R. W. POINDEXTER.

PROCESS OF PRODUCING FINELY DIVIDED CARBON.

APPLICATION FILED JAN. 6, 1920.

1,402,957. Patented Jan. 10, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

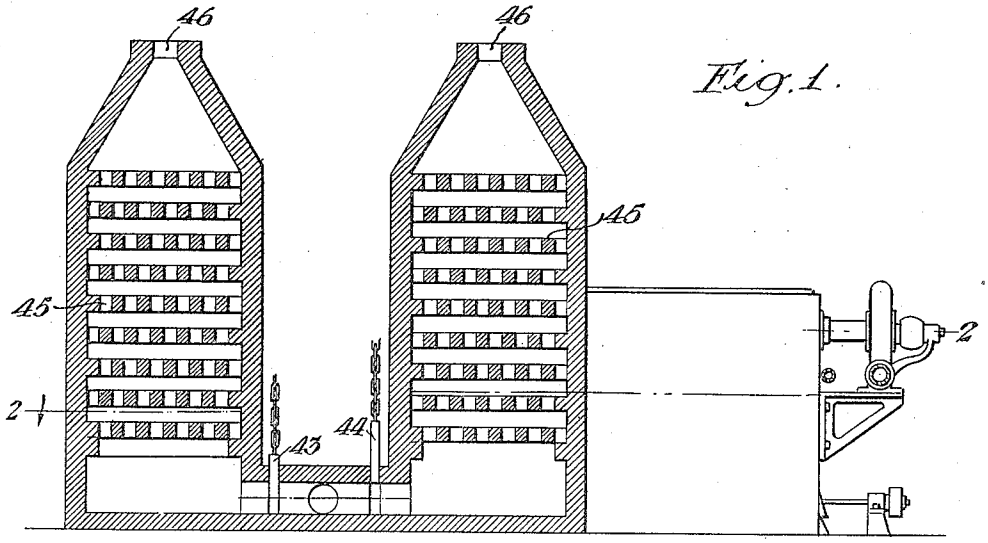
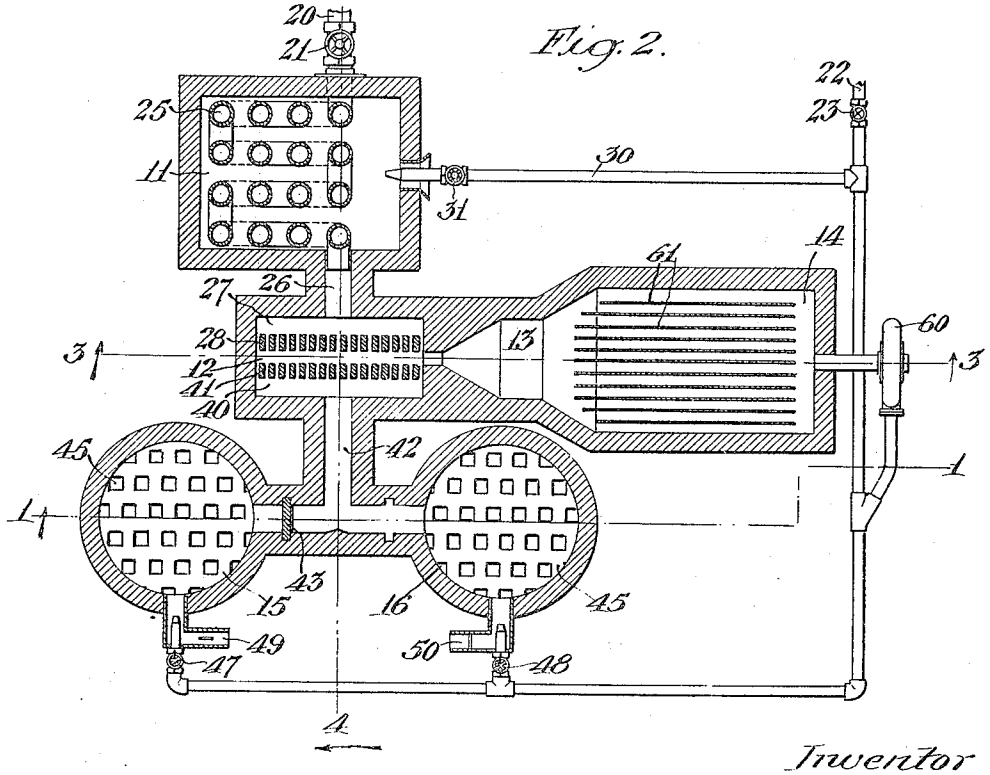


Fig. 2.



