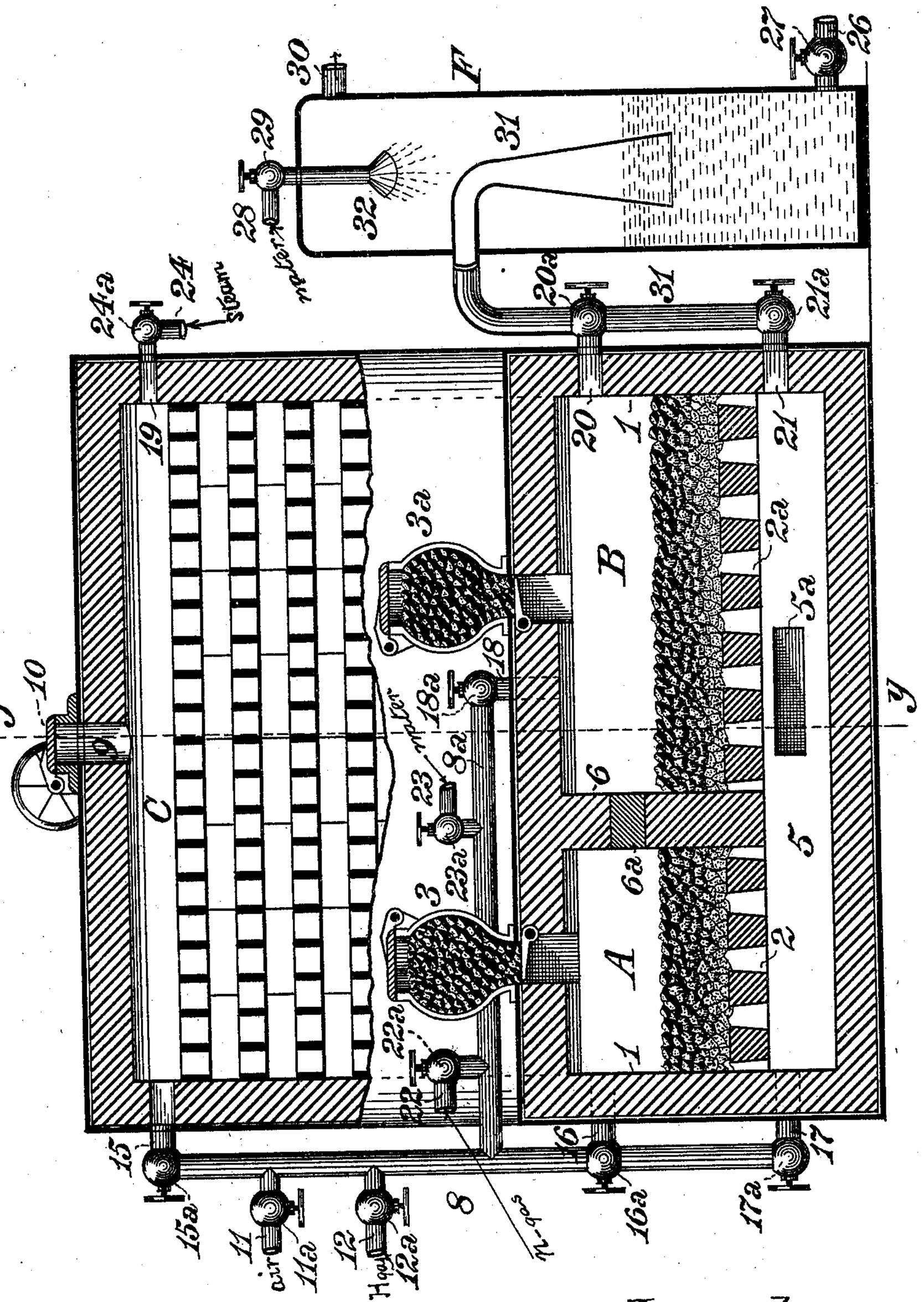
(No Model.) 2 Sheets—Sheet 1.

B. BRAZELLE.

PROCESS OF DISTILLING CARBONACEOUS MATERIAL.

