No. 618,104. Patented Jan. 24, 1899.

J. W. KENEVEL.

PROCESS OF DESULFURIZING AND DEPHOSPHORIZING COAL OR ORES.

(Application filed Aug. 7, 1897.)

(No Model.)

Fig. 2

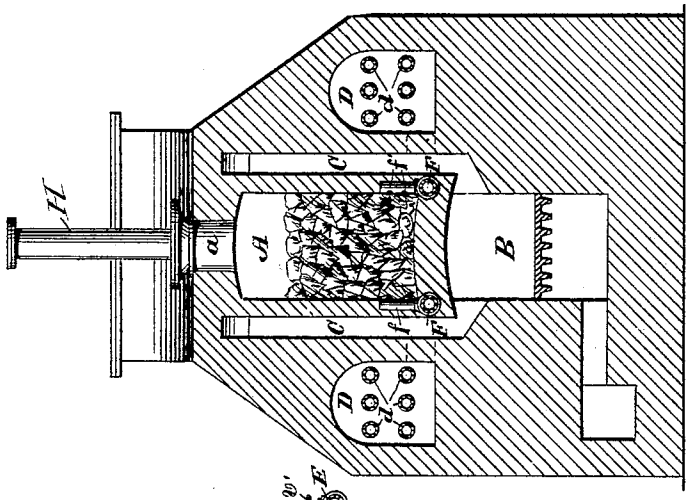
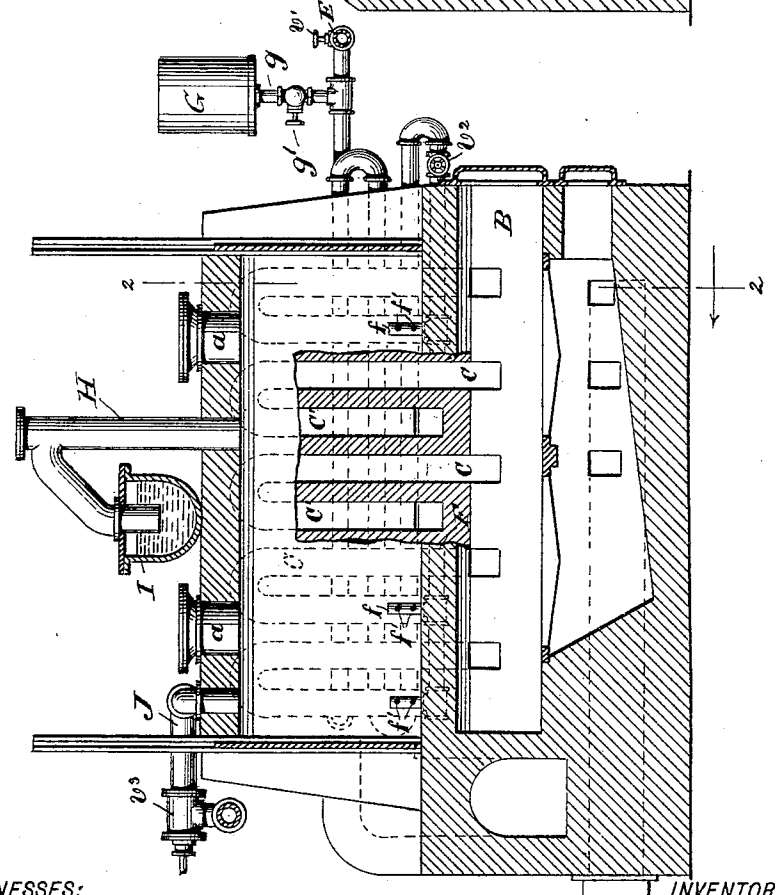


Fig. 1



WITNESSES:

John A. Bergstrom

Wm. J. Handover

INVENTOR

Jeannot W. Kenevel

BY

Murphey & Metcalf

ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JEANNOT W. KENEVEL, OF NEW YORK, N. Y., ASSIGNOR TO THE KENEVEL-COKING-PROCESS COMPANY, OF CHICAGO, ILLINOIS.

PROCESS OF DESULFURIZING AND DEPHOSPHORIZING COAL OR ORES.

