

E. POWELL.
FURNACE.

No. 551,476.

Patented Dec. 17, 1895.

FIG. 1.

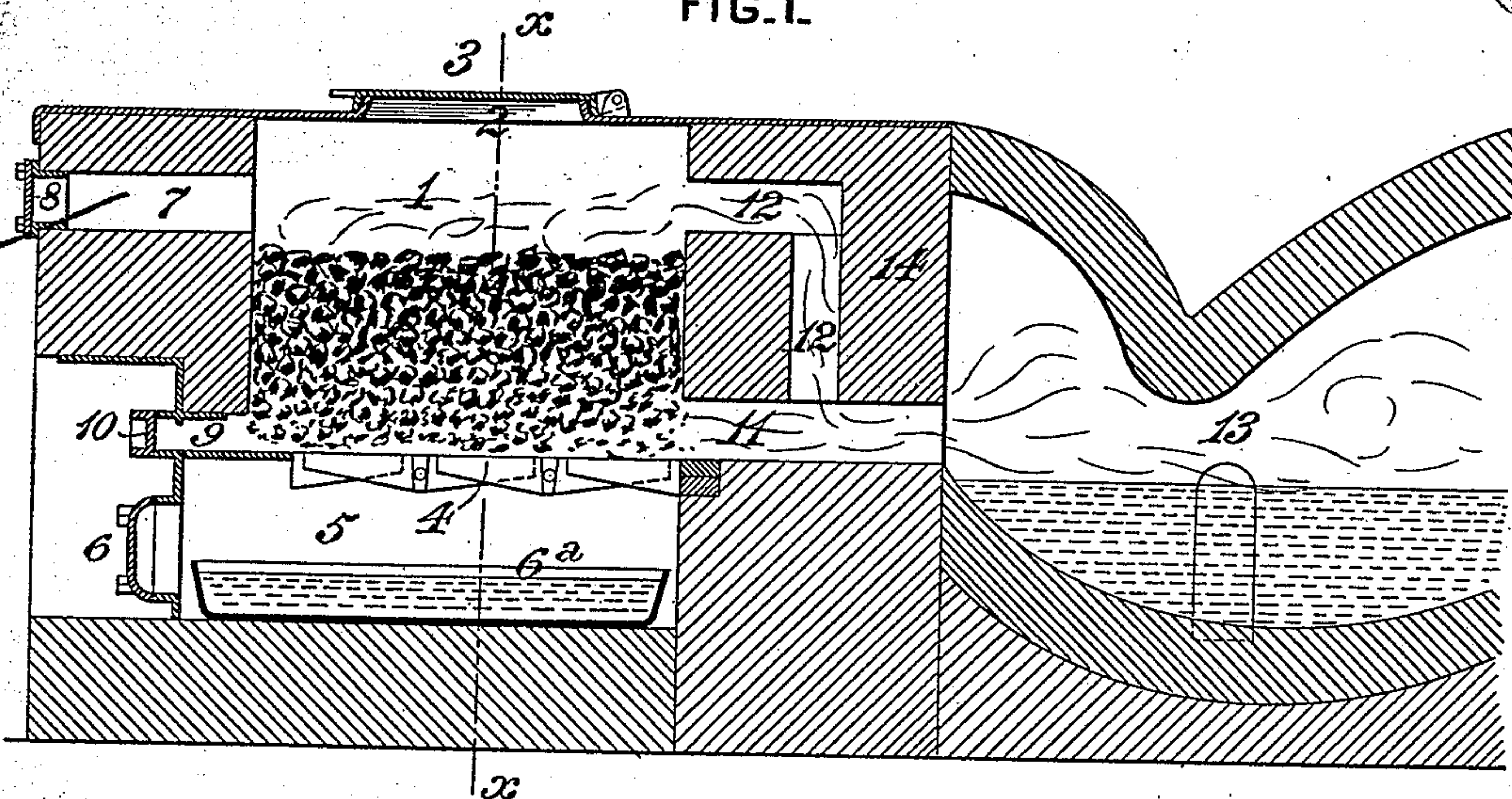
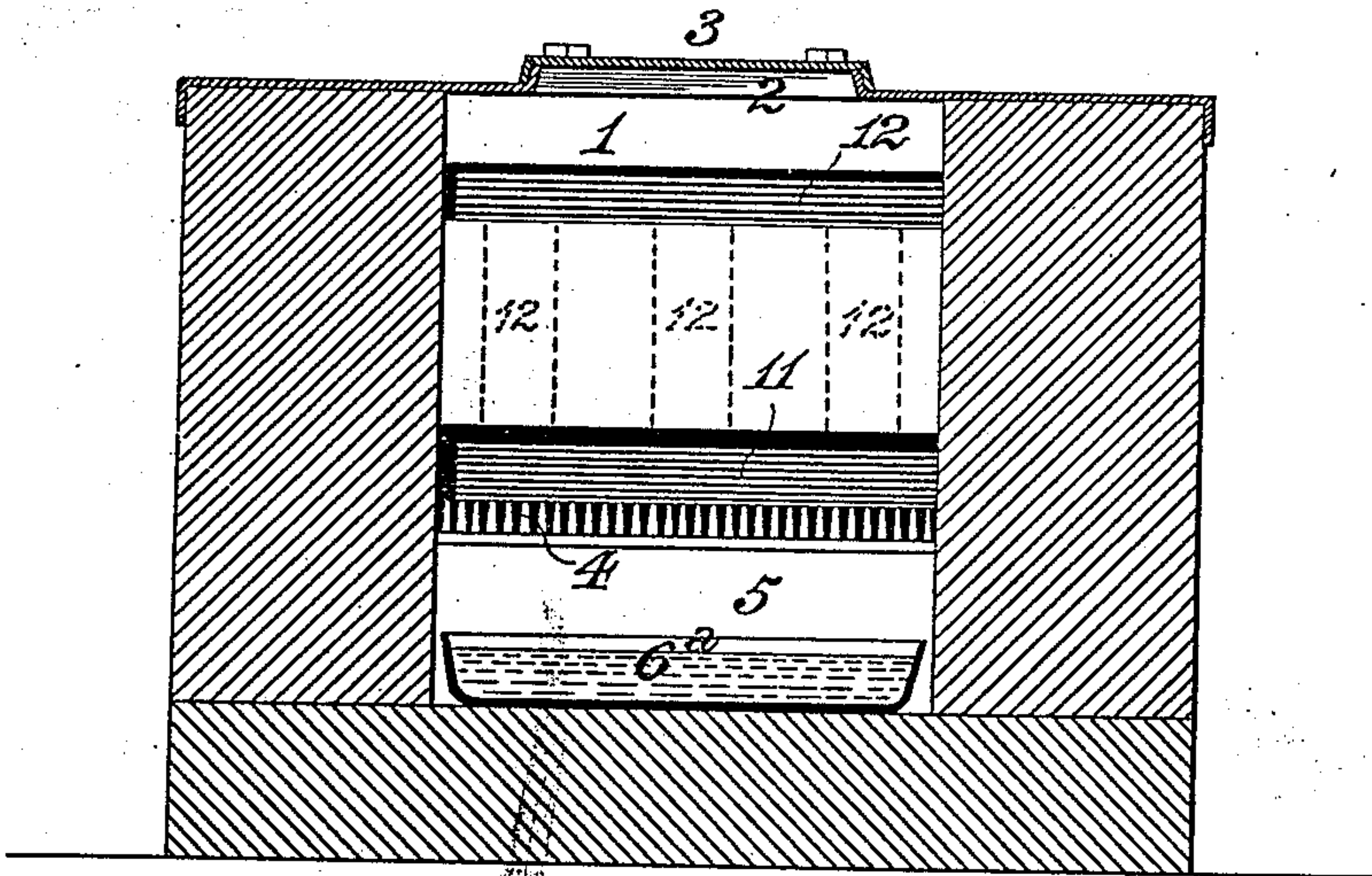


