

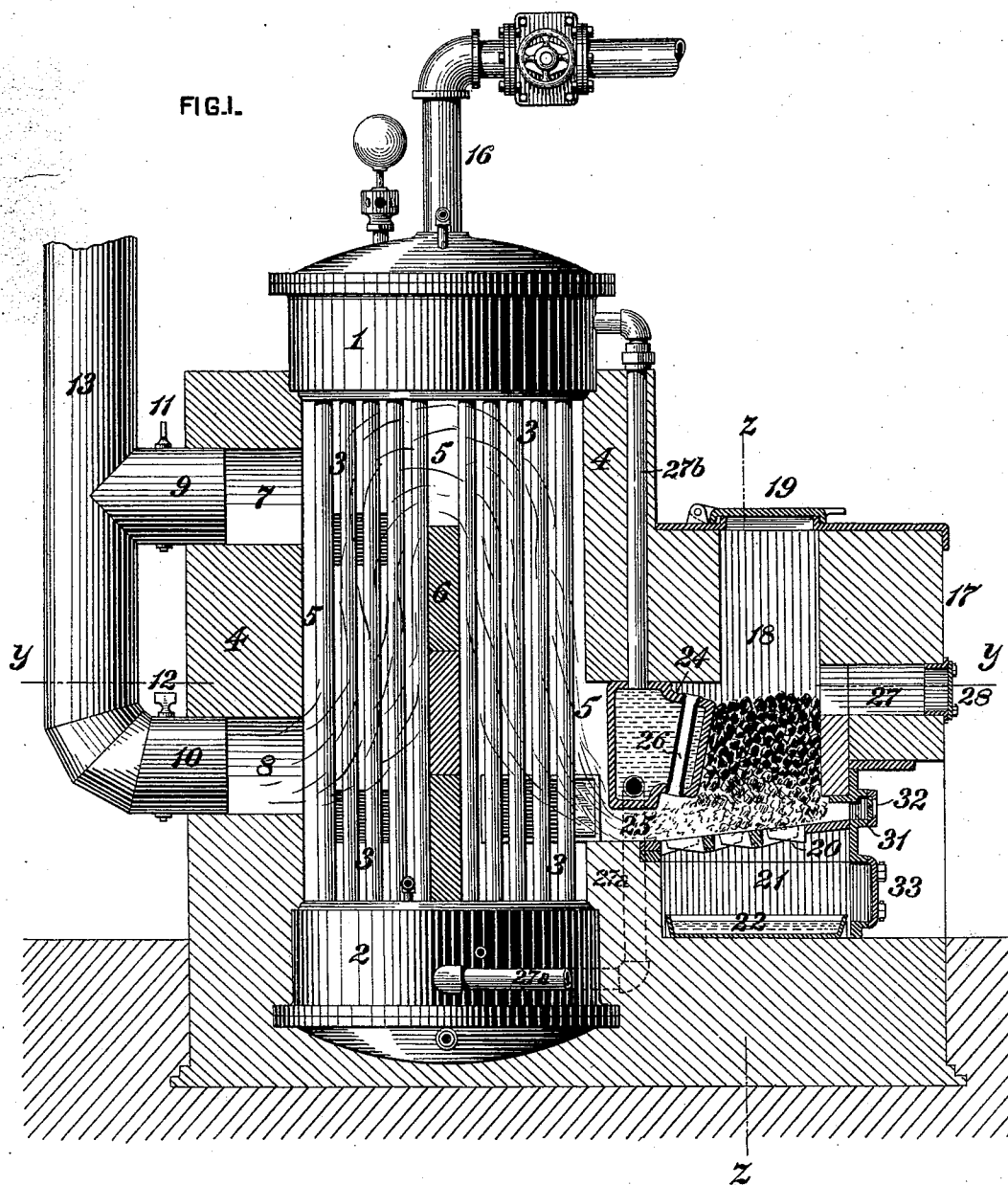
(No Model.)

5 Sheets—Sheet 1.

E. POWELL.
BOILER FURNACE.

No. 543,631.

Patented July 30, 1895.