Inventor

Robert Wade Poindexter,

by Graham & Mann

Attorneys.

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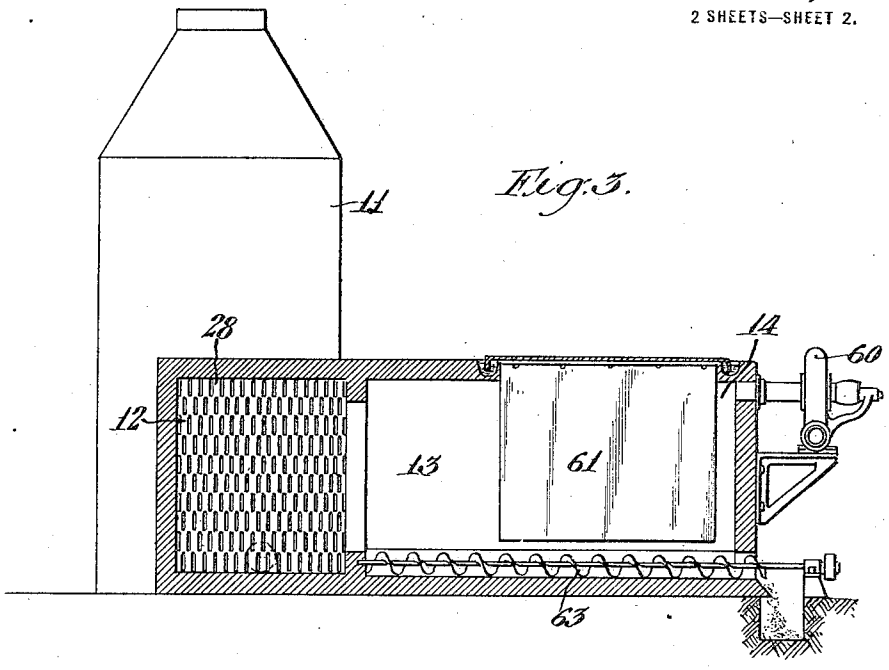


Fig. 3.

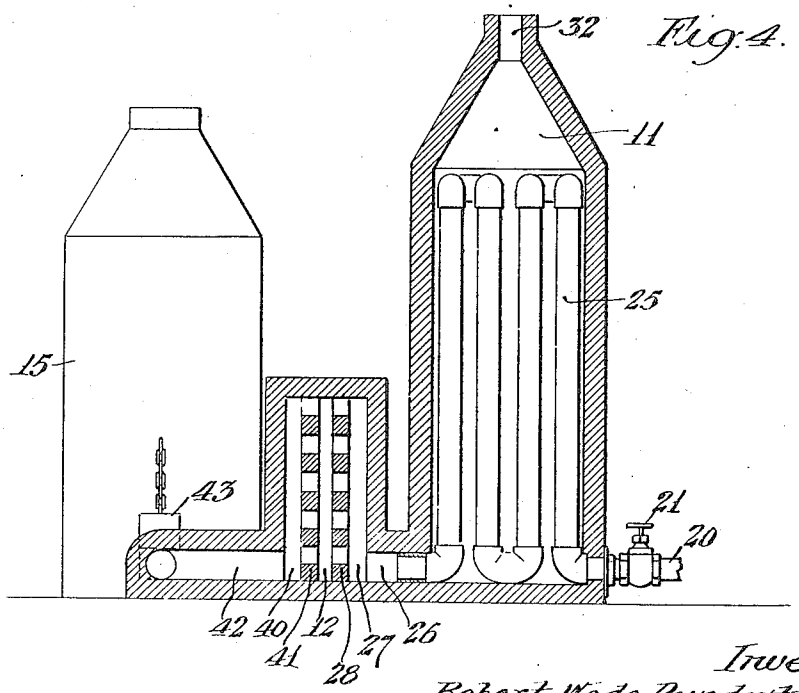


Fig. 4.

