

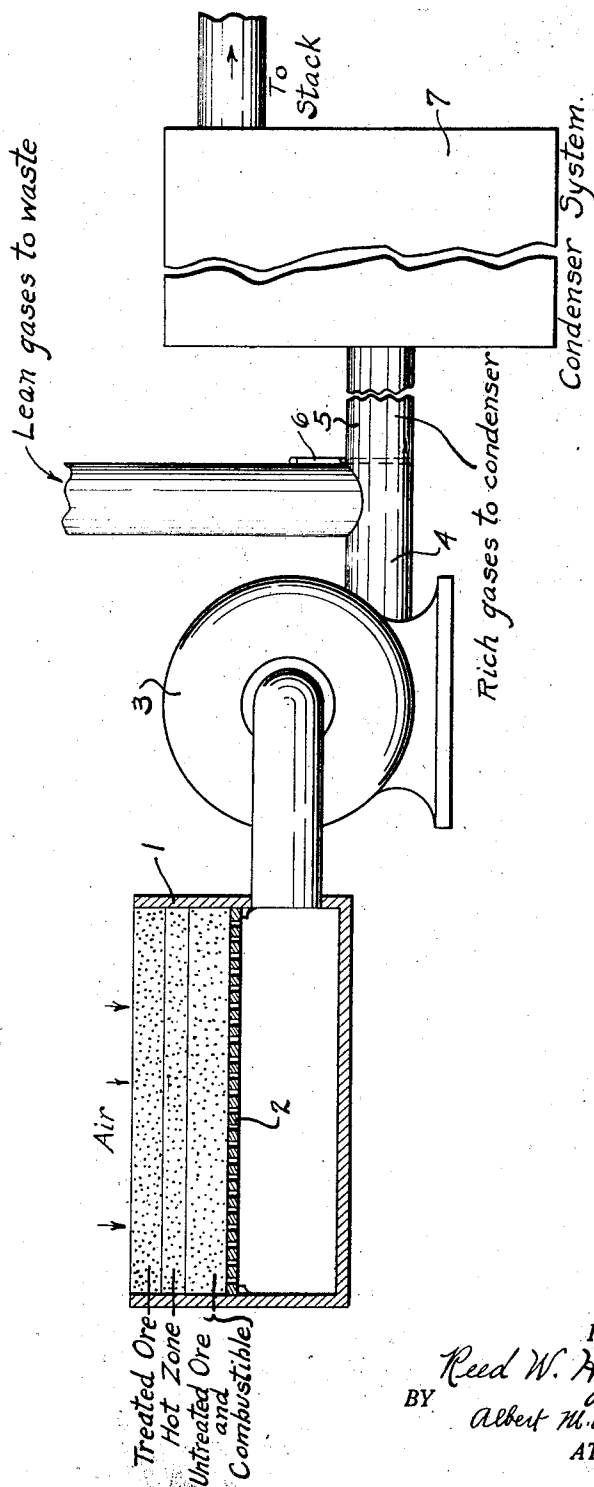
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PROCESS OF TREATING MERCURY BEARING ORES

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PROCESS OF TREATING MERCURY-BEARING ORES.

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This invention relates to a process of separating mercury from mercury bearing material, and relates particularly to a process of treating mercury bearing ores in their native state without previous metallurgical treatment to distil the mercury therefrom.

Metallic mercury is rarely found in native ores. Usually it is combined with sulphur as (HgS), and the greater part of the mercury of commerce is recovered from sulphide ores. According to the present practice such ore is heated with an excess of air to remove the sulphur and to distill the mercury. Usually the ore is heated for various extended periods of time depending on the type of furnace, the character of the ore, and the quality of the fuel. Various types of furnaces have been employed, both stack and rotary kiln furnaces being in common use. In all of the types of furnaces now employed gases of combustion commingle with the mercury vapor in large volume and elaborate installations are necessary not only for handling the ore but for cooling the gases and for the subsequent condensation of the mercury.

