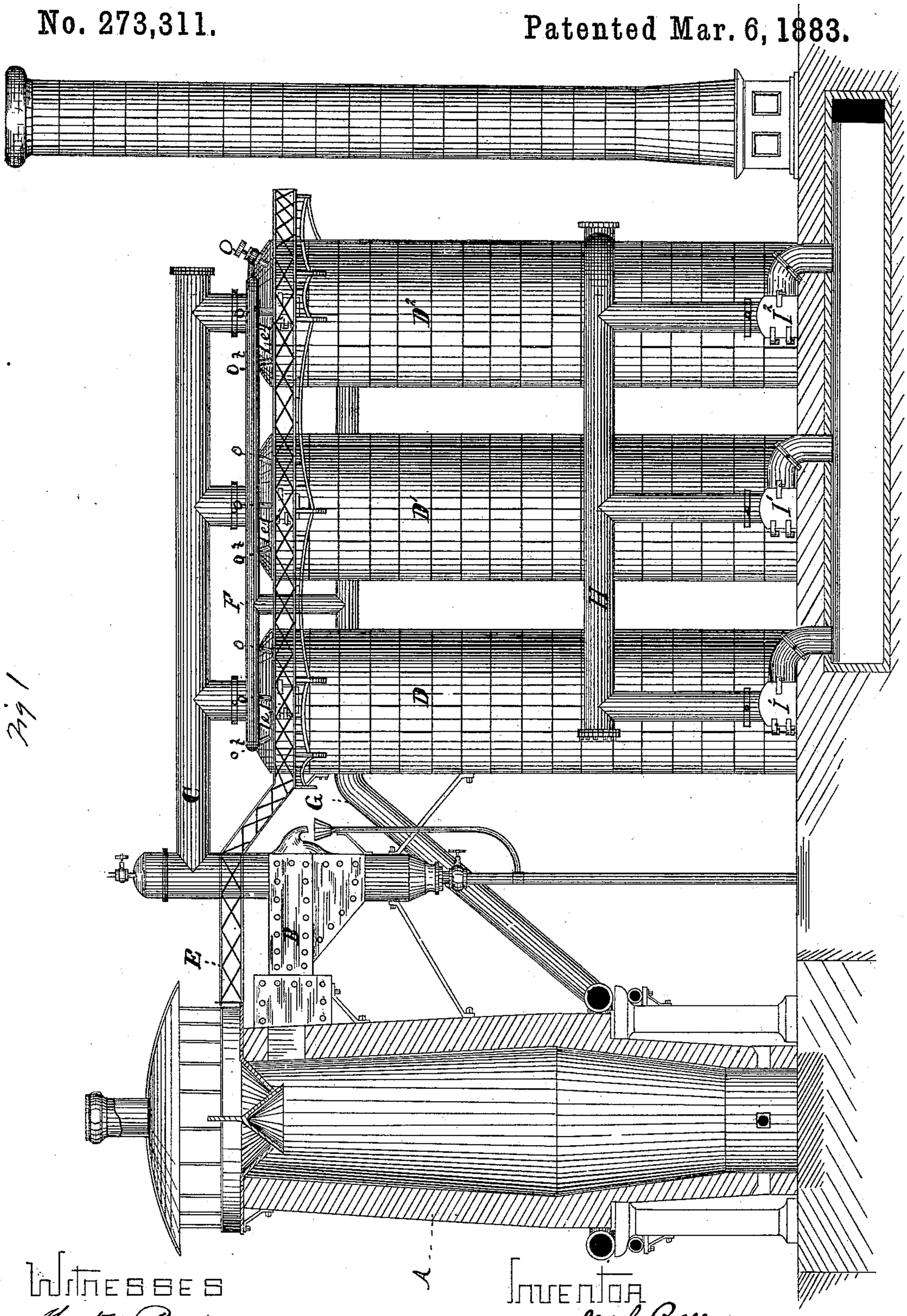
(No Model.)

2 Sheets—Sheet 1.

J. REESE.

BLAST FURNACE PLANTS.