No. 472,614. Patented Apr. 12, 1892.

FIG. 1.



Witnesses:
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(No Model.) 2 Sheets—Sheet 2.

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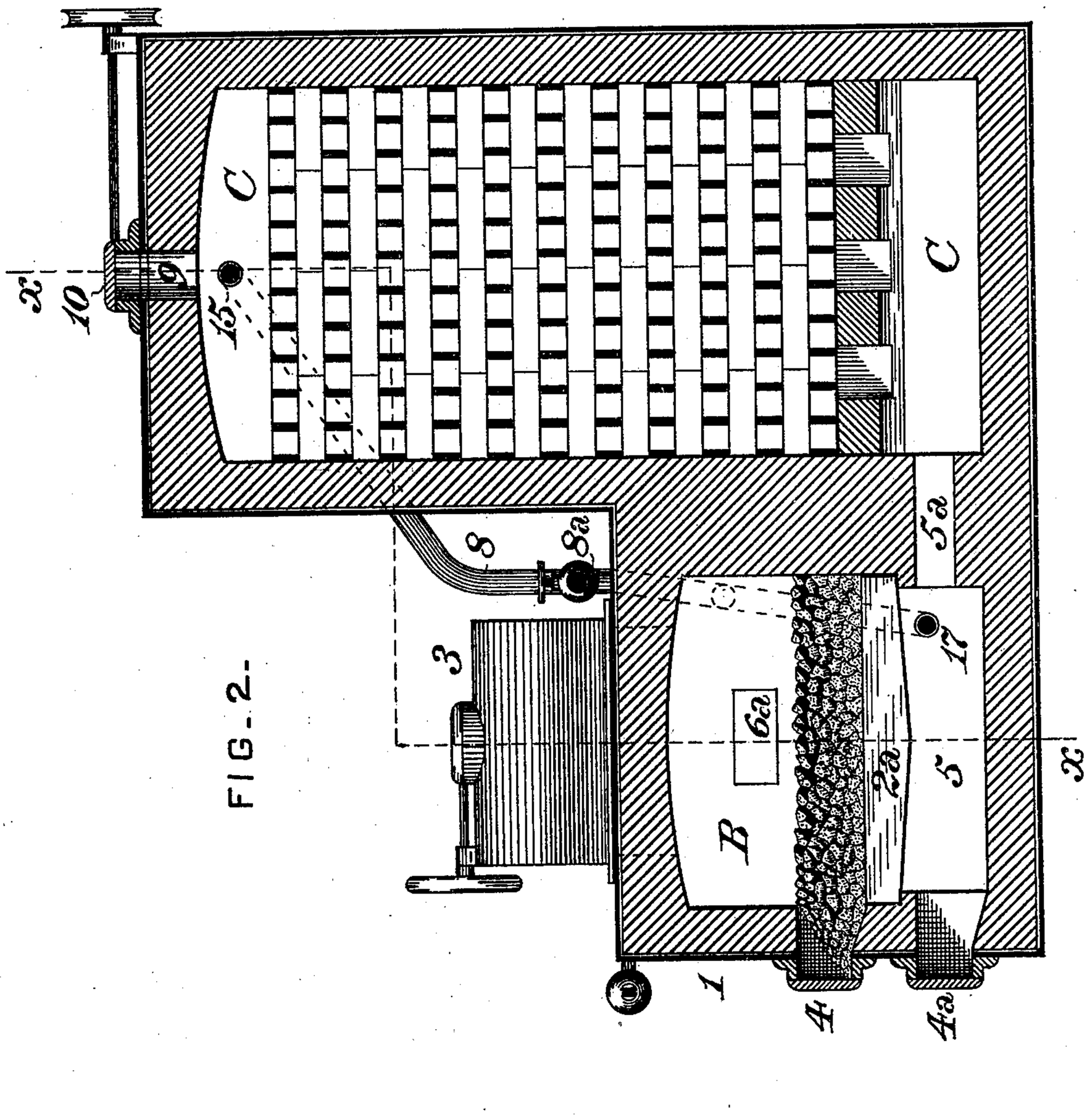

FIG. 2.