FIG. 2.



WITNESSES:

T. J. Hogan.
J. C. Gaither

INVENTOR

Edwin Powell
by J. H. Woodcock, Att'y.

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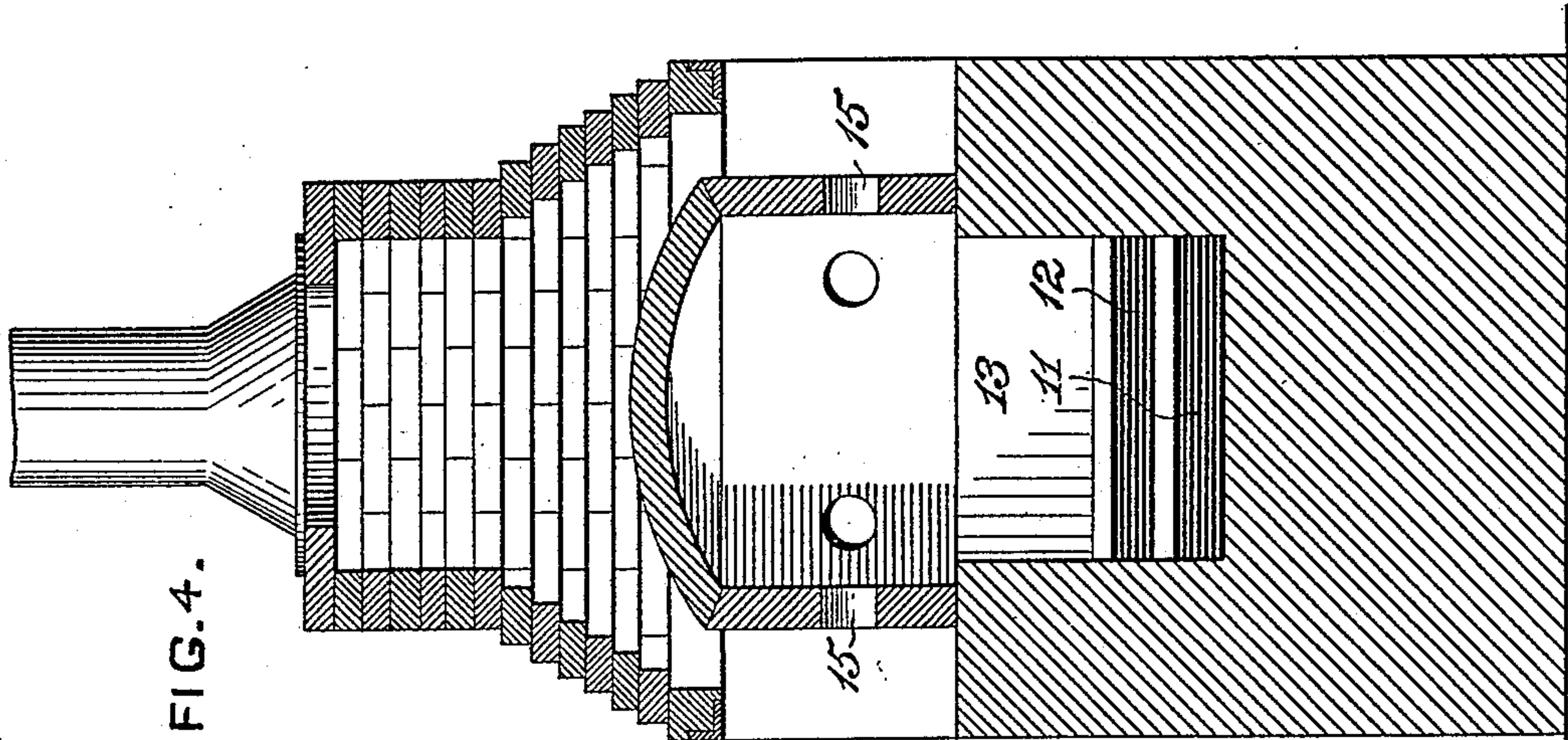


FIG. 4.

