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APPARATUS FOR PRODUCING ACTIVATED CARBON

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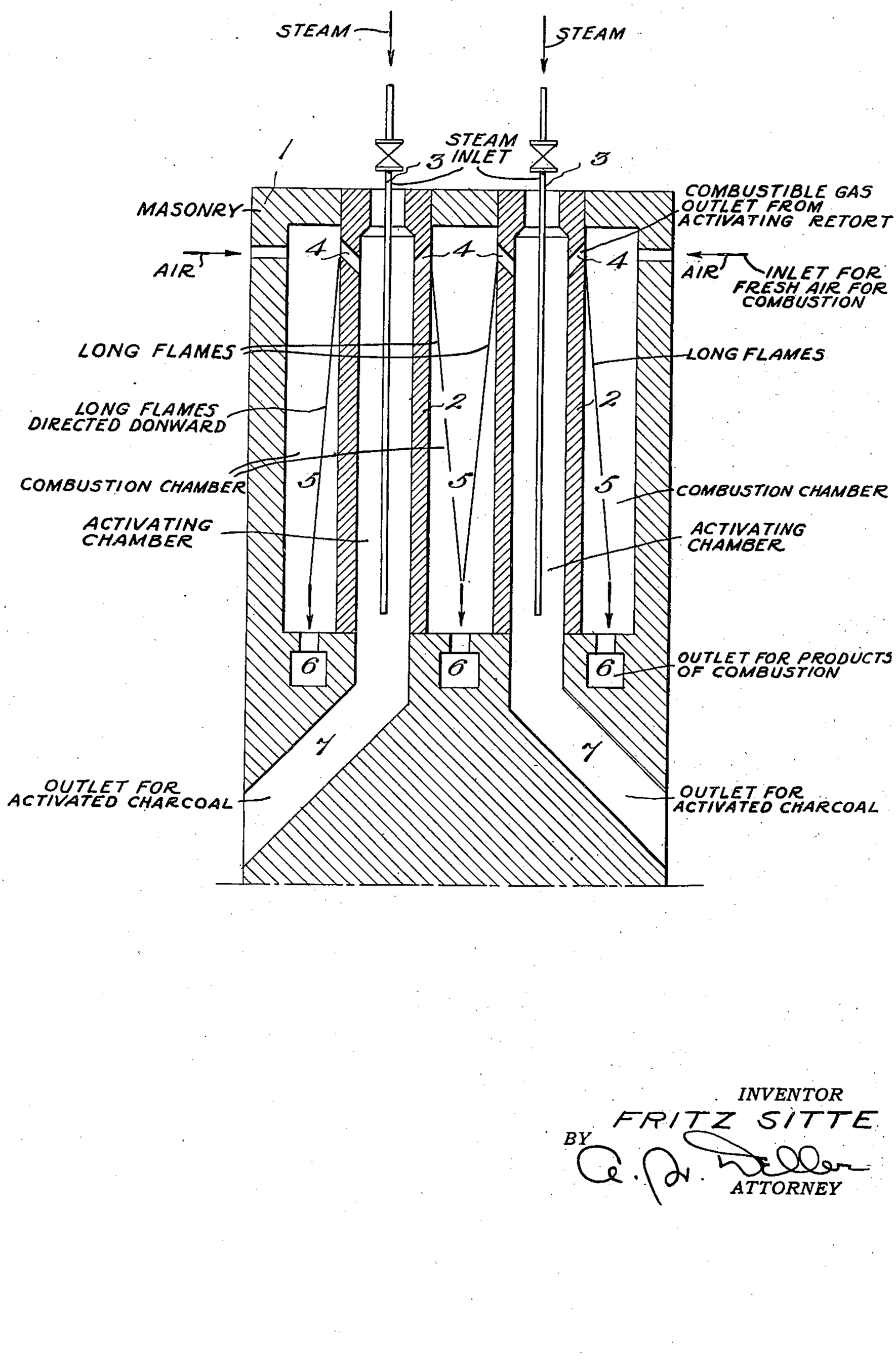

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APPARATUS FOR PRODUCING ACTIVATED CARBON

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5 Claims. (Cl. 202—124)

The present invention relates to an apparatus for producing activated carbon.

It is an object of the present invention to provide vertical ovens for activating carbon in which the full length of the carbon containing retorts are freely arranged in the heating chamber.

It is another object of the present invention to provide an apparatus in which combustible gases produced during the activating process are employed for the indirect heating of the carbon containing retorts.

