Reduction%20Company%22&f=false

REPORT OF THE MINE INSPECTION DEPARTMENT

OF THE

Industrial Commission of Utah

Working in co-operation with the U. S. Bureau of Mines

C. A. Allen..... Chief of the Department
John Crawford..... Coal Mine Inspector
E. A. Hodges..... Metal Mine Inspector
(H. G. Snyder..... Metal Mine Inspector
May 1921, to June, 1922)
Dr. A. L. Murray..... Surgeon, U. S. Bureau of Mines
Mrs. Viola De Hon..... Secretary to the Department
Otis N. Hart..... Stenographer, U. S. Bureau of Mines

886 REPORT OF INDUSTRIAL COMMISSION

UTAH MINING COMPANIES—Continued
(Not including coal mines)

GRAND COUNTY

Keystone Metals Reduction Company—

Property: Number of carnotite claims.
Near Colorado-Utah state line.
I. N. Goff, Gen. Mgr.
Office: Polar Mesa, Grand County, Utah.

Panama Mining and Milling Company—

Property 300 acres, La Sal Mountains.
J. W. Hoke, Pres.; C. N. Nelson, Sec.
Fred McCoy, Mgr.
Office: Castleton, Utah.

Pittsburgh Radium Company—

Property: group of carnotite claims, 20 miles north
of Moab.
N. J. Stevenson, Pres.; Edwin N. Ohl, Sec.
E. H. Beckstrand, V. Pres., University of Utah.

American Chemical Society – Treasurer's Report

http://books.google.com/books?id=4cAGAAAAYAAJ&pg=PT63&lpg=PT63&dq=%22Keystone+Metals+Reduction%22&source=bl&ots=LRh0O_WiQP&sig=F6MA6lNc4MrUST_n8Dlvm_PC58&hl=en&ei=y0R2Stf1N4OyNujwILEM&sa=X&oi=book_result&ct=result&resnum=6#v=onepage&q=%22Keystone%20Metals%20Reduction%22&f=false

New York, February 23, 1922.

DR. J. E. TEEPLE, *Chairman Finance Committee,*
American Chemical Society,
50 East 41st Street, New York City.

MEMBERS ELECTED BETWEEN FEBRUARY 15 AND MARCH 15.

Hart, Leland P., Oria, Texas.

Hayashi, Sukeharu, Department of Applied Chemistry, Faculty of Engineering, Tokyo Imperial Univ.,
Tokyo, Japan.

Heinle, F. J., Keystone Metals Reduction Co., Cheswick, Pa.

Hendricks, Steriling B., U. of A. Bookstore, Fayetteville, Ark.

Hendry, James, % Messrs. A. M. Bickford & Sons, Ltd., 42 Currie St., Adelaide, Australia.

W. H. Wiley Records, WH961, Western History Collection, The Denver Public Library.

http://eadsrv.denverlibrary.org/sdx/pl/doc-tdm.xsp?id=WH961_d0e33&fmt=text&base=fa&root=&n=&qid=&ss=&as=&ai=

Box 11 - W.H. Wiley - Business

FF26 - 1922 - Keystone Metals Reduction Company, Polar Mesa property: report

(Note: may contain address uranium ore / concentrates were shipped to in PA. dja)

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United States Metals Reduction Co.

http://books.google.com/books?id=2NJIAAAAMAAJ&pg=PA1374&lpg=PA1374&dq=radium+%22United+States+Metals+Reduction+Co%22&source=bl&ots=5slwmZugn7&sig=XCwUdvvy4ELfvqzODNw3mp3otlg&hl=en&ei=7xJ3SpWUOc63twfJ0fGWCQ&sa=X&oi=book_result&ct=result&resnum=3#v=onepage&q=radium%20%22United%20States%20Metals%20Reduction%20Co%22&f=false

INTERNATIONAL EDITION
THE MINES HANDBOOK

AN ENLARGEMENT OF

THE COPPER HANDBOOK

Founded by Horace J. Stevens, 1900

A MANUAL OF

THE MINING INDUSTRY OF THE WORLD

BY

WALTER HARVEY WEED, E.M.

Former Geologist in the U. S. Geological Survey, 1883-1906; Member
Institution of Mining and Metallurgy of America; Fellow
Geological Society of America; Author: Copper
Mines of the World; Geology of Butte,
Montana; Nature of Ore
Deposits, etc.

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1920

UNITED STATES METALS REDUCTION CO.