Broadly stated my improved process consists in subjecting a mercury bearing material, for example an ore or concentrate in its native state crushed to comparatively small pieces or particles but without any prior metallurgical treatment to the heat of a relatively narrow rapidly moving zone of combustion at a temperature above the vaporizing point of mercury for a comparatively short period of time thereby to distil the mercury from the ore with a minimum consumption of fuel and a minimum volume of gases of combustion.

The process also consists in causing such zone of combustion to move progressively and in a horizontal plane through each succeeding strata or layer of the charge without fusion or substantial fusion of the particles of ore and without substantial caking or agglomeration of the body or mass of ore whereby the several particles or pieces of ore comprising the ore body or charge may remain practically separate and distinct at the end of the treatment.

In carrying out the process, the mercury bearing material, such as ore in its native state and without previous metallurgical treatment, is crushed into relatively small

particles, for example, to pass through a screen having half inch mesh or less. Sufficient combustible may then be added to the crushed ore to support rapid combustion. Preferably carbonaceous combustible in a solid form is employed, such as crushed coal, or even lignite, since it is possible to use an inferior grade of combustible and still obtain the desired temperature. However, the necessary heat may be obtained from burning a liquid hydrocarbon, such as fuel oil, if economically advantageous. In case a solid combustible is used the mixture is preferably moistened to produce a slightly coherent mass and also to cool the gases of combustion.

The mixture of mercury bearing material or ore with the added combustible is spread in a charge or layer of proper thickness to permit rapid combustion without fusing or slugging the charge. The surface of the charge is then ignited in any suitable or well known manner and the charge is subjected to the action of a current of air of sufficient volume to maintain a narrow continuous and practically horizontal zone of combustion and to cause such zone to progress through the ore charge with greater or less rapidity.

The temperature of the combustion zone must be above 357°C ., which is the vaporizing point of mercury, and preferably is below the normal fusion point of the ore. For example, I have found that a temperature of 600° to 700°C . is sufficient to permit rapid progression of the zone of combustion through the charge and at the same time expel all the mercury contained in the ore. If the ore contains considerable sulphur the quantity of combustible may be reduced accordingly since the sulphur in the presence of the large excess of oxygen supplied by the air blast readily oxidizes and passes off as sulphur dioxide.

In the accompanying drawing, I have indicated diagrammatically one form of apparatus adapted to carry out my improved process, although it will be understood that the process is not dependent upon any particular type or character of apparatus and that various other forms of apparatus may be utilized in practicing the invention provided only that the steps of the process be performed substantially as set forth.

Referring to said drawing for purpose of illustration, the charge of crushed ore, mixed with the requisite amount of combustible, is placed in a suitable receptacle 1, provided with grates 2. The receptacle may be open to the air, and connected with a suitable suction device, for example, the fan 3. An outlet pipe 4 for the gases and products of combustion is provided with a by-pass 5, controlled by a valve 6, whereby the gases may be wasted if desired. The outlet pipe 4 communicates with a suitable condenser 7, shown diagrammatically, for condensing and recovering the mercury that is carried over with the gases of combustion.

The ore receptacle may be closed if desired, by a cap or cover and connected through a supply pipe with an air compressor, whereby air may be forced into the receptacle and through the ore charge to support combustion and carry the gases of combustion and the vaporized mercury through an outlet pipe provided with a valve controlled by-pass for wasting the lean or barren gases.

In practice the combustible at the surface of the ore charge is ignited in any well known manner as by an oil burner and an air current is induced through the charge by operation of the fan or compressor. The air current is drawn through the charge in sufficient volume and at the proper rate to produce a localized zone of relatively high temperature which progresses rapidly through the charge and distills the mercury without substantial fusion of the ore. Preferably the temperature is at all times less than the fusion temperature of the ore under treatment since this conserves fuel and the gases exit at a lower temperature. Consequently neither a smelting nor a sintering operation takes place. This process, however, is not concerned with the further treatment of the material or the condition thereof after the mercury has been removed.