Inventor

Robert Wade Poindexter,

by Graham + Kerr Attorneys

UNITED STATES PATENT OFFICE.

ROBERT WADE POINDEXTER, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO NORRIS GOODWIN, OF LOS ANGELES, CALIFORNIA.

PROCESS OF PRODUCING FINELY-DIVIDED CARBON.

1,402,957. Specification of Letters Patent. Patented Jan. 10, 1922.

Application filed January 6, 1920. Serial No. 349,830.

To all whom it may concern:

Be it known that I, ROBERT WADE POINDEXTER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented a new and useful Improvement Comprising a Process of Producing Finely-Divided Carbon, of which the following is a specification.

My invention relates to the art of producing finely divided carbon such as is commercially used as a pigment and for other purposes. Carbon to be valuable for most purposes must be produced in an extremely finely divided state and must be free from tars or other binding materials which tend to impair its color and render it otherwise unsuitable for certain industrial purposes notably in connection with the manufacture and treatment of rubber.

The principal object of my invention is to provide a process and apparatus by which carbon may be produced in high yield quantity at a low cost and in an extremely finely divided condition reasonably free from tars, oils or other deleterious substances.

A further object of my invention is to provide a process that will be highly efficient and economical.

Further objects and advantages will be set forth more in detail hereinafter.

Referring to the drawings which are for illustrative purposes only.

Fig. 1 is a side elevation partly in section on a plane represented by the line 1—1 of Fig. 2.

Fig. 2 is a plan view partly in section on a plane represented by the line 2—2 of Fig. 1.

Fig. 3 is a section on a plane represented by the line 3—3 of Fig. 2.

Fig. 4 is a section on a plane represented by the line 4—4 of Fig. 2.

The apparatus illustrated in these drawing consists primarily of a gas heated chamber 11, a mixing chamber 12, a reaction chamber 13, a collection chamber 14 and two air heating stoves 15 and 16. Many different hydrocarbons may be used for the production of finely divided carbon, but I have found that natural gas furnishes a cheap and satisfactory source of supply. This gas is supplied to a pipe 20, controlled by a valve 21 and also to a pipe 22 controlled by a valve 23. The gas from the pipe 20 is carried through a heating coil 25 consisting of vertical pipes joined at the top and bottom to form a continuous coil located in the heating chamber 11. The gas is heated in this coil as will hereinafter be explained being delivered through an opening 26 into a passage 27 which is separated from the mixing chamber 12 by a checker work 28 of fire brick. This checker work provides a multiplicity of narrow slots or openings through which the hot gas is forced in a large number of jets. The gas heating chamber 11 is heated primarily by means of gas supplied through the pipe 22 to a pipe 30 which is controlled by a valve 31, gas being forced into the chamber 11 where it is ignited, the products of combustion escaping through an opening 32 at the top thereof. Air or another gas or mixture of gases is delivered into the mixing chamber 12 from a passage 40 through a checker work 41 which is similar in construction to the checker work 28. The passage 40 is supplied through a throat 42 from one of the stoves 15 or 16, valves 43 and 44 being provided to shut off the throat 42 from either of these stoves. The stoves 15 and 16 consist of towers which are filled with a brick checker work 45 and which are provided with an opening 46 in the extreme top thereof. The stoves are heated initially by natural gas supplied through the pipe 22, through valves 47 and 48 air being admitted through pipes having dampers 49 and 50. In starting the apparatus natural gas is admitted to the bottom of the stoves together with combustion air, this gas being burned in the stoves and thereby heating the checker work 45 which will store up the heat for considerable periods. Two stoves 15 and 16 are provided so that one of them may be heated while air is being heated in the other. If it is desired to heat the stove 15, for example, the valve 43 is closed, the valve 47 is opened, and a damper 49 is opened allowing combustion to take place in the stove and heating up the checker work 45. The stove 16 may of course be heated by closing the valve 44 and opening the valve 48 and the damper 50. An exhaust fan 60 is provided for the purpose of forming a partial vacuum in the collection chamber 14, this vacuum tending to pull gas into the gas manifold 27 and to pull air in the air passage 40. The stove 16 having been previ-