WITNESSES:

Chas F. Miller.
T. J. Hogan.

INVENTOR,

Edwin Powell
by J. H. Henden Bell, Att'y.

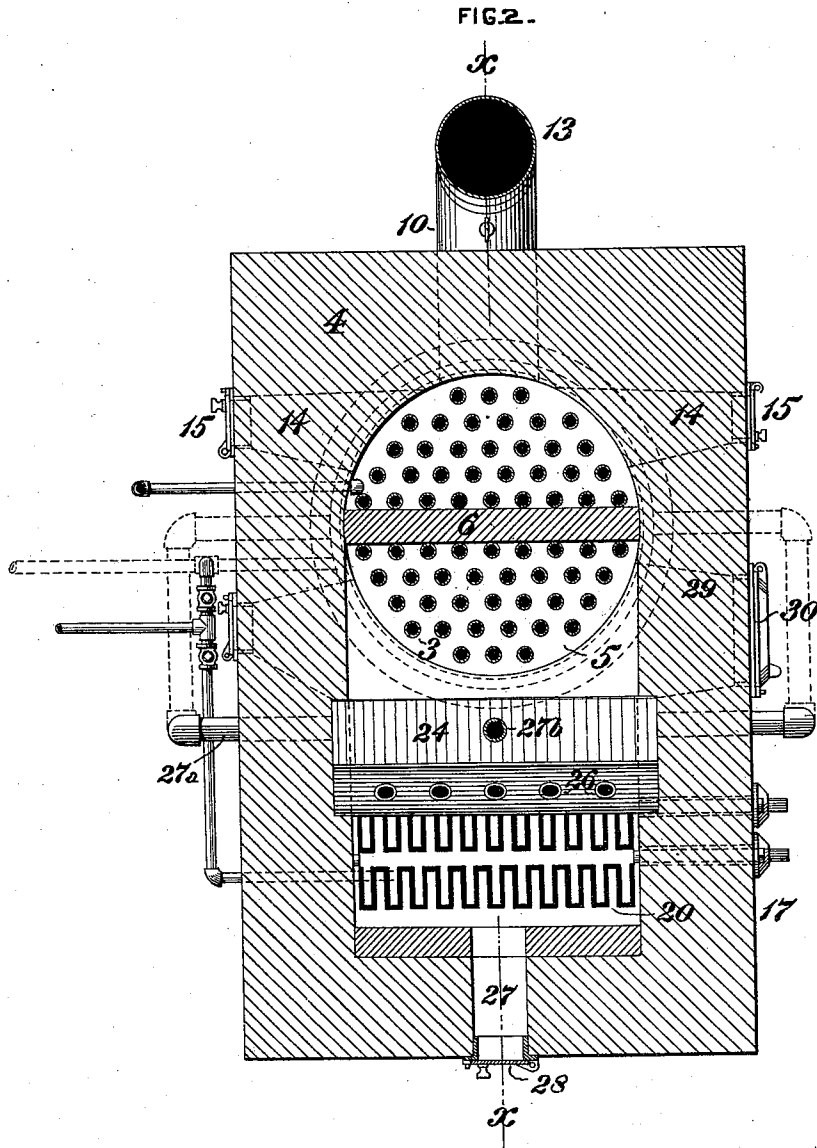
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