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UNITED STATES PATENT OFFICE.

BENJAMIN BRAZELLE, OF ST. LOUIS, MISSOURI.

PROCESS OF DISTILLING CARBONACEOUS MATERIAL.

SPECIFICATION forming part of Letters Patent No. 472,614, dated April 12, 1892.

Application filed March 20, 1891. Serial No. 385,752. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN BRAZELLE, of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Processes of Distilling Carbonaceous Material, of which improvement the following is a specification.

My invention relates to the production of tar, ammonia, gas, and other volatile matters by distillation from carbonaceous material; and its object is to economize and perfect such process by admitting of the employment of low-priced material for distillation and low-grade fuel, and also to expedite the manufacture and enable the process of distillation to be conducted in an apparatus of durable construction and comparatively small compass and cost.

To this end my invention, generally stated, consists in a novel method of effecting and combining the operations of heating bodies of carbonaceous and of refractory material, evolving and distilling the volatile constituents, and carbonizing the solid constituents of the carbonaceous material by the passage through the same of heated non-oxidizing gases, absorbing heat from the refractory material by forcing non-oxidizing gases through the same, and transferring the heat to the carbonaceous material.

The improvement claimed is hereinafter fully set forth.

The subordinate details of my improved process may be preliminarily stated as embodying the heating of a furnace or generator and a separate body of refractory material to a state of incandesence, charging the generator with carbonaceous material, forcing a blast of inert or non-oxidizing gas (such as hydrogen, nitrogen, &c., but, by preference, hydrogen) through the heated body of refractory material, and thence through the body of carbonaceous material, thereby evolving the volatile constituents and carbonizing the solid constituents thereof, passing the blast of non-oxidizing gas, together with the evolved products, through condensers and separators, delivering the evolved gas to a suitable holder, and from time to time withdrawing from the generator the carbonized material, &c.

In the accompanying drawings, which illustrate an apparatus adapted for the distillation and carbonization of carbonaceous material in accordance with my invention, Figure 1 is a vertical longitudinal section through the apparatus at the line $x\ x$ of Fig. 2, and Fig. 2 a transverse section at the line $y\ y$ of Fig. 1.

For the practice of my invention I provide a furnace or generator 1, which is divided by a vertical partition 6 into two fuel-chambers A and B, provided with fire brick grates 2 2^a, adapted to support charges of carbonaceous material, charging-hoppers 3 3^a, and raking-doors 4. An ash-pit 5 is formed below the grates and communicates by a passage 5^a with a chamber C, which is filled with pieces of refractory material, as a checker-work of fire-brick or the like, and is provided at top with an outlet 9, controlled by a valve 10. A pipe 8 and communicating branch pipe 8^a are provided with the following connections, viz: a pipe 15, leading into the refractory-material chamber C and controlled by a valve 15^a; a pipe 16, leading into the combustion-chamber A and controlled by a valve 16^a; a pipe 17, leading into the ash-pit 5 and controlled by a valve 17^a; a pipe 18, leading into the combustion-chamber B and controlled by a valve 18^a; a pipe 11, leading from an air-pump or pressure-blower and controlled by a valve 11^a; a hydrogen-supply pipe 12, leading from a source of supply of hydrogen or other non-oxidizing gas and controlled by a valve 12^a; a nitrogen-supply pipe 22, controlled by a valve 22^a, and a water-supply pipe 23, controlled by a valve 23^a. A steam-supply pipe 24, controlled by a valve 24^a, communicates with a pipe 19, leading into the top of the chamber C.

A condenser F, which is located adjacent to the furnace 1 and is partially filled with water, is provided at top with a water-supply pipe 28, controlled by a valve 29 and having a spraying-nozzle 32 on its discharge end within the condenser. A gas-outlet pipe 30 leads from the top of the condenser to a gas-holder, and a water and tar outlet pipe 26, controlled by a valve 27, leads from the bottom of the condenser to a suitable point of discharge. A dip or seal pipe 31, having its discharge end below the level of the water in the condenser, communicates by a pipe 20, controlled by a valve 20^a, with the combustion-chamber B,

and by a pipe 21, controlled by a valve 21^a, with the ash-pit 5.