No. 273,311. Patented Mar. 6, 1883.



Witnesses
Walter Reese.
R. C. Winshaw

Inventor
Jacob Reese
by Frank M. Reese, Atty

(No Model.) 2 Sheets—Sheet 2.

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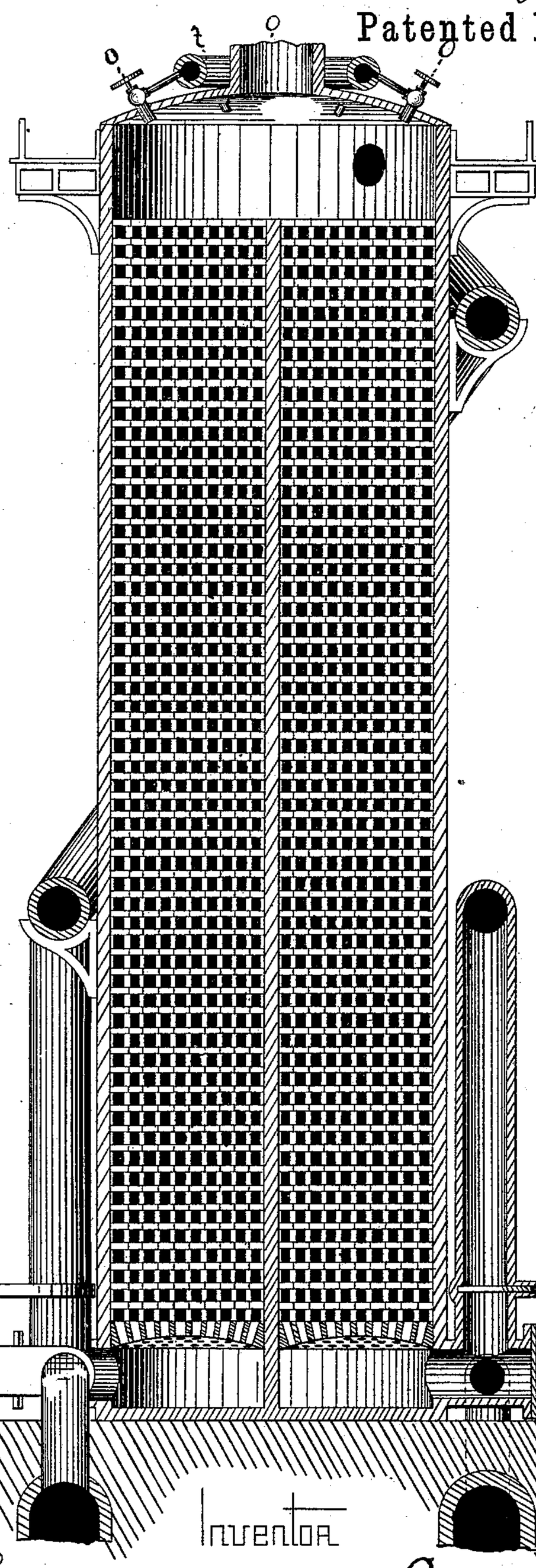
Fig 1.



Witnesses
Hacker Reese.
R. C. Wrenshall

Inventor
Jacob Reese
by
Frank M Reese Atty

UNITED STATES PATENT OFFICE.

JACOB REESE, OF PITTSBURG, PENNSYLVANIA.

BLAST-FURNACE PLANT.

SPECIFICATION forming part of Letters Patent No. 273,311, dated March 6, 1883.

Application filed July 11, 1881. (No model.)

To all whom it may concern:

Be it known that I, JACOB REESE, a citizen of the United States, residing in the city of Pittsburg, county of Allegheny, and State of Pennsylvania, have invented certain Improvements in Blast-Furnace Plants, of which the following is a full, clear, and exact description.

The principal objects of my invention are to secure perfect combustion of the gases and products of combustion as they pass from the furnace to the smoke-stack to extract the heat therefrom, and to do both in as economical a manner as possible.