SPECIFICATION forming part of Letters Patent No. 618,104, dated January 24, 1899.

Application filed August 7, 1897. Serial No. 647,433. (No specimens.)

To all whom it may concern:

Be it known that I, JEANNOT W. KENEVEL, a citizen of the United States of America, and a resident of the city, county, and State of New York, have discovered certain new and useful Improvements in the Process of Desulfurizing and Dephosphorizing Coal or Ores, of which the following is a description.

The effect of the application of my improved process to sulfur and phosphorus bearing coals and ores is the elimination and removal of a larger percentage of those deleterious elements than has heretofore been possible and that in a simple, effective, and economical manner.

In carrying out my process the coal or ore to be treated is charged into a suitable oven or retort and sufficient heat applied to cause the liberation of the volatile elements. As those elements are liberated one or more jets of steam (preferably superheated) or hot air carrying a comparatively small percentage of a vaporized acid solvent of sulfur or phosphorus is discharged into the body of coal or ore preferably in such a manner as to necessarily pass through the whole body of the same. The sulfur and phosphorus liberated by the combined action of the heat and the acid solvent vapor, together with the gases and volatile elements, are carried out of the charge and the oven by the current of steam or air, which is of sufficient force for that purpose. The gases and other by-products may then be secured by means now well-known and not necessary to be described.

The acid solvent which I have commonly used with success and which I prefer on account of its effectiveness and low cost is acetic acid, and it may be successfully employed in the form of good commercial vinegar. The acid is preferably fed into the steam or air pipes at a point sufficiently remote from the oven to allow of its vaporizing and incorporating with the steam or air, or, in other words, becoming thoroughly and evenly mixed with and to a certain extent saturate the same. The action upon the charge of coal or ores is therefore uniform throughout the entire body. The superheating of the steam or air facilitates this equal distribution and at the same time prevents the cooling of the charge and the consequent retarding of the process.

For the purpose of clearly explaining my process I have shown one form of apparatus adapted for such use; but it will be understood that I do not limit myself to any particular form of apparatus.

In the accompanying drawings, wherein like reference-letters indicate like or corresponding parts, Figure 1 is a longitudinal section with parts broken away to show the construction, and Fig. 2 is a transverse section in line 2 2 of Fig. 1.

The coal or ore to be treated is placed in the retort A through the charging-openings *a*. The products of combustion from the furnace B pass up through the flues C, which are arranged on either side of the retort, and are connected at their upper ends to the return-flues C′, Fig. 1, the lower ends of which communicate with the flues D on each side of the retort. In the flues D are placed the superheating-pipes *d*, which pipes are connected with the main steam or air pipe E, leading from the generator, (not shown,) if steam be employed in the process, or from a suitable air-supply under pressure if air be employed.

Below and on each side of the retort are arranged the pipes F, connecting with the superheating-pipes *d*, and provided with a series of nozzles *f*, through which the saturated air or steam is discharged into the retort, preferably near the bottom of the charge. Suitable valves v' and v^2 are provided for the purpose of controlling communication between the main supply-pipe E and the superheating-pipes *d* and also between the latter and the pipes F. A suitable tank or receptacle G for containing a supply of acid is arranged to discharge its contents into the pipe E. A suitable valve g' is so arranged as to control the flow of the acid into the pipe E, which acid will be immediately vaporized and become mingled with the current of air or steam in said pipe and be carried forward therewith into the retort.

The retort is provided with an outlet H, by which the gases may be carried to the hydraulic main I, which is of well-known construction. It is also provided with an outlet

J, provided with a valve v^3, through which the steam or air, together with the liberated gases, may, if preferred, be permitted to escape through the pipe N, as hereinafter set forth.

Having thus briefly described the form of apparatus which I preferably employ, I will now proceed to give the steps constituting my improved process.