In the operation of an apparatus provided with the above-described or equivalent means for the practice of my invention the hopper 3 and chamber A are charged with fuel, and the charge in the chamber A having been ignited the outlet-valve 10 of the chamber C, the valve 11^a of the air-blast pipe 11, and the valves 16^a and 17^a of the inlet-pipes 16 and 17 are opened. The blast of air entering the fuel-chamber A is forced down through the fuel into the ash-pit 5, where the gaseous products are ignited and burned by the air-blast entering through the pipe 17. The heated products of combustion enter the chamber C through the passage 5^a and pass upwardly through said chamber, heating the body of refractory material therein. When said refractory material has been heated at bottom to, say, from 2,500° to 3,600° and at top to about 400°, the air-blast valves and the outlet-valve 10 are closed, and (if it is desired to distill and carbonize coal) a charge of coal is dropped from the hopper 3^a, which has been previously charged, upon the grate 2^a of the chamber B. The valve 20^a of the seal-pipe 31 is opened and the valves of the gas-supply pipe 12 and the pipe 15, leading into the chamber C, are opened. A blast of hydrogen or other non-oxidizing gas is then forced through the pipe 15 into the chamber C, thence downward through the hot refractory material therein through the passage 5^a into the ash-pit 5, and thence up through the charge of coal in the chamber B, heating the charge, evolving the gaseous, tarry, and other volatile products and coking the coal.

The hydrogen blast and evolved products from the charge pass through the pipe 31 downward into the water in the condenser F. The major part of the tar, ammonia, &c., remains in the water; but the hydrogen-gas blast and the gases that are evolved from the coal escape upward, meeting a spray of water from the nozzle 32, by which they are further cooled and washed, and the gas is forced out through the pipe 30 to the holder. When the volatile and tarry products have been driven off from the charge of coal or other carbonaceous material and the hydrogen blast has reduced the temperature of the refractory material in the chamber C to such a low degree that the blast is no longer effective to evolve the volatile products, the hydrogen blast is shut off and all other open valves are closed. The outlet-valve 10 and the air-blast valves are now opened and the apparatus reheated, as previously described. When sufficiently heated, the air-blast valves and the outlet-valve 10 are closed and the valve 20^a of the seal-pipe 31 is opened. A charge of coal is dropped upon the incandescent coal in the chamber B, the valve 12^a of the gas-blast pipe 12 and the valve 15^a of the pipe 15 are opened, and the hydrogen-gas blast is forced down through the heated refractory material in the chamber C into the ash-pit 5 and up through the coal in the chamber B. The gases and volatile products pass into the condenser F, as before described. All valves, except the valve 21^a of the seal-pipe 31, are now closed and the valves 23^a of the pipe 23 and 18^a of the pipe 18 are opened, and a spray of water and steam is passed into the chamber B and down through the hot coke therein, cooling the same, into the ash-pit 5. The steam and generated gases pass through the passage 21 and seal pipe 31 into the condenser F, and the gases pass thence to the holder. All the valves are now closed and the coke is raked out at the doors 4.

When it is desired to decrease the production of tar and increase the production of gas and ammonia, the apparatus is reheated, as before, a fresh charge of coal is dropped from the hopper 3 upon the incandescent charge in the chamber A, and the valves 20^a of the seal-pipe 31 and of the pipes 12, 15, 16, and 24 are opened. A hydrogen-gas blast is passed through the pipe 16 into the chamber A and thence down through the fresh and incandescent charge of coal into the ash-pit 5, a hydrogen-gas blast is passed through the pipe 15, and a steam-blast through the pipe 24 into the chamber C. The gas and steam blasts pass together down through the hot refractory material in the chamber C and through the passage 5^a into the ash-pit 5. These blasts mingling with the tar and gases that are evolved from the coal in chamber A, the tar and steam are decomposed into constituent gases, and the nitrogen from the coal and hot hydrogen gases form ammonia. The gases pass up through the incandescent coke in the chamber B, through the seal-pipe 31, into the condenser F, the ammonia being absorbed by the water and the other gases passing off to the holder.