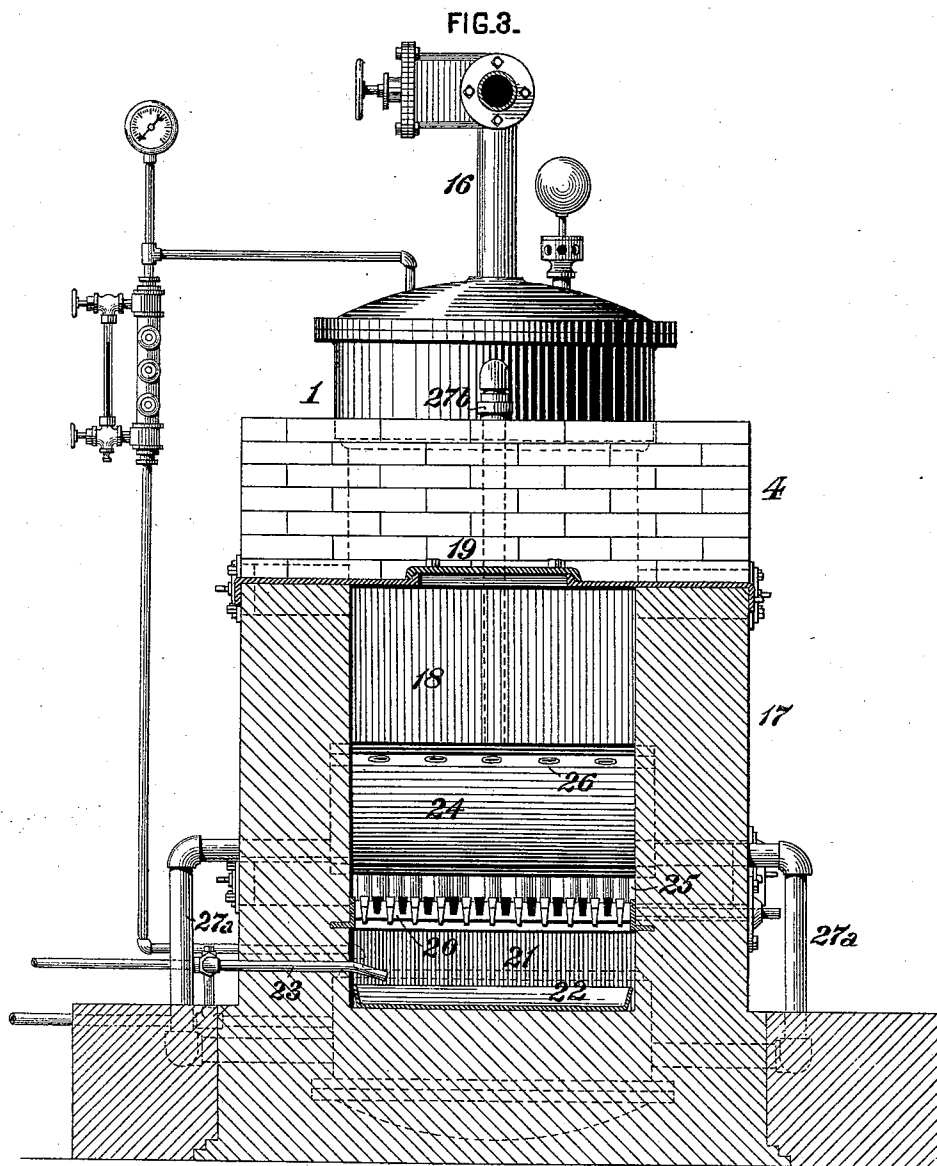
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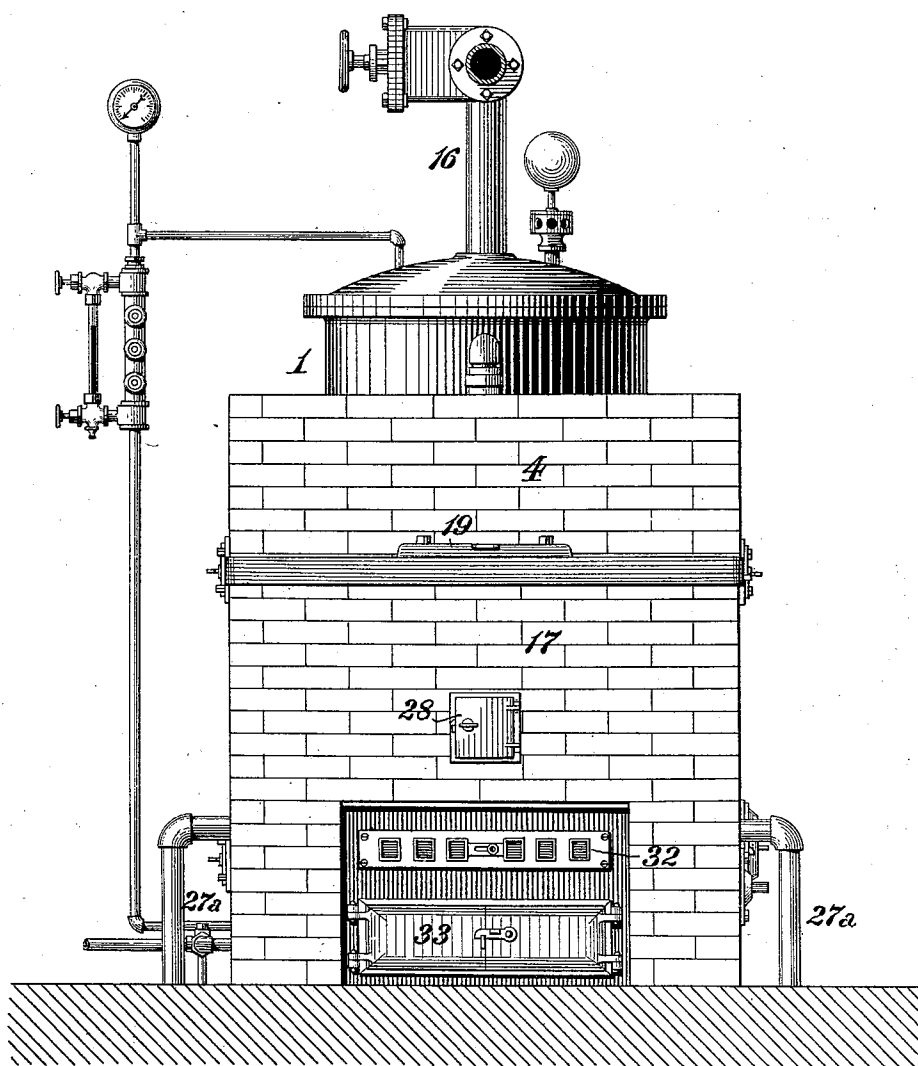
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FIG. 4.