It is a further object of the present invention to provide an apparatus for activating carbon in which the combustible gases given off by the carbon during treatment flow from the top of the retort to the bottom in a uniform manner.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawing which is a vertical section of one embodiment of the present invention.

Broadly speaking carbonaceous material, particularly charcoal, is activated by treatment with steam and carbonic acid in vertical retorts in such a manner that the combustible gases produced during the activating process are burned in the oven and are employed for the indirect heating of the retorts. Generally speaking, the waste gases of the activating process are burned beneath the oven in a heating chamber in admixture with air and the gases of combustion are conducted upward through conduits.

It has been discovered that special advantages are obtained by carrying out the activating process, in accordance with the principles of the present invention, in an oven in which the retorts throughout the full length thereof are freely arranged in the heating chamber. The vertical retorts are provided with openings at the upper ends thereof which lead from the interior to the exterior of the retort in an upwardly inclined direction. These openings permit transfer of the combustible waste gases of the activating process into the oven space while the outlets for the waste gases of combustion are uniformly distributed at the lower end of the heating chamber so that the heating gases are drawn from the top to the bottom in a uniform flow. Thereby the retorts are uniformly surrounded by these gases on all sides. Preferably, the main air inlets are provided in the upper portion of the retort chamber. In order to obtain complete combustion, additional air may also be introduced in other sections of the oven. Steam is introduced into the retort at the bottom thereof, preferably by means of a tube or conduit which is carried through the full length of the retort from the top, down. In addition to the surprising simplicity of construction, the oven constructed in accordance with the principles of the present invention has a further advantage. Due to the fact that the transfer of heat necessary for carrying out the strongly endothermic activation reaction may be effected without hindrance, the activating process is carried out much faster. Moreover, due to the uniform distribution of heat in the oven space and consequently throughout the retort area local overheating of the carbon being treated is avoided. In this manner the formation of graphite is avoided to a very great extent and in fact is practically eliminated.

While in the past the finest particles of the material being treated quickly covered and obstructed the heat conduits in the present construction the dust is deposited practically entirely on the bottom of the oven space and can be readily removed together with fine carbon particles which are always carried away by the waste gases during the activation periods of great intensity.

The novel oven of the present invention permits the activation of the material being treated from the bottom to the top of the mass and consequently permits activation of the finely divided material in particular. As a result the novel construction of the present invention provides further advantages in that the full length of the retort is utilized to a great extent for the purpose of activation and the carbon at the discharge end automatically is at the lowest temperature. Furthermore, the discharge of carbon monoxide when opening the retorts for the purpose of withdrawing the activated material is positively eliminated. In addition at that point in the retort where the speed of activation would be greatest due to the high steam concentration the retort temperature is automatically maintained at a lower level by the dilution of the steam with combustible gases produced during the activation. In this manner a completely uniformly progressing activating process results.

Preferably, retorts are constructed or constituted of ceramic material of good heat conductivity, of iron or of heat-resisting steel. An embodiment of the present invention which has given satisfactory results in practical operation is illustrated in the accompanying drawing. The oven 1 is fabricated of ceramic material in which are located retorts 2 provided with conduits 3 for the introduction of steam and with the openings 4 extending to the free oven space. In the com-

bustion chamber 5 the combustion is carried out by air introduced thereinto. The burning gases are drawn downward in the conduits or channels 6 by means of the draft of a stack or a fan and introduced into the flue through channels if desired, in conjunction with waste heat utilizing devices, such as boilers or steam preheaters. As far as possible, the channels or conduits 6 are uniformly arranged in the bottom of the oven so that the gases are not subjected to any disturbance but move in a downward direction causing uniform distribution of heat. The activated carbon may be continuously or intermittently removed from the carbon space 7.

Although the present invention has been described in conjunction with a preferred embodiment, it is to be understood that modifications and variations thereof may be made as those skilled in the art will readily understand. Such variations and modifications are to be considered within the purview of the present specification and the scope of the appended claims.