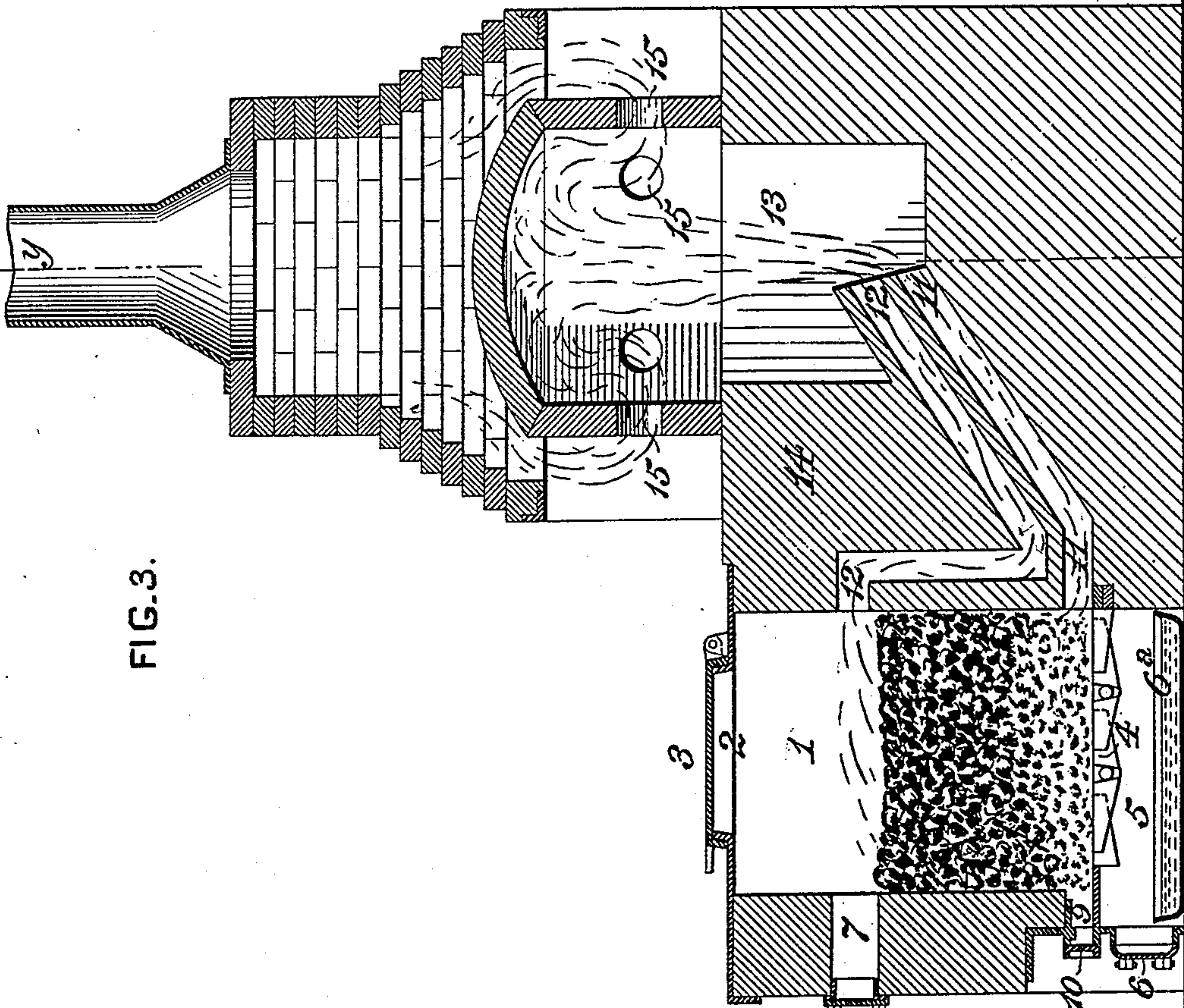


FIG. 3.

WITNESSES:

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INVENTOR

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UNITED STATES PATENT OFFICE.

EDWIN POWELL, OF PITTSBURG, PENNSYLVANIA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 551,476, dated December 17, 1895.

Application filed August 28, 1895. Serial No. 560,747. (No model.)

To all whom it may concern:

Be it known that I, EDWIN POWELL, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Furnaces, of which improvement the following is a specification.

My invention relates to furnaces for the evolution of heat from fuel in the various descriptions of heating apparatus employed in manufacturing and mechanical operations and the generation of steam for the numerous purposes required in the arts and trades; and its object is to provide means whereby the thorough, economical, and smokeless consumption of fuel may be effected in a structure of simple and inexpensive construction and ready applicability to existing conditions of location, service, and relation to other structures in connection with which it may be required to be used.

To this end my invention, generally stated, consists in the combination of a furnace or fuel-chamber, a fire-bed therein which is closed to access of air below it, an air-supply passage above said fire-bed, a combustion-chamber, an exit throat or passage connecting the fuel-chamber, at or near the fire-bed thereof, with the combustion-chamber, and a gas-conduit leading from the fuel-chamber, above the normal plane of incandescence therein, to a point of discharge adjacent to the discharge-outlet of the exit throat or passage.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical longitudinal central section through a metallurgical furnace, illustrating an application of my invention; Fig. 2, a vertical transverse section through the same at the line *xx* of Fig. 1; Fig. 3, a vertical longitudinal central section through a glass-furnace, illustrating a modification of detail; and Fig. 4, a vertical transverse section through the same at the line *yy* of Fig. 3.