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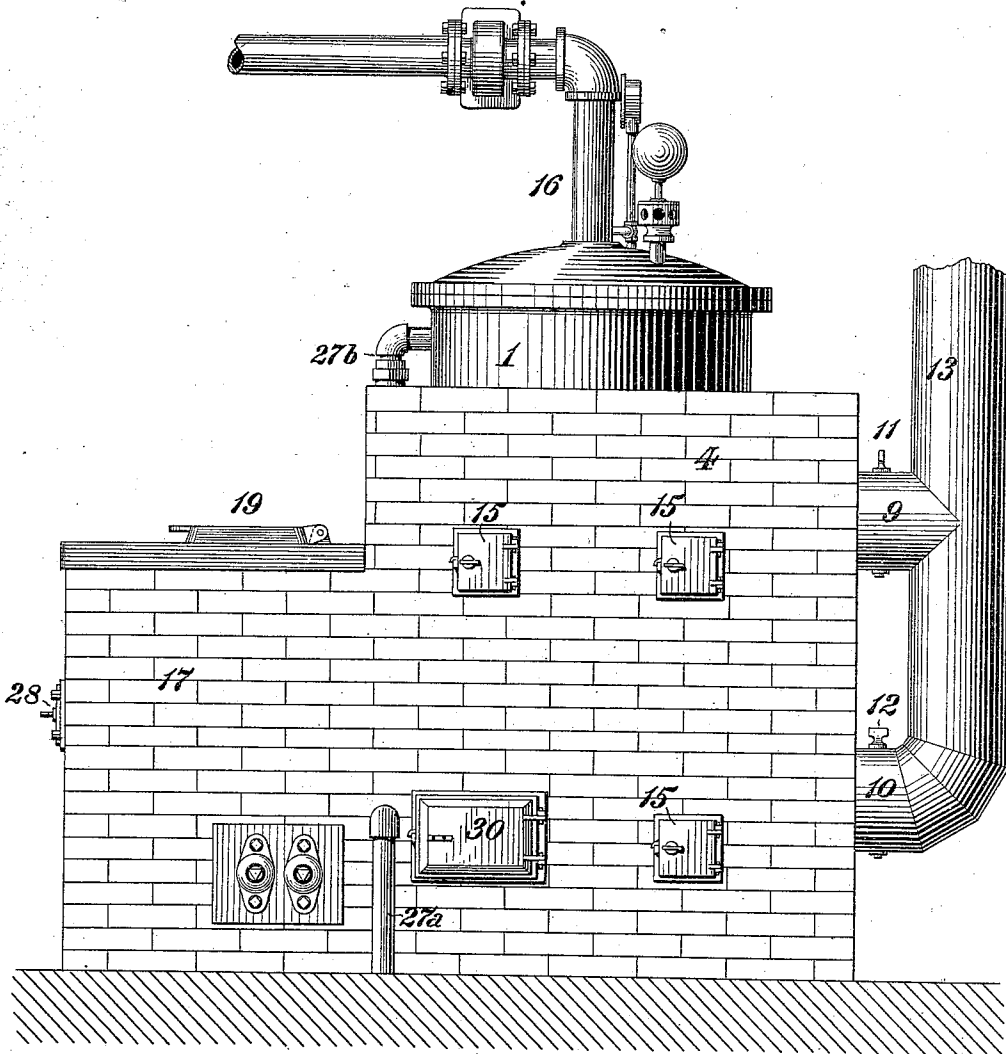
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FIG. 5.