ously heated, for example, the valve 44 is opened and air is pulled in through the opening 46 in the top of the stove 16 passing through the checker work in which it is highly heated and passing through the throat 42 into the passage 40; this air passes in a series of tiny jets through the checker work 41, these jets mixing with the jets of gas from the gas manifold 27. The mixture of air and gas passes from the mixing chamber 12 into the reaction chamber 13 and a partial combustion of the natural gas may take place in the reaction chamber 13 with the result that hydrogen is liberated and finely divided free carbon is formed. This free carbon is deposited on a series of plates 61, and as these deposits increase the carbon falls into the bottom of the collection chamber 14 being removed therefrom by means of a screw conveyor 63 driven from any suitable source. A mixed gas comprising hydrogen, together with carbon monoxide and some carbon dioxide, is drawn off through the exhaust fan 60 and after the apparatus is once started this mixed gas is fed through the pipe 30 into the gas heating chamber 11 where it is burned to supply the necessary pre-heating to the gas in the pipes 25. The mixed gas is also fed through the valves 47 and 48 into one of the stoves 15 or 16 for the purpose of heating the brick checker work. When the apparatus is operating properly no gas is supplied to the pipe 22, the valve 23 being closed, the necessary heat for combustion being supplied by the mixed gases withdrawn from the chamber 14 by the exhaust 60.

In practice I find it is desirable to heat the gas in the coils 25 to a point just below the decomposition temperature, which in practice may be 800 to 1100° C., the gas passing through the checker work 28 is therefore at a temperature just below its decomposition temperature and very little heat need be supplied to decompose and produce the carbon black. The necessary heat for decomposition when operated in this manner is furnished by the highly heated air delivered from the stoves 15 or 16; this air may be very much higher in temperature than the decomposition temperature of the natural gas in which case a very small volume need be supplied to break the gas up. This breaking up is partially accomplished when air is used by the combustion of a portion of the natural gas but the greater portion is broken up by the high temperature of the air, in fact I have found that non-oxidizing gases may be used in the stoves 15 and 16 with perfect success, it being, however, more convenient to use air.

I claim as my invention:—

1. A process of producing a finely divided carbon which comprises heating a hydrocarbon to a degree slightly less than its decomposition temperature; mixing said hydrocarbon with a gas heated above said decomposition temperature so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

2. A process of producing a finely divided carbon which comprises heating a hydrocarbon to a degree slightly less than its decomposition temperature; mixing said hydrocarbon with air in such a manner that a partial combustion takes place so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

3. A process of producing a finely divided carbon which comprises heating a hydrocarbon to a degree slightly less than its decomposition temperature; mixing said hydrocarbon with heated air in such a manner that a partial combustion takes place so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

4. A process of producing a finely divided carbon which comprises heating a hydrocarbon to a degree slightly less than its decomposition temperature; mixing said hydrocarbon with air heated above said decomposition temperature so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

5. A process of producing a finely divided carbon which comprises heating a gas containing hydrocarbons to a degree slightly less than the decomposition temperature of the hydrocarbons; mixing said gas with a gas heated above said decomposition temperature so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

6. A process of producing a finely divided carbon which comprises heating a gas containing hydrocarbons to a degree slightly less than the decomposition temperature of the hydrocarbons; mixing said gas with air in such a manner that a partial combustion takes place so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

7. A process of producing a finely divided carbon which comprises heating a gas containing hydrocarbons to a degree slightly less than the decomposition temperature of the hydrocarbons; mixing said gas with heated air in such a manner that a partial combustion takes place so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

8. A process of producing a finely divided carbon which comprises heating a gas containing hydrocarbons to a degree slightly less than the decomposition temperature of

the hydrocarbons; mixing said gas with air heated above said decomposition temperature so that a portion of the hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

9. A process of producing a finely divided carbon which comprises heating a gas above the decomposition temperature of a hydrocarbon; mixing said hydrocarbon with said heated gas so that a portion of said hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

10. A process of producing a finely divided carbon which comprises heating air in quantities insufficient to support complete combustion to a point near the decomposition temperature of a hydrocarbon; mixing said hydrocarbon with said heated air so that a portion of said hydrocarbon is broken up to form free carbon; and thereafter collecting said free carbon.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 30th day of December, 1919.

ROBERT WADE POINDEXTER.