The apparatus may now be reheated, and if it is desired to still further increase the production of ammonia then the valve 12^a of the pipe 12 and the valves of the pipes 22, 15, and 31 are opened. A hydrogen blast and a nitrogen blast enter the pipe 8 from the pipes 12 and 22, mingle together, and pass through the pipe 15 into the chamber C, thence down through the hot refractory material therein, through the passage 5^a into the ash-pit 5, and up through the incandescent coke in the chamber B. The hydrogen and nitrogen form ammonia, which passes through the seal-pipe 31 into the condenser F, from which it, with the other residuals, may be drawn off by the pipe 26.

When it is desired to employ gaseous fuel for heating the apparatus instead of carbonaceous fuel, the plug 6^a, which closes an opening in the partition-wall between the chambers A and B, is removed, and the outlet-valve 10, the valve of the air-blast pipe 11, the valve of the hydrogen-gas-blast pipe 12, and the valve of the ash-pit-connection pipe 17 are opened. Air and gas enter the pipe 8 and

mingling together pass downward and through the pipe 17 into the ash-pit 5, where they are ignited and burned. The hot products of combustion pass through the passage 5^a and up through the chamber C, heating the refractory material therein. All the valves are now closed and the valve 20^a of the seal-pipe 31 is opened, coal is dropped from the hoppers 3 3^a upon the incandescent charges in the chambers A and B, and the valve of the hydrogen-gas blast 12 is opened. A blast of hydrogen gas is forced into the chamber C, down through the hot refractory material therein, through the opening 5^a into the ash-pit 5, and thence up through the coal in the chambers A and B, eliminating and driving off the volatile products from the coal through the seal-pipe 31 into the condenser F. The gas passes thence to the holder and the apparatus may be reheated, as before described. If preferred, oil fuel may be forced in with the air-blast and burned to heat the apparatus instead of gas.

The apparatus herein exemplified as employed in the practice of my invention is not claimed as of my present invention, as the same will constitute the subject-matter of a separate application to be filed in due time.

I claim as my invention and desire to secure by Letters Patent—

1. The improvement in the process of distillation of carbonaceous material, which consists in blasting carbonaceous material with air, heating a charge of carbonaceous material and a body of refractory material to a state of incandescence, supplying a fresh charge of carbonaceous material to the first charge, which has been heated to an incandescent state, forcing a non-oxidizing gas first through the body of incandescent refractory material, then through the combined charge of carbonaceous material, leading off the volatile constituents of the carbonaceous material to a condenser, and cooling and washing the solid remainder of the carbonaceous material by forcing a spray of water through it prior to its withdrawal from the heating-chamber, substantially as set forth.

2. The improvement in the process of distillation of carbonaceous material, which consists in blasting carbonacous fuel with air, heating a charge of carbonaceous material and a body of refractory material to a state of incandescence, supplying a fresh charge of carbonaceous material to the first charge, which has been heated to an incandescent state, forcing a non-oxidizing gas, together with the evolved gaseous and tarry products of the fresh charge, through the incandescent part of the combined charge, forcing a non-oxidizing gas and steam through the hot refractory material and mingling them with the gaseous and tarry products to decompose the steam and tar for the formation of gas and to form ammonia from hydrogen gas and nitrogen, and passing the resultant products through another body of carbonaceous material, substantially as set forth.

3. The improvement in the process of distillation of carbonaceous material, which consists in heating a body of carbonaceous material by the combustion of fuel with air, said fuel being in close contact to said carbonaceous material, but without the passage of air or the products of combustion through the said carbonaceous material, heating a body of refractory material by the passage of the hot products of combustion through the same and thereafter passing blasts of hydrogen, nitrogen, and steam through the hot refractory material, and thence through the carbonaceous material to evolve the volatile constituents for the formation of coke, tar, gas, ammonia, &c., substantially as set forth.

BENJAMIN BRAZELLE.

Witnesses:
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CHRISTIAN F. SCHNEIDER.