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UNITED STATES PATENT OFFICE.

EDWIN POWELL, OF PITTSBURG, PENNSYLVANIA.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 543,631, dated July 30, 1895.

Application filed April 20, 1895. Serial No. 546,518. (No model.)

To all whom it may concern:

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

My invention relates more particularly to furnaces or fireplaces for steam and hot water boilers of different descriptions, but is applicable, without variation of principle or essential features, to furnaces employed in other classes of service where the utilization of fuel under the conditions of uniform, effective, and economical combustion is desired.

The object of my invention is to provide a furnace of comparatively simple and inexpensive construction and readily applicable, within small compass, for such service as may be required, in the operation of which the combustion of the fuel, particularly when bituminous and of low grade, may be effected with thoroughness and economy and without the inconvenience and waste resultant upon the evolution of smoke.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical central section through a steam-boiler setting, illustrating an application of my invention, the section being taken at the line *xx* of Fig. 2; Fig. 2, a horizontal section through the same at the line *yy* of Fig. 1; Fig. 3, a vertical transverse section at the line *zz* of Fig. 1; Fig. 4, a front view in elevation, and Fig. 5 a side view in elevation.

My invention is, in this instance, exemplified as applied in connection with a vertical water-tube boiler, which is designed for the heating of a building by low-pressure steam, and is composed of an upper drum or cylinder 1, a corresponding lower drum 2, and a series of vertical water-tubes 3, connecting said drums. The lower drum, the water-tubes, and the lower portion of the upper drum are inclosed within a setting of brick work 4, which forms the walls of a combustion-chamber 5, surrounding the tubes and closed at its top and bottom by the drums 1 and 2, respectively. The combustion-chamber 5 is transversely divided by a central partition 6, of

firebrick or tile, which extends upwardly from its bottom for about three-fourths of its height, and openings 7 8 are formed in its rear wall, from which openings pipes 9 10 controlled by valves or dampers 11 12 lead to a discharge flue or stack 13. Passages 14, in the walls of the combustion chamber, (indicated in dotted lines in Figs. 2 and 3,) controlled by doors 15, enable access to be had to the tubes for cleaning purposes. The boiler is provided with a valved steam-delivery pipe 16, leading out of its upper drum, and with its usual accessories, as a water feed-pipe, safety-valve, gage-cocks, pressure-gage, &c.

The boiler above described is of a known type and does not, in and of itself, form any part of my invention, which, as before stated, may be applied in connection with boilers of other descriptions or for heating other appliances than the combustion-chamber of a boiler.