The combustion zone traverses the ore body or layer at a relatively high speed. For example a layer of mercury ore and crushed coal having a thickness of 7 inches may be traversed in 14 minutes with practically complete distillation of the mercury. At such speed only a limited surface fusion without agglomeration of the ore particles takes place although the maximum temperature at the point of combustion may be at or above the fusion point of the ore but the temperature of the ore body outside of the combustion zone is much lower.

By means of my improved process the volume of gases to be handled in the condenser is small compared to the volume produced by any process now in use. Furthermore, such gases enter the condenser at a relatively low temperature, thus permitting more efficient condensation with cheaper apparatus.

The gases are clean and practically free from dust and no tar or soot is present to hinder subsequent condensation of the mercury. A minimum quantity of fuel is used, since the exact amount required to distil the mercury from a given quantity of the ore can be determined with reasonable accuracy, effecting marked economies in treatment. A charge of ore is treated in a very short period of time compared with prior processes, permitting large tonnages to be handled with a given equipment, and also permitting a less expensive type of apparatus to be employed whereby extensive deposits of low grade ores otherwise valueless become commercially available.

Although I have shown and described and have pointed out in the annexed claims, certain novel features of my invention, it will be understood that various omissions, substitutions and changes in the several steps of my process and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. The process of distilling mercury from native mercury bearing material, which consists in spreading the material in finely divided condition mixed with a limited amount of a combustible sufficient to support combustion in the mixture in a thin layer of substantially uniform horizontal section above a pervious support, igniting the combustible at the surface of the mixture, causing a uniform rate of combustion from top to bottom through said mixture while maintaining the temperature below the fusion point of the ore, withdrawing the products of combustion, and condensing the volatilized mercury therefrom.

2. In the process of distilling mercury from native mercury bearing material, the steps which consist in spreading the material in finely divided condition and a small amount of a combustible in a thin layer on a pervious support, igniting the mixture at the top and causing combustion to progress from top to bottom with a substantially uniform rate of heating while maintaining the temperature below the fusion point of the material.

3. The process of recovering mercury in metallic form from mercury bearing material in small particles, which consists in spreading the material in a thin, uniform, permeable layer mingled with carbonaceous material in quantity sufficient to produce a continuously progressive zone of combustion through the layer, igniting the layer, causing air to pass through said layer in volume sufficient to cause a zone of combustion to travel rapidly through the layer at a rate sufficient to heat the particles to a temperature above the volatilization point of the

mercury, thereby to heat uniformly all of the particles and volatilize the mercury contained therein, and cooling the gases issuing from said layer to condense the volatilized mercury.

4. The process of extracting mercury from mercury bearing ores which consists in dividing the ore into relatively fine particles and mixing combustible material therewith in limited quantity whereby complete fusion of the ore particles is prevented, spreading said mixture in a thin layer and igniting the combustible at one surface of the layer, causing a zone of combustion to progress through said layer at a suitable rate to heat the particles in said zone uniformly above the volatilization temperature of mercury, causing the volatilized mercury to be carried off with the gases of combustion, cooling the gaseous products and collecting the mercury.

5. The process of extracting metallic mer-

cury from mercury bearing ores which consists in dividing ores into relatively fine particles and mixing combustible material therewith in limited quantity whereby fusion of the ore particles is substantially prevented, spreading said mixture in a thin layer and igniting the combustible at one surface of the layer, causing currents of air to pass through said layer in volume sufficient to produce a zone of combustion moving progressively through said layer and simultaneously volatilizing the mercury in said particles whereby the gas stream is admixed with a relatively high percentage of mercury vapor, then cooling said gas stream to condense the mercury and collecting said mercury.

Signed at New York, in the county of New York and State of New York, this 8th day of May, A. D. 1924.

REED W. HYDE.