UTAH

A close corporation, controlled by a Pittsburg syndicate. A 15-ton plant, 15 miles from Castleton, and 50 miles from Cisco, was built in 1918, to treat radium bearing ores. The company owns 37 claims. Details not available.

as well as of free amino acids, increases the amino nitrogen determinable. That this same operation produces also ammonia has been shown in the hydrolysis of gelatin by Fischer,¹⁰ Daken,¹¹ Van Slyke,¹² Bogue,¹³ and others. It seems probable to the writer that collagen is a polymerized complex of gelatin. Upon heating gelatin to 130° C. an anhydride is probably produced, but this is not similar to the original collagen. The polymerization seems to be chemical rather than physical, and would, therefore, be comparable to the relation between gelatin and proteose, or between proteose and peptones. Neither of the latter can be treated to reproduce gelatin, and it seems very doubtful if gelatin can be treated so as to reproduce collagen.

The optimum conditions for hydrolysis of collagen to gelatin are, of course, those by which the greatest amount of nitrogen passes into solution in the shortest period of time, but during which process the minimum amount of degradation of the gelatin takes place. In the experiment reported, these conditions seem to be best attained by the following control:

1.—The hydrogen-ion concentration of the hydrolyzing solution should be such that the resulting gelatin or glue solution will possess an H-ion concentration between pH 3.0 and 4.0 or between pH 7.5 and 8.5. The region of pH 4.5 to 6.0 should be avoided as the hydrolysis is very slow at that concentration of hydrogen ions. Above pH 8.5 the degradation of the gelatin

becomes too great, with a corresponding loss of nitrogen as ammonia, and below pH 3.0 there is also a degradation, while in both cases the velocity and jelly strength of the product become very low.

2.—A temperature of 50° C. seems most favorable to the hydrolysis of collagen to gelatin, and an 8-hour period of heating is satisfactory. There is too little hydrolysis at lower temperatures or shorter periods of heating (although a somewhat purer product may result under these conditions), while at higher temperatures and longer periods the greatly increased degradation of the gelatin offsets any advantages of more rapid collagen hydrolysis.

3.—The optimum ratio of dry stock to hydrolyzing solution (including water in the stock) seems to be about 1:12 or 1:14. Lower concentrations necessitate later evaporation, while greater concentrations give lower yields of gelatin and increased degradation of the gelatin formed.

4.—The stock may be swollen in a number of different reagents, lime and lactic acid showing the best results to date, but the excess of reagent should be removed completely by washing and neutralization, as a depressing effect on the viscosity and jelly strength may result from their presence.

5.—A fine cutting of the stock and constant agitation are desirable as they make possible a more rapid hydrolysis, but to prevent also a more rapid degradation of the gelatin a shorter period of heating or a lower temperature will be necessary. A 5 or 7-hour heating at a temperature of 75° C. probably will produce, with finely cut stock and thorough agitation, about the same hydrolysis as an 8-hour heating at 50° C. under the opposite conditions.

ACKNOWLEDGMENT

The writer wishes to express his indebtedness to C. K. M. Ritchie for performing a number of the determinations reported herein.

¹⁰ Fischer, Levene, and Anders, *E. Physiol. Chem.*, **35**, 70 (1932).

¹¹ *J. Biol. Chem.*, **44**, 324 (1920).

¹² *Ibid.*, **10**, 48 (1911).

¹³ *Chem. Ind. Eng.*, **23**, 156 (1920).

Extraction and Recovery of Radium, Vanadium, and Uranium from Carnotite¹

By K. B. Thews and E. J. Hoimle

KEYSTONE METALS REDUCTION CO., CHESWICK, PA.

THIS carnotite ores now mined in Colorado and Utah are of too low a quality to permit handling and shipping to the reduction plants without first picking out the higher grade ores or else concentrating this ore. The practice in almost all cases is to pick out the higher grade material, which makes it necessary to store in the field large quantities of low-grade carnotite, and it appears that in the future American radium manufacturers will be forced to concentrate all these ores before shipment to the plants is profitable. For this reason, the writers have described in detail the extraction of the values from concentrates instead of ores, and have only mentioned the advantages occurring in extracting the values from ores.

