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# UNITED STATES PATENT OFFICE

WALTER GLAESER, OF BROOKLYN, NEW YORK, ASSIGNOR TO GLAESER RESEARCH CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

## METHOD OF PRODUCING MERCURY

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The present invention relates to a new and improved method of producing mercury, and is particularly directed to a method of extracting mercury from cinnabar ore in a wet way and without the necessity of subliming the ore as is the case in the method now in general use. My improved process is very much more economical than that in use and is capable of effecting a recovery of better than 90 per cent. of the total amount of mercury in the ore. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The following description sets forth in detail one approved method of carrying out the invention, such disclosed mode, however, constituting but one of the various ways in which the principle of the invention may be used.

In the present process cinnabar ore is first crushed to the fineness of an 80 to 150 mesh screen, and is then mixed with a hydroxide of an alkaline earth metal, such as barium, after which I add to the mixture a solution of sodium sulfhydrate which dissolves the mercuric sulphide in the ore to a double water-soluble sulphide, which is probably represented by the formula $HgS.Na_2S$ or $HgS.BaS$ or $2HgS.BaS.Na_2S$.

Filtration of the mixture containing the double water soluble sulphide and washing of the residue with water is not necessary, but I prefer to filter the mixture, after the reaction is completed, which generally takes twenty-four hours at ordinary temperature. The speed of the solving action may be hastened by warming the mixture to from 50 to 80 degrees C. The reactions which probably take place may be represented by the equations:

1. $Ba(OH)_2+2NaSH=Ba(SH)_2+2NaOH.$
2. $Ba(SH)_2+2NaOH=BaS+Na_2S+2H_2O.$
3. $2HgS+Ba(SH)_2+2NaOH=2HgS.BaS.Na_2S+2H_2O.$
4. $HgS+BaS=HgS.BaS.$
5. $HgS+2NaSH+Ba(OH)_2=HgS.Na_2S+BaS+2H_2O.$

From the solution containing the double sulphide the mercury is then removed as an amalgam by adding some finely divided metal, such as zinc, aluminum, an alloy or the like, which reacts with the double sulphide according to the following equations:

1. $2HgS.BaS.Na_2S+2Zn_2=2HgZn+2ZnS+BaS+Na_2S.$
2. $HgS.BaS+2Zn=HgZn+ZnS+BaS.$
3. $HgS.Na_2S+2Zn=HgZn+ZnS+Na_2S.$

This double sulphide of mercury and barium, or mercury and sodium, or mercury, sodium and barium may also be treated with an acid forming a salt with the sodium or barium sulphide to free the sulphide of mercury from the other sulphides. I prefer to employ carbonic acid or hydrochloric acid for this purpose. If an amalgam has been formed the mercury may be removed therefrom by distilling at a temperature sufficient to volatilize the mercury, after which the mercury is condensed, and the other metal may be used again in the process. If the black sulphide of mercury is formed it is filtered off, dried and then furnaced with sodium carbonate or lime, with or without the addition of coke, in a muffle furnace. The further reactions which take place during the precipitation of the black sulphide of mercury and during the furnacing operation may be represented as follows:

1. $2HgS.BaS.Na_2S+2HCl=\underset{\text{Black}}{2HgS}+2NaCl+Ba(SH)_2$
2. $HgS.+Na_2CO_3=Hg+Na_2S+CO_2+O$
3. $Na_2S+2O_2=Na_2SO_4$
4. $Na_2SO_4+C_2=Na_2S+4CO$
5. $HgS+CaO+C=Hg+CaS+Co.$

In either case the mercury which is volatilized during the furnacing operation is condensed and a recovery in excess of 90 per cent of the original mercury content of the ore can be obtained, particularly if the original mixture is heated and agitated during the formation of the double sulphide or mercury as described above.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards

the method herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a method of extracting mercury from cinnabar ore, the step which consists in subjecting the finely divided ore to the action of nascent sulphide in the presence of alkali metal and alkaline earth metal ions.

2. A method of extracting mercury from cinnabar ore, which comprises reacting upon the finely divided ore with a hydroxide of an alkaline earth metal and a sulfhydrate of an alkali metal, thereby forming a double sulphide of mercury and an alkali metal.

3. A method of extracting mercury from cinnabar ore, which comprises reacting upon the finely divided ore with a hydroxide of an alkaline earth metal and a sulfhydrate of an alkali metal, and separating the mercury out of the sulphide formed.

4. A method of extracting mercury from cinnabar ore, which comprises converting the mercury in the ore into a double sulphide, subjecting to the action of an acid, removing the mercuric sulphide precipitated, and furnacing the same with a carbonate in exclusion of air.

5. A method of extracting mercury from cinnabar ore, which comprises subjecting the ore to the action of nascent sulphide in the presence of alkali metal and alkaline earth metal ions.

6. A method of extracting mercury from cinnabar ore, which comprises reacting upon the ore with a hydroxide of an alkaline earth metal and a sulfhydrate of an alkali metal, thereby forming a double sulphide of mercury and an alkali metal.

Signed by me, this 20th day of September, 1924.

WALTER GLAESER.