UNITED STATES PATENT OFFICE.

WILLIAM A. HALL, OF NEW YORK, N. Y.

PROCESS FOR DESULFURIZING ORES.

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To all whom it may concern:

Be it known that I, WILLIAM A. HALL, a citizen of the United States, residing at New York city, borough of Manhattan, in the county of New York and State of New York, have invented certain new and useful Improvements in Processes for Desulfurizing Ores, of which the following is a specification.

The object of my present invention is to distil the sulfur contained in sulfid ores—the so-called fixed atom, as well as the so-called feeble atom, of sulfur—in the form of elemental sulfur with the production of a minimum amount H_2S and SO_2, and preferably with the production of substantially no such gases.

In carrying out my process I preferably subject the ore, broken into small pieces or pulverized, and while being agitated, to the direct action of a reducing (or at least a non-oxidizing) flame, and steam. The temperature of the ore should be between about 700° C. and 925° C.—the former being the approximate temperature at which the sulfur content of the sulfids is distilled, and the latter being the approximate temperature at which the sulfids fuse. In order to maintain a reducing flame of the desired temperature in the presence of steam, the air should be introduced with the fuel under pressure to produce a blow pipe flame and an excess of steam should be avoided. Preferably the flame is caused to impinge directly on the ore. By this procedure I am able to distil off in the form of elemental sulfur, without passing to any considerable extent through any of its combined forms, not only the so-called feeble atom, but also the so-called fixed atom, while the fumes from the furnace contain only a negligible amount of H_2S and SO_2—so small an amount that said gases may be discharged into the air without detriment and without noticeable odor.

If with sufficient steam present considerably lower temperatures than those above described are employed, say between 500° and 650° C., substantially all the sulfur will be converted into H_2S, but if the lower temperatures described (say about 700° C.) be employed, substantial quantities of elemental sulfur, as well as H_2S, may be produced. I prefer to regulate the temperatures so as to avoid the production of any substantial or detrimental amount of H_2S, but some may be formed, and, if formed, it may be converted into sulfur by admitting regulated quantities of air to form SO_2 in combining proportions, as is well known. Such air may be admitted at the outlet of the furnace; or, if a furnace employing multiple burners be used, one of the flames may be made of an oxidizing character; or the air may gain access to the furnace through leakage.

So far as I know I am the first to distil and to recover directly in the form of elemental sulfur the so-called fixed atom of sulfur in sulfid ores. Indeed, by my process the sulfur contained in such ores as pyrrhotite which contain no feeble atom, can be distilled and recovered directly in the form of elemental sulfur.

In practising my process I may employ a furnace of the McDougal, Herreshoff or Wedge types, or of any other suitable type.

What I claim is:

1. The process of desulfurizing ore which consists in subjecting the ore in the presence of steam to the action of a non-oxidizing flame at a temperature upward of the temperature at which the sulfur content of the sulfids is distilled.

2. The process of desulfurizing ore which consists in subjecting the ore in the presence of steam to the action of a non-oxidizing flame at a temperature sufficiently high to distil the sulfur of said ore, but below a temperature at which said ore would fuse.

3. The process of desulfurizing ore which consists in subjecting the ore in the presence of steam to the action of a non-oxidizing flame at a temperature upward of the temperature at which the sulfur content of said ore is distilled, and agitating the ore.

4. The process of distilling and recovering directly in the form of elemental sulfur the fixed atom of sulfur in sulfid ores, which consist in subjecting the ore in the presence of steam to the action of a non-oxidizing flame at a temperature upward of the temperature at which the sulfur content of said ore is distilled.

5. In the recovery of sulfur from sulfid ores the step of heating said ore in a non-oxidizing environment until at least the major part of so called "fixed atom" of said ore has distilled.

6. In the recovery of sulfur from a pyrrhotite ore, the step of treating said ore

with a reducing flame, and with a small amount of steam, at a temperature between 700 and 925° C.

7. In the production of free sulfur from sulfid ore, the step of subjecting said ore to the action of a non-oxidizing flame, in the presence of steam, at a temperature at which substantially all the sulfur of the ore will distil from said ore, in the form of elemental sulfur.

8. In the process of obtaining sulfur from sulfid ore, the step of distilling the fixed atom of sulfur from said sulfid ore by the application to said ore of a reducing flame.

9. In the process of obtaining sulfur from sulfid ore, the step of distilling the fixed atom of sulfur from said sulfid ore by the application to said ore of a reducing flame at a temperature between 700 and 900° C.

10. A process of distilling the sulfur of those varieties of sulfid ores in which no considerable amount of sulfid having both "fixed" and "feeble" sulfur atoms exists, said process comprising the treatment of a layer of said ore with a reducing flame while agitating said ore.

11. A process of distilling the sulfur of those varieties of sulfid ores, in which no considerable amount of sulfid having both "fixed" and "feeble" sulfur atoms exists, said process comprising the treatment of a layer of said ore with a reducing flame while maintaining the temperature between 700 and 900° C.

12. A process of distilling the sulfur from pyrrhotite ore, which comprises exposing said ore to the action of steam and of a reducing flame while simultaneously agitating said ore.

13. In the production of sulfur from metallic sulfids, subjecting the metallic sulfids to the action of a reducing flame and of a limited amount of steam which amount is in itself insufficient to decompose said sulfid to any substantial extent but sufficient to prevent substantial loss of sulfur due to formation of SO_2 and COS.

14. A process of extracting sulfur from metallic sulfids, which comprises agitating the sulfid and simultaneously subjecting the same to the combined action of a direct reducing flame and of a small amount of H_2O.

15. A process of extracting sulfur from metallic sulfids which comprises subjecting the sulfids to the simultaneous action of a reducing flame and of a relatively small volume of steam while causing fresh surfaces of the sulfids to be exposed throughout the operation.

16. In the production of free sulfur from sulfid ore, the step of subjecting a layer of said ore, to the action of a reducing flame, and of steam, while agitating said ore.

17. In the production of free sulfur from sulfid ore, the step of subjecting a layer of said ore, to the action of a reducing flame, together with a small amount of steam.

18. In the production of free sulfur from sulfid ore, the step of subjecting a layer of said ore, to the action of a reducing flame, together with sufficient steam to prevent the formation of material amounts of SO_2, and to decompose any COS formed.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM A. HALL.

Witnesses:
A. W. PERKINS,
M. R. MCKAY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."