RADIUM EXTRACTION AND RECOVERY

In iron tanks or pressure boiling kettles the following mixture is made—2 parts water, 1 part concentrates, and approximately 200 pounds of soda ash for each per cent of uranium oxide present. This mixed mass is boiled with continuous stirring for from 8 to 10 hours. Should this boiling be done in an open tank and coils used for heating, a small amount of the condensed steam should be returned into the boiling tank to take care of the evaporation of the water. Otherwise, the mass would boil down to the concentration point of soda salts, which would result in the crystallizing out of the uranium salts as the sodium uranyl carbonate. A more complete conversion is made in pressure kettles be-

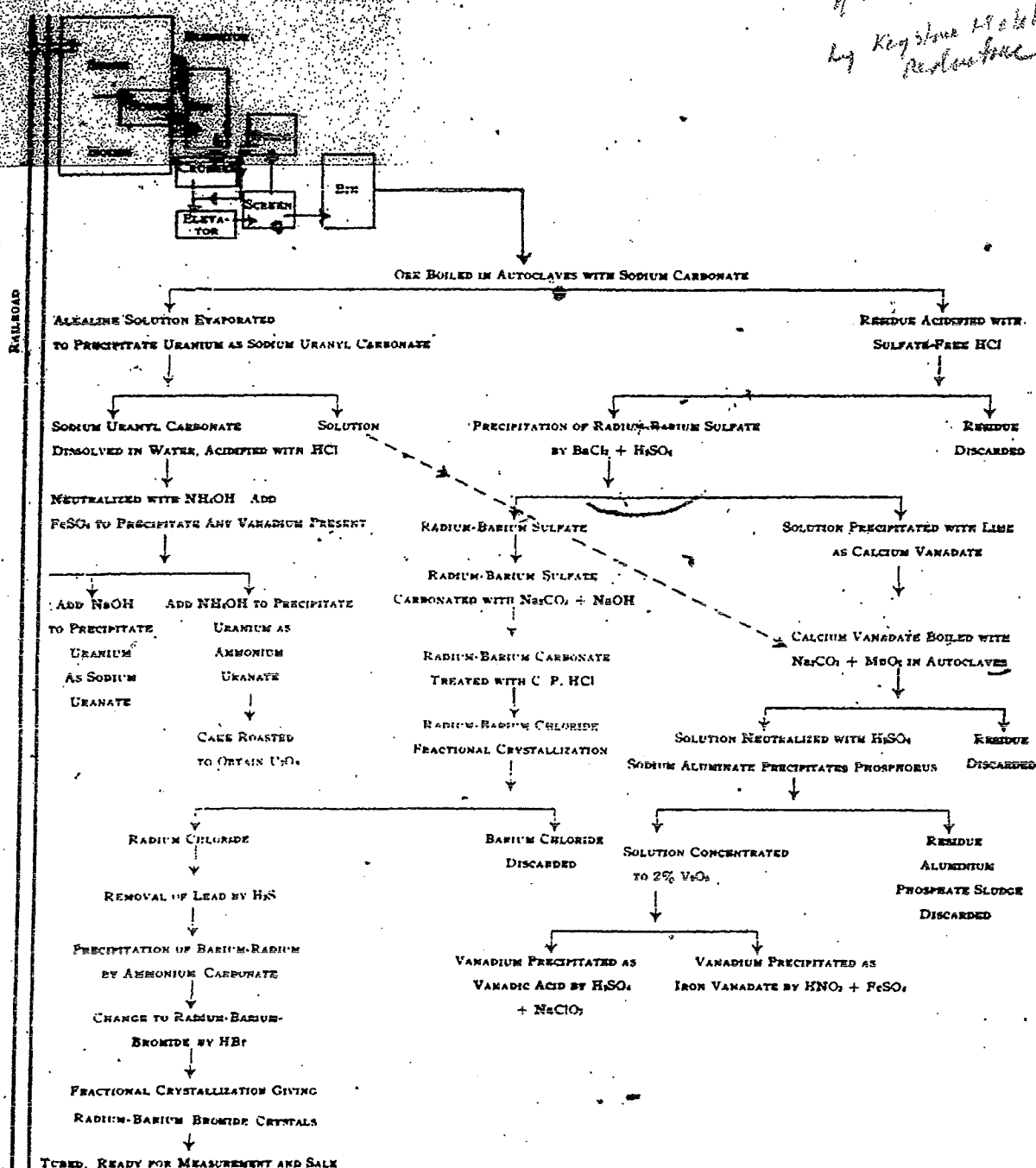
cause of greater heat, and practically all companies using this process have installed pressure kettles.

The object of this carbonation is to convert the acid-insoluble barium and radium salts to the acid-soluble barium and radium carbonates, also to convert about 90 per cent of the uranium to the soluble sodium uranyl carbonate and some of the vanadium to the soluble sodium vanadate.