The derivative objects of my invention are as follows: first, to secure thorough mixing of the gas and products of combustion with the hot air in the combustion-chambers of the regenerators; second, to secure as great as possible heating-surface in the regenerators; third, to allow ample space for the expansion of the gases in the combustion-chambers of the regenerators; fourth, to supply each regenerator, when used for the combustion of gases, with a graduated hot-blast, said blast being hottest when said regenerator is cold and decreasing in temperature as the same becomes heated; fifth, to provide, as far as possible, against the escape of heat and for the ready cleansing of the regenerators.

My invention consists, first, in constructing each regenerator with its gas-induction pipe entering through the middle of its dome, and with the hot-blast pipes entering said dome around said gas-pipes; second, in constructing the regenerators with the lattice-work heating-surface of fire-brick occupying the whole cross-sectional area of said regenerator, in dividing said heating-surface into two compartments by a vertical partition, and in providing each compartment with a separate distributing-chamber; third, in combining with said two compartments and distributing-chambers a single combustion-chamber occupying the whole cross-sectional area of the regenerator; fourth, in using a series of regenerators whose hot-blast pipes and gas-conduits are all valved and connected together and whose distributing-chambers are connected with the smoke-stack and the cold-blast pipes by valved connections; fifth, in combining and arranging the different parts of the plant in such manner as to require the least possible surface-area of connecting-pipes, in providing doors on each side of the tops and bottoms of the regenerators, and in having a gangway running around the tops of the regenerators and blast-furnace.

In the drawings, Figure 1 represents a front elevation, partly in section, of my improved plant, and Fig. 2 is a sectional elevation of one of the regenerators.

A is the furnace, from which the gases and products of combustion are conducted through the dust settler and washer B into the conduit C and to the domes of the regenerators. The construction of said settler and washer B it is unnecessary to explain, as it is fully set forth in another application filed by me September 20, 1880, Patent No. 244,075, dated July 15, 1881. The gas-conduit C opens into the combustion-chambers of the regenerators D D′ D², and is provided with suitable valves to disconnect it from said regenerators when necessary. The regenerators are connected together at the top by the hot-blast pipe F (which is connected with the tuyeres by pipe G) and annular pipes *f*, the latter opening into the combustion-chamber of each regenerator through several valves, *o*, surrounding the inlet of the conduit C. Said regenerators are connected at their bases with the cold-blast pipe H by auxiliary pipes, which enter the distributing-chambers on the opposite sides of each regenerator, and are provided with valves by which the cold-blast may be shut off when required. The regenerators have also (through the medium of the distributing-chambers) valved connections with the smoke-stack of the plant.

e e′ e² are doors situated on each side of the top of the regenerators, and I I′ I² are like doors placed on each side of the bottom of the same and opening into the distributing-chambers. These doors are to enable the workmen to clean the regenerators when they become clogged.

E is a bridge or gangway leading from the tunnel-head of the blast-furnace around the tops of the regenerators to enable the workmen to reach the doors *e e′ e²*.

The internal construction of the regenerators, as shown in Fig. 2, is as follows: Each regenerator is divided vertically from base to combustion-chamber into two compartments

by means of a central division-wall. At the lower end of each compartment a distributing-chamber is formed having a perforated arched roof of fire-brick. Both vertical compartments of each regenerator are filled with fire-brick in lattice-work arrangement from the roof of the distributing-chamber up to the combustion-chamber. Said combustion-chamber occupies the whole dome of the regenerator and extends over both compartments thereof. The reasons for this peculiar construction are that by dividing the regenerator into two compartments having two distributing-chambers said regenerators can be made of very much larger size, and much additional heating-surface thereby obtained. In practice these regenerators are found to be most economical when from eighteen to twenty feet in diameter. This size necessitates an immense weight, which cannot well be borne by a single arch. Hence I use a division-wall and two arches. At the same time this construction enables me to distribute the cold-blast more equally through the lattice-work. A single combustion-chamber is used, because the sudden expansion of the air and gases on entering said chamber is thereby better allowed for than would be the case were there two or more chambers.