In the application of my invention which is herein described and shown I provide at the front of the boiler-setting 4 an extension thereof, inclosing a vertical chamber 18, which is closed at top by a fuel-supply door 19 and at bottom by a fire-bed 20. The chamber 18 is preferably made of such capacity that its upper portion serves as a fuel magazine or receptacle and the portion adjacent to the lower end as a fire-chamber. An air-tight ash-pit 21 is located immediately below the fire-bed, and a pan 22, to which water is supplied by a pipe 23, is set on the bottom of the ash-pit. The fire-bed 20 is preferably in the form of a grate, as shown, in order to allow ashes and clinkers to drop into the ash-pit, as well as to permit the vapor generated by the heat of the ignited fuel on the fire-bed to pass thereinto and by its decomposition to promote the combustion thereof. An imperforate plate may, however, be substituted for the grate-bars, if desired.

While a construction, as herein shown and described, in which the fuel-magazine is integral with and forms a continuation of the upper portion of the fire-chamber, is deemed by me to be preferable in practice by reason of structural economy, it will be obvious that such is not an essential of my invention, as the fuel-magazine might be made separate from the fire-chamber and connected therewith by a suitable supply-chute, or it might, if

desired, be dispensed with and fuel fed to the fire-chamber from time to time, as required from any other receptacle, either stationary or portable. In either case the essential features of construction and mode of operation which characterize my invention would be complied with in the same manner and to the same extent as in the specific construction set forth.

The chamber 20 is separated from the combustion-chamber 5 by the front wall of the brick-setting and by a bridge-wall 24, which extends across and closes an opening in said wall for such distance as to form the upper boundary of an exit throat or passage 25, located at and adjacent to the level of the fire-bed 20, through which throat the gaseous products of combustion of the fuel on the fire-bed pass into the combustion-chamber. The face of the bridge-wall 24, adjacent to the chamber 18, is preferably inclined downwardly in the direction of the combustion-chamber, as shown in Fig. 1, and it is recessed or shouldered at the front portion of its top to provide a clear space above the upper end of a gas conduit, consisting, in this instance, of a series of tubes 26, which extend from its upper to its lower sides near its top. An air-supply passage 27, closed by a door 28, is formed in the front wall of the setting 17, which incloses the chamber 18, adjacent to the level of the top of the gas-conduit, said wall being otherwise closed throughout.

In the instance shown, and preferably in other applications of my improvement in connection with a boiler, the bridge-wall 24 is constructed in the form of a hollow casting or water-back, the gas conduits 26 being made of tubes secured at each end therein, for which a single channel extending for the major portion of the length of the bridge-wall may be substituted, if desired. A continuous natural circulation of water into and through the water-back is provided for by circulating pipes 27^a 27^b, one of which 27^a leads from the lower drum 2 of the boiler into the lower portion of the water-back, and the other 27^b from the top of the water-back to the upper drum 1 of the boiler.

In order to enable the exit-throat 25 to be readily cleared of clinkers or other accumulation of solid matter tending to obstruct the free passage of the gaseous products of combustion to the combustion-chamber, a cleaning-passage 29 (indicated in dotted lines in Fig. 2) is formed in the setting 4, at and above the lower level of the throat 25, said passage being of sufficient width and height to afford ready access by a poker or slice-bar to all parts of the throat 25 and being closed at its outer end by a door 30. An opening or series of openings 31, closed by a door or doors 32, may also be provided at the front of the fire-bed to facilitate the cleaning of the fire from time to time, as may be found necessary, and access to the ash-pit 21 is afforded through an

opening in the front wall thereof, which is closed by tight-fitting doors 33.

In the operation of a furnace in accordance with my invention the fire-chamber and fuel-magazine 18 is supplied with fuel, preferably to a level near or somewhat below that of the top of the bridge-wall, the fuel is ignited, and a proper quantity of air admitted through the air-supply passage 27. The major portion of the hot gases evolved by the combustion of the fuel pass out through the throat 25 into the combustion-chamber 5. The heat of the fire being applied directly to the water-back bridge-wall 24 highly heats the water therein, generating steam and inducing a strong natural circulation through the water-back, circulating-tubes 27^a and 27^b, and the drums and water-tubes of the boiler. The hot gases passing into the combustion-chamber 5 circulate around the water-tubes 3 and impart the greater part of their heat to the water circulating through said tubes before escaping into the discharge-flue 13. When the fire is started the damper 12 of the lower discharge-pipe 10 is closed and the damper 11 of the upper pipe 9 opened in order to promote the draft. After the fuel has become thoroughly ignited the upper damper is closed and the lower damper opened, and the hot gases then circulate upwardly around the tubes on the front side of the central partition 6 and downwardly around those on the rear side thereof, the heat of the gases being thus more fully utilized than when they are allowed to escape through the upper discharge-pipe.