It has been found that in a concentrate about 90 per cent of the uranium and about 80 per cent of the vanadium are converted to soluble salts. This carbonation should be made in three series, each large enough to supply the plant with a full day's run. In this manner the concentrate is boiled one day, settled the second, and decanted and filter-pressed on the third day. After decantation the mass is pumped into a washing type, iron filter press and the cake washed with sulfate-free water until the resulting filtrate is free from sulfate. From 6 to 10 hours are required to accomplish this washing. All the decanted liquor, filtrate from press, and part of the wash water containing the soluble vanadium and uranium salts are pumped into evaporating tanks (recovery later), and the remaining wash water is used as mix for new conversions. The cake in the filter press containing the radium is carefully taken out, broken up with about 20 per cent of sulfate-free water in a paddle tank, and pumped into the acid-treating tanks. These tanks resist the action of the acid and are so constructed that the mass can be stirred well. Enough sulfate-free hydrochloric acid is added to neutralize all carbonates, etc., and to acidify the solution. A solution of 2 per cent

¹ Received June 28, 1923.

*End of 3rd Page
of article Vol. 15, No. 11
by Key Stone 1923
Revised 1924*



FLOW SHEET OF RADIUM PROCESS

acidity is generally sufficient for this purpose. The acid-consuming number can be easily found by taking a 100-gram sample of the carbonated cake, acidifying, and boiling it with a given quantity of hydrochloric acid and then titrating the filtrate with a normal caustic solution. The excess needed can then easily be calculated. The acidified mass, in tanks, is then boiled for 20 to 60 minutes and pushed into washing-type, wooden filter presses, by means of a blow case, and washed with sulfate-free water until the resulting wash waters are barium-free. The filtrate and wash waters will now contain over 90 per cent of the radium and about 80 per cent of the vanadium not taken out by the carbonate conversion. The cake in the filter press is free from radium.

vanadium, and uranium and can be discarded. The filtrate wash waters are run into large boiling tanks and the radium is precipitated with sulfuric acid, or a soluble sulfate, such as sodium acid sulfate. In case no barium has been introduced, a small quantity (about one-half pound) of barium chloride per milligram of radium present is added before this precipitation is made. The precipitated radium barium sulfates are left to settle for from 2 to 4 days, when most of the liquor containing the vanadium is decanted off, and the remaining liquor plus the precipitated sulfates dropped on vacuum filters and the liquor separated from the cake. This radium barium sulfate will contain about 1200 milligrams per ton; therefore, a concentration of 1 to 100 or more has been made.

The cake containing all the radium and barium as sulfates is washed and mixed in an autoclave with two parts of its dry weight of soda ash, 10 per cent caustic soda, and four parts of water, and boiled for about 12 hours. The radium barium carbonates resulting from this conversion plus liquors are pumped into a small washing type, iron filter press, and washed sulfate-free with distilled water. The cake containing the radium and barium is taken out carefully and treated with C. P. hydrochloric acid. After filtering, the radium in the filtrate is ready for fractional crystallization. This is done by either the neutral or acid method of crystallization. Since many publications have been written on the fractional crystallization of radium, the writers will not describe it in this paper.

PLANT CONTROL OF RADIUM

Chemical plant control is a very important factor and is carried out with great care. Possible contaminations by sulfates must be guarded against and eliminated, and since the ore contains sulfates and sulfuric acid is used in the process, contaminations are easily possible. Rapid qualitative tests for sulfates are made repeatedly, especially after the carbonate conversions and before the hydrochloric acid treatment. The hydrochloric acid treatment department is generally kept away from the other departments for this reason, and all operators are warned to keep clothing such as shoes, etc., in clean condition. At this point sulfates will do most of the damage. Should sulfates enter, reprecipitate some of the radium to insoluble sulfate, a costly reconversion with sodium carbonate is necessary.

EXTRACTION FROM ORES

Most of the radium plants today do not concentrate their ores but resort to hand picking and shipping this picked ore to their plants. In this case the ore is first crushed and ground to from 20 to 30-mesh before the values are converted with sodium carbonate, and after the first hydrochloric acid treatment the slimes and liquors are decanted off and pumped into filter presses. Since the average ore, after crushing, consists of about 15 per cent of slimes and 85 per cent sandy material, and since the sands after acid treatment contain practically no radium, this decantation results in a considerable saving in labor and equipment. A few washes after the main liquor has been decanted off will free the sands from all values. Otherwise, ores are treated the same as concentrates.