The operation of my plant is as follows: The gases from the blast-furnaces are admitted into one of the regenerators and lighted, and the latter heated to the desired temperature. The valve connecting said regenerator with the cold-blast pipe H and the valves *o* are then opened and the cold-blast allowed to pass through the heated interior of the regenerator. Simultaneously with the opening of the aforesaid valves the valves *o* of a second regenerator and the valves connecting the distributing-chamber of the same with the smoke-stack and the combustion-chamber with the gas-conduit are opened. The effect of this is to allow the gas and products of combustion from the blast-furnace and the hot-blast from the heated regenerator to enter the combustion-chamber of the second regenerator, where the gas and products of combustion are consumed, the interior of said second regenerator heated, and the residue of said gas and products of combustion allowed to pass out through the smoke-stack.

It will be observed that when the gas and the hot-blast first enter the second regenerator the said regenerator is cold. To insure perfect combustion, therefore, the hot-blast should be at a very high temperature. As the interior of said regenerator becomes heated a less degree of temperature is required in the blast. This gradual diminution of temperature is effected by supplying said hot-blast from the first regenerator, for as the cold blast continues to pass through said first regenerator the interior of the latter gradually cools, and the resultant hot blast therefrom becomes lowered in temperature. When the second regenerator has attained its maximum temperature the gas-conduit valve and the valves connecting the distributing-chambers with the smoke-stack are closed, and the cold-blast valve is opened. The cold-blast, passing up through the regenerator, is heated to a high temperature and passes out through the valves *o* into the hot-blast pipe F. The valves *o*, the gas-conduit valve, and the smoke-stack valve in the third regenerator are then opened. The gas and a part of the hot blast from the second regenerator thereupon enters the combustion-chamber of the third and heats the same in the manner already described. The third regenerator having reached its maximum temperature, the same shutting off and opening of the valves is effected as in the case of the second, and the first regenerator is called into action, and so on in rotation as long as a hot-blast is desired.

It will be understood that only a part of the hot-blast from any regenerator is at any time used in the combustion of gases in another regenerator, the remainder being forced through the pipes F and G into the tuyeres, and thence to the blast-furnace.

It will be apparent that the temperature of the hot-blast used in the combustion of the gases will at all times be graduated to suit the exigencies of the case.

Any number of regenerators may be used, and two or more may be heating or imparting heat to the cold-blast at the same time.

Having thus described my invention, what I claim is—

1. The combination, with the main hot-blast pipes G F and the regenerator provided with gas-pipes and entrance in the middle of its dome, of the annular pipe *f* and valves *o*, substantially as described, whereby the hot air and the gases may be thoroughly mixed, for the purpose set forth.

2. A cylindrical hot-blast regenerator, provided with air and gas conduits leading into the combustion-chamber in the dome of the stove, having a heating-surface of fire-brick in lattice-work arrangement divided into two distinct vertical compartments by a central division-wall, and provided with two distributing-chambers at its base, constructed and arranged to operate as and for the purposes herein set forth.

3. In a regenerator, the combination, with two vertical heating-compartments and two distributing-chambers, of a single combustion-chamber provided with gas and hot-air entrances, substantially as described, whereby the products of combustion are allowed room for expansion, as set forth.

4. In a blast-furnace plant, the combination of a series of regenerators having combustion-chambers in their domes, and provided with hot-gas and hot-air connections with the combustion-chambers, and whose distributing-chambers have valve-connections with the cold-blast pipe, and with the stack, substantially as described, whereby a perfect combustion and a uniform expansion of the gases is secured by means of the hot air in combustion-

chambers whose areas are greater than that of all the openings in the regenerators, as set forth.

5. The within-described blast-furnace plant, consisting essentially of the furnace A, dust-settler and washor B, gas-conduit C, regenerators D D′ D², provided with distributing-chambers, as described, hot-blast pipes G F *f*, valves *o*, cold-blast pipe H, and branch-pipes connected with said distributing-chambers, and the smoke-stack, all arranged and operated in the manner and for the purposes set forth.

JACOB REESE.

Witnesses:
FRANK M. REESE,
WALTER REESE.