The retort A having been charged with the coal or ore to be treated heat is applied, and as the temperature of the charge rises the hydrocarbon and lighter sulfur-gases which are liberated first escape from the retort, preferably by the outlet H into the hydraulic-main I. As the rising temperature approaches the point at which the denser sulfur-gases begin to be liberated and preferably before the flaming-point is reached, the valves v^2, v^3, and g' are opened, the valve g' being opened only slightly to permit the acid in the tank G to pass slowly into the pipe E. The steam or air in the superheating-pipes on its way to the pipe F will vaporize and carry along with it in a minute state of subdivision the acid which escapes from the tank G, thus saturating the air or steam, as stated. The steam or air thus charged with the acid solvent is forcibly discharged into the retort near the bottom of the charge through the nozzles f in the form of jets and is under sufficient pressure to cause the jets to quickly penetrate the charge and escape from the retort through the outlet H or the outlet J. The acid thus carried into the retort acts as a solvent for the sulfur and phosphorus contained in the charge, and the elements of the air or steam will combine partially with the sulfur or phosphorus, forming sulfurous and phosphorous compounds, which will escape from the retort through the outlet H or J, the uncombined sulfur being mechanically carried out therewith by the current of air or steam. This treatment need not necessarily be continuous during the liberation of the volatile elements. In some cases the steam or air may be introduced for short periods at intervals; but it is better that the introduction of the steam or air be discontinued as soon as the charge is freed from its volatile elements, especially when coal is under treatment in the manufacture of coke. In such case if the steam or air be introduced after the coal is coked the quality of the coke will be seriously impaired and reduced in quantity.

The exact time at and during which the air or steam should be introduced will, within the limits above stated, vary considerably with the refractoriness of the coal or ore under treatment; but these points will be readily determined by a skilled operator.

In the form of apparatus shown it will be observed that the retort is closed and preliminarily heated externally. This form, though preferred, may be modified without departing from the spirit of my invention. Hence I do not limit myself to such, the broad idea of my process consisting in liberating the volatile elements from the charge by means of heat and during this step subjecting the charge to the action of a hot gas containing oxygen, such as steam or hot air charged or saturated with an acid solvent of metalloids, such as sulfur or phosphorus.

I wish it understood that the terms employed in this specification are intended to embrace steam, gaseous steam, or other hot gases.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described process of desulfurizing and dephosphorizing coal or ores, which consists in subjecting the charge while in a heated condition and during the liberation of the volatile elements to the action of steam charged with an acid solvent of a metalloid such as sulfur or phosphorus, substantially as described.

2. The herein-described process of desulfurizing and dephosphorizing coal or ores, which consists in subjecting the charge while in a heated condition and during the liberation of the volatile elements to the action of superheated gas charged with an acid solvent of a metalloid such as sulfur or phosphorus, substantially as described.

3. The herein-described process of desulfurizing and dephosphorizing coal or ores, which consists in forcing superheated gas charged with an acid solvent of a metalloid such as sulfur or phosphorus through the charge during the liberation of the volatile elements, substantially as described.

4. The herein-described process of desulfurizing and dephosphorizing coal or ores which consists in subjecting the charge while in a heated condition and during the liberation of the volatile elements to the action of a heated gas charged with acetic acid, substantially as described.

5. The herein-described process of desulfurizing and dephosphorizing coal or ores which consists in forcing superheated steam charged with acetic acid through the charge of coal or ore during the liberation of the volatile elements, substantially as described.

6. The herein-described process of desulfurizing or dephosphorizing coal or ores, which consists in subjecting the charge while in a heated condition and during the liberation of the volatile elements, to the action of hot gas containing oxygen and charged with an acid solvent of metalloids such as sulfur or phosphorus, substantially as described.

7. The herein-described process of desulfurizing or dephosphorizing coal or ores, which consists in subjecting the charge while in a heated condition and during the liberation of the volatile elements, to the action of hot gas containing oxygen and charged with acetic acid, substantially as described.

8. The herein-described process of desulfurizing or dephosphorizing coal or ores, which consists in forcing superheated gas containing oxygen and charged with an acid solvent of metalloids, such as sulfur or phosphorus, through the charge during the liberation of the volatile elements, substantially as described.

9. The herein-described process of desulfurizing coal or ores which consists in forcing superheated gas charged with an acid solvent of sulfur through the charge during the liberation of the volatile elements, substantially as described.

JEANNOT W. KENEVEL.

Witnesses:
CHAS. A. MURPHEY,
JOSIAH H. MEAD.