In the practice of my invention I provide a downward-draft furnace or fuel-chamber 1, having at or near its top a fuel-supply passage or opening 2, closed by a door 3, and having its bottom formed by a grated or perforated fire-bed 4, the openings in which are

provided to permit the passage of ashes into a lower closed ash-pit 5, having a tight door 6 for the removal of ashes, and provided preferably with a water-pan 6^a on its bottom. The walls of the fuel-chamber 1 are closed on all sides, except as to the openings of the fuel-supply passage 2 and fire-bed 4, above specified, one or more air-supply passages 7 formed in the front wall of the fuel-chamber at a point above the normal level of the fuel therein and controlled by a door or register 8, a cleaning-passage 9 in the front wall at or near the level of the fire-bed, controlled by a door 10, and gas-discharge passages 11 and 12, to be presently described. The ash-pit being also tightly closed, the draft of the fuel-chamber is downward from the air-supply passages 7 through the body of fuel.

A combustion-chamber 13, in which the heat evolved from the fuel in the fuel-chamber 1 is utilized for the particular purpose for which it may be required—as, for example, the melting or reheating of metal, glass, &c., the burning of brick, lime, or pottery, the generation of steam, or other calorific action—is located adjacent to the fuel-chamber 1, and is separated therefrom by the rear wall 14 thereof. An exit throat or passage 11, through which the major portion of the gaseous products of combustion evolved from the fuel in the fuel-chamber 1 are discharged into the combustion-chamber 13, leads from the fuel-chamber 1, at or about the level of the highest incandescence therein—that is to say, at or closely adjacent to the top of the fire-bed 4—into the combustion-chamber 13. A gas-conduit 12, of which either one or more may be employed, a plurality being indicated in dotted lines in Fig. 2, leads from the fuel-chamber 1 at a point above the normal plane of incandescence therein, and, preferably, as shown, slightly above the top of the normal charge of fuel in the chamber, to a point of discharge to the combustion-chamber adjacent to the discharge-outlet of the exit throat or passage 11 thereto, the object of said conduit 12 being to provide an avenue for the passage of the smoke and partially-consumed gases which may rise through the unconsumed and cooler portions of the fuel, at and below the top of the charge, from the upper portion

of the fuel-chamber to a point where they are commingled with, and thoroughly consumed by, the highly-heated gases which pass off from the portion of the charge of fuel, at and near the fire-bed, which is at the highest degree of incandescence. The gases thus commingled burn with a flame of intense heat in the combustion-chamber, and any smoke which may be formed by incomplete combustion of portions of the charge above that which is in a state of incandescence is found to be completely consumed.

As shown in Fig. 1, the point of discharge of the gas-conduit 12 is on one of the boundaries of the exit throat or passage 11, between the fire-bed 4 and the outlet of the passage 11, to the combustion-chamber 13, so that the products of combustion which pass through the conduit 12 meet the heated gases passing through the exit-throat 11 before the latter are discharged into the combustion-chamber, and the conduit 12 and passage 11 thus have a common outlet to said chamber, which outlet is adjacent to the point of discharge of the conduit 12. The same result will, however, be attained if the conduit 12 and passage 11 deliver the gaseous products from the fuel-chamber to the combustion-chamber through separate and contiguous outlets, the only requisites as to the location of the point of discharge of the conduit 12 being that it shall be such that the gaseous products passing out of the conduit 12 must immediately mingle with the hot gases which pass through the exit throat or passage 11, and that it shall be sufficiently far removed from the fire-bed to insure that the gaseous products passing through the conduit 12 shall escape therefrom entirely beyond and clear of all portions of solid fuel, and shall meet the gases which are evolved from the incandescent portion of the fuel at a point where their traverse is unimpeded by solid fuel or ashes.

Figs. 3 and 4 illustrate a modification in which the discharge of the products of combustion from the exit throat or passage 11 and the gas-conduit 12, respectively, is effected through separate outlets, as above specified, the outlet of the passage 11 opening into the combustion-chamber 13, as in the instance first described, and that of the gas-conduit 12, also opening into the combustion-chamber, above and closely adjacent to that of the passage 11. The partially-consumed products of combustion escaping from the outlet of the gas-conduit 12 meet and mingle with the highly-heated gases discharged from the outlet of the passage 11, as both enter the combustion-chamber, and the former are, as in the instance first described, thoroughly consumed, producing a flame of intense heat in the combustion-chamber. The combustion-chamber 13 is shown as of the form employed in glass-furnaces, having "glory-holes" in the upper portion of its walls, but it will be obvious that it may be of any other de-

sired construction, without departure from my invention.