URANIUM RECOVERY

The liquor from the first carbonation, containing about 90 per cent of the uranium and some of the vanadium, is pumped into large tanks and evaporated until the concentration point of the contained soda ash is reached. This point can be ascertained by blowing a film on the top of a sample taken from the solution. At this point all the uranium crystallizes out as the sodium uranyl carbonate, and the vanadium remains in the liquor. The mass is filtered and the sodium uranyl carbonate slightly washed with cold water. The sodium uranyl carbonate is dumped into a wooden tank and enough water added to dissolve the salt. The mixture is then slightly acidified and boiled to drive off all carbonates and almost neutralized with ammonia. A little vanadium is carried along with the uranium, and for the purpose of eliminating this vanadium a small quantity of ferrous sulfate is added. After the iron vanadate has been separated from this solution by filtration, the uranium is precipitated with ammonium hydroxide as the ammonium uranate. The precipitated mass is pumped into a washing type, iron filter press and the cake washed until all the soda salts have been removed. The ammonium uranate is put into a roasting furnace and converted to the uranium oxide by heat. A small amount of the ura-

nium will be precipitated as sodium salts, owing to the soda salts present, but it has been found that an oxide of 97 per cent purity can be made. In case a purer salt is wanted the ammonium uranate is redissolved and reprecipitated.

If caustic soda is used after the solution has been freed from the vanadium, sodium uranate is precipitated.

VANADIUM RECOVERY

The vanadium in the acid solution decanted from the precipitated barium radium sulfate is pumped into large stirring tanks, boiled, and the vanadium precipitated with lime as the calcium vanadate, filtered, and washed. The cake containing the vanadium is then mixed with the liquor from the sodium uranyl carbonate evaporation plus 10 per cent of sodium carbonate, a small amount of oxidizing agent such as manganese dioxide, and boiled for 2 hours. By adding the liquor from the sodium uranyl carbonate evaporation to the lime cake, vanadium is not only combined, but a considerable saving in soda ash is made. The boiled mass is pumped into washing type, iron presses and the cake washed free of vanadium. About 95 to 98 per cent of the vanadium is now in solution. The cake can be discarded. This solution is pumped into wooden tanks, almost neutralized with sulfuric acid, and the phosphorus from the ore carried along, precipitated with sodium aluminate as an aluminium phosphate sludge. This sludge is filtered off and the solution is pumped into an evaporating tank and boiled until a 2 per cent vanadium solution is reached. This is then precipitated as the vanadic acid by adding a slight excess of sulfuric acid and boiling vigorously. It has been found that sulfuric acid will not precipitate vanadium in weak solution and that when a solution is concentrated to about 2 per cent V_2O_5 content, the most efficient results are obtained. A vanadic acid containing 80 per cent V_2O_5 can be precipitated by this method. This precipitated vanadic acid is filter-pressed, washed free from sulfates, and dried. The resulting vanadium oxide is ready for reduction. In case iron vanadate is wanted, the solution does not have to be evaporated, but is almost acidified with sulfuric acid, and after dephosphorization slightly acidified with nitric acid and the vanadium precipitated with ferrous sulfate. By decreasing or increasing the excess acidity, iron vanadate of various purities can be made. A higher acidity will give a higher grade concentrate.

CONCLUSION

The process described has its disadvantages when compared with others, such as the nitric acid, sulfuric acid leaching, niter cake fusion processes. It requires more equipment, more careful checking, and the solutions and cakes have to be handled more frequently. Its chief advantage lies in the fact that when operated carefully, purer and more easily worked solutions result. Under normal conditions, recoveries of 80 per cent or better of all values in carnotite are being made. There is very little difference in costs of operation between these processes, so this process is today the most popular one used on carnotite ores.

- * Parsons, Moore, Lind, and Schafer, *Eng. Miner. Res.* 104.
- * Fleck, Haldane, and White, U. S. Patent 88, 384.
- * Schindt, U. S. Patent.

Indiana Section Aids Fire Department

At the request of the chief of the fire prevention division of the Indianapolis Fire Department a committee headed by Cecil Calvert will prepare instructions for the use of firemen when handling fires in which acids or other chemicals that might cause explosions or spread dangerous gases are encountered. The recent unfortunate experience of the Milwaukee department led to the request and the organization of the committee. Possibly other sections may find that they can similarly serve their own communities.

CHESWICK



65

PILLOW

65

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R.R. RIGHT OF WAY

Allegheny River

SPRING

60

R.M. PIPE

R.M. PIPE

Grass Run, Wirt Co.
Kirtland Hotel, Steubenville Co.
not in operation, see page 100
1000 near waterfalls and ruins

GRASS RUN
WIRT CO.

85