I claim:

1. An apparatus for the activation of carbonaceous materials which comprises an oven, a plurality of vertical retorts in said oven, means for introducing carbonaceous material to be activated into said retorts, means for introducing steam into said retorts at a point near the bottom of a column of carbonaceous material to be activated, conduit means near the upper extremities of said retorts for removing combustible gas from said retorts, said conduit means extending in a downwardly inclined direction from the exterior of said retorts to the interior thereof, means in the upper portion of said oven for the introduction of air to support combustion of said combustible gases for heating said retorts, outlet means in the lower portion of said oven for the removal of the products of the combustion of said combustible gases, said outlet means being uniformly distributed at the bottom of said oven to provide uniform flow of said combustion gases for heating said oven from the top to the bottom thereof; means to create a flow of burning combustible gases from the tops of said retorts to said outlet means whereby said retorts are heated throughout the height thereof, and means for removing activated carbonaceous material from said retorts.

2. An apparatus for the activation of carbonaceous materials which comprises an oven having a heating chamber, a plurality of vertical retorts in said heating chamber, sealable closure means at the upper extremities of said retorts for introducing carbonaceous material to be activated, means disposed in said closure means constructed and arranged to introduce steam into said retorts near the lower extremities of columns of carbonaceous material in said retorts, means near the upper extremities of said retorts for the escape of combustible gases from said retorts into said heating chamber, said means extending in a downwardly inclined direction from the exterior of said retorts to the interior thereof, means for introducing oxygen containing gases into said heating chamber to support combustion of said combustible gases for heating retorts, outlet means uniformly distributed in the floor of said heating chamber for the removal of the products of combustion of the aforesaid combustible gases, means to create a flow of said combustible gases in a predetermined direction from the outlets of said retorts to the aforesaid floor outlet means whereby uniform flow of said gases for heating is obtained and said retorts are heated throughout the height and periphery thereof, and means for removing activated carbonaceous material from said retorts.

3. An apparatus for the activation of carbonaceous material which comprises an oven having a heating chamber, a plurality of freely arranged vertical retorts disposed in said heating chamber to provide heat transfer throughout the entire surface of said retorts, means for introducing steam into said retorts, said steam inlet means extending from the tops of said retorts to the region of the bases thereof and having a steam outlet at the lower extremity of each steam inlet means, outlets in the upper portions of said retorts for the escape of combustible gases generated during the activation of said carbonaceous material, said outlets extending in a downwardly inclined direction from the exterior to the interior of said retorts; air inlet means in the region of the upper extremities of the walls of the said heating chamber for the introduction of gases to support the combustion of said combustible gases, said air inlet means being constructed and arranged in relation to said retort outlets for the escape of combustion gases to provide a zone of highest temperature in that region of said retorts in which the dilution of the steam is greatest; outlet means uniformly disposed in the base of said heating chamber for the withdrawal of the products of the combustion of said combustible gases, means associated with the aforesaid uniformly disposed base outlet means adapted to create a uniform flow of burning gases from the tops of said retorts to the bottoms thereof whereby the hottest products of combustion surround that portion of the retorts in which the steam is most dilute, and means associated with the bases of said retorts constructed and arranged to provide for the removal of activated carbonaceous material substantially without the escape of noxious gases from said retorts.

4. An apparatus for the activation of carbonaceous material which comprises an oven having a heating chamber, air inlet means in said heating chamber, burned gas outlet means uniformly disposed in the floor of said chamber for the removal of products of combustion, a plurality of retorts freely arranged in said chamber with the greatest linear dimension vertical, said retorts being uniformly heated by said products of combustion, means extending from tops of said retorts constructed and arranged to introduce steam into said retorts in the neighborhood of the lower extremities thereof, outlet means in the upper portions of the walls of said retorts extending in a downwardly inclined direction from the exterior to the interior of said retorts for the escape of combustible gases into said heating chamber, and means associated with the chamber outlets capable of creating a uniform downward flow of burning gases from the tops to the bottoms of said retorts whereby local overheating of the carbonaceous material to be treated is avoided and the production of graphite practically eliminated.

5. An apparatus for the activation of carbonaceous material which comprises a tubular heat-resistant container for carbonaceous material to be activated freely arranged in a heating chamber, said tubular container being provided with closure means at the upper extremity thereof, steam inlet means disposed in said closure means and extending within said tubular container to a

point in the neighborhood of the bottom thereof, said steam inlet means being constructed and arranged to introduce steam near the bottom of said tubular container, gas outlet means near the top of said tubular container arranged in an upwardly inclined position to introduce combustible gases generated during activation of said carbonaceous material into said heating chamber, means for burning said combustible gases as a stream of uniformly flowing burning gases completely surrounding said tubular container in said heating chamber, the temperature of said stream of burning gases being greatest in the region of the upper extremity of said tubular container where the concentration of the steam is lowest, and means for removing activated carbonaceous material.

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