I have found in practice that an unusually high heat is generated, and a complete combustion effected, by a construction embodying the essential features above described, and, while the precise action of the furnace in the evolution and combustion of gases may be difficult of ascertainment with absolute certainty, it is my present understanding that this advantageous result is due to the following facts: The smoke and partially-consumed gases which are evolved from the portion of the body of fuel above that which is in a high state of incandescence are disengaged and pass off slowly, at a comparatively low temperature, owing to the resistance of the unconsumed and cold solid fuel above the level at which they are generated. On the other hand, the gases evolved from the incandescent portion of the fuel escape freely, rapidly, and at a high temperature through the exit-passage 11. The latter gases are, therefore, capable of carrying with them and consuming and utilizing the combustible products which meet and mingle with them at the discharge-outlet of the conduit 12, thereby generating a correspondingly higher degree of heat than would be attainable if the unconsumed products from the upper portion of the charge of fuel were led into and through the incandescent portion thereof, and before the gases of combustion were released therefrom, as has been proposed, and set forth in Letters Patent, prior to my present invention.

The essential feature of difference between my improvement and the prior constructions referred to consists in the provision of the described means for effecting the union of the products of combustion of a downward-draft furnace from the unconsumed and the incandescent portions of the charge of fuel, respectively, at a point wholly exterior to the fuel-chamber, where the traverse of the hotter gases is unimpeded by solid fuel, and so that combustion shall be completed at the outlet through which the gaseous products pass into the combustion-chamber, and produce a flame of exceptionally high heat at said outlet.

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

1. The combination, substantially as set forth, of a furnace or fuel chamber, a firebed therein which is closed to access of air from below it, an air supply passage above said firebed, a combustion chamber, an exit throat or passage connecting the fuel chamber, at or near its firebed, with the combustion chamber, and a gas conduit leading from the fuel chamber, above the normal plane of incandescence therein, to a point of discharge adjacent to the discharge outlet of the exit throat or passage and exterior to the bed of incandescent fuel.

2. The combination, substantially as set

forth, of a furnace or fuel chamber, a firebed
therein which is closed to access of air from
below it, an air supply passage above said
firebed, a combustion chamber, and passages
5 connecting the fuel chamber and combustion
chamber, said passages leading out of the fuel
chamber at or near the point or level of high-
est incandescence, and above the normal
plane of incandescence, respectively, and dis-
10 charging exterior to the bed of incandescent
fuel.

3. The combination, substantially as set
forth, of a furnace or fuel chamber, a firebed
therein which is closed to access of air from
15 below it, an air supply passage leading into
the fuel chamber above the normal upper level
of the charge of fuel, a door or register con-
trolling said passage, a combustion chamber,
an exit throat or passage leading from the
20 fuel chamber, at or near the level of the fire-
bed, to the combustion chamber, and a gas
conduit leading from the fuel chamber, above
the normal upper level of the charge of fuel,
and discharging, exterior to the bed of fuel,
25 to the combustion chamber.

4. The combination, substantially as set
forth, of a furnace or fuel chamber, a firebed
therein which is closed to access of air from
below it, an air supply passage above said

firebed, a combustion chamber, an exit throat 30
or passage leading from the fuel chamber, at
or near its firebed, to the combustion cham-
ber, and a gas conduit leading from the fuel
chamber, above the normal plane of incan-
descence therein, to the combustion chamber, 35
and having its discharge outlet wholly exte-
rior to the fuel chamber and open to the pro-
ducts of combustion delivered through the
exit throat or passage.

5. The combination, substantially as set 40
forth, of a furnace or fuel chamber, a firebed
therein which is closed to access of air from
below it, an air supply passage above said
firebed, a combustion chamber, an exit throat
or passage leading from the fuel chamber, at 45
or near its firebed, to the combustion cham-
ber, and a gas conduit leading from the fuel
chamber, above the normal plane of incan-
descence therein, to the combustion chamber,
and having a discharge outlet therein, inde- 50
pendent of, and adjacent to, that of the exit
throat or passage.

In testimony whereof I have hereunto set
my hand.

EDWIN POWELL.

Witnesses:

GEO. W. BLAIR,
J. SNOWDEN BELL.