In the ordinary constructions in which a downward draft is maintained through fuel supplied to a fire-bed from a magazine, no provision has been made which is effective in practice, so far as my knowledge and information extend, for the combustion and utilization of such of the gases evolved from the fuel as pass upwardly through the same, and in some cases inconvenience is experienced by reason of the escape of such gases, or their explosion from time to time within the magazine. Under my improved construction the evolved gases which pass upwardly through the fuel are met by a current of air entering the chamber 18 through the fuel-supply passage 27, and, uniting with the air, are drawn downward through the gas-conduits 26 and discharged at the lower ends thereof, adjacent to the exit-throat 25. The heat at this point being very high, the thorough combustion of the gases passing out of the conduits 26 is effected, thereby effecting a corresponding economy of fuel and the prevention of smoke, even when low-grade bituminous fuel is employed.

I am aware that downdraft-furnaces of various constructions, in which fuel is supplied from a magazine to a fire-bed and the gaseous products of combustion discharged through an opening below a bridge-wall, were

known in the art prior to my invention, and such construction I do not, therefore, broadly claim. I am not, however, aware of any instance in which the admission of air is effected through a single passage in an otherwise closed front, so located as to cause the air to combine with and carry the gases which rise through the fuel into a conduit or conduits, by which they are delivered at a point where their combustion is effected by the direct heat of incandescent fuel, such a construction being the essential and characteristic feature of my invention.

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

1. The combination, substantially as set forth, of a boiler, a combustion chamber located in position to impart heat thereto, a fire chamber, a lower firebed, a water back bridge wall interposed between the fire chamber and the combustion chamber and located above an exit throat or passage adjacent to the firebed, circulating tubes connecting the water back bridge wall with the upper and lower portions of the boiler, a tubular gas conduit passing through the water back bridge wall, its lower end being located adjacent to the exit throat and its upper end being open to the fire chamber near the top of the water back bridge wall, and an air supply passage leading into the fire chamber adjacent to the upper end of the gas conduit.

2. The combination, substantially as set forth, of a boiler, a combustion chamber in a setting inclosing the heating surfaces of said boiler, a fire chamber in a lateral extension of said setting, a lower fire bed in said fire chamber, a water back bridge wall abutting on its upper face against the setting wall which separates the fire chamber from the combustion chamber, and forming the upper boundary of an exit throat or passage adjacent to the fire bed, circulating tubes connecting the water back bridge wall with the upper and lower portions of the boiler, a series of tubular gas conduits passing through the water back bridge wall, their lower ends being lo-

cated adjacent to the exit throat and their upper ends being open to the fire chamber near the top of the water back bridge wall, and an air supply passage leading into the fire chamber adjacent the upper ends of the gas conduits.

3. The combination, substantially as set forth, of a boiler composed of an upper and a lower drum and a series of connecting water tubes, a combustion chamber in a setting inclosing the heating surfaces of said boiler, a central partition extending upwardly in the combustion chamber from the lower drum of the boiler to a level below the upper drum thereof, valve controlled exit flue passages in the upper and lower portions of the combustion chamber, a lateral fire chamber, a lower firebed therein, a water back bridge wall interposed between the fire chamber and the combustion chamber above an exit throat or passage adjacent to the fire bed, circulating tubes connecting the water back bridge wall with the upper and lower drums of the boiler, a tubular gas conduit passing through the water back bridge wall and open at its ends to the exit throat and to the fire chamber respectively, and an air supply passage leading into the fire chamber adjacent to the upper end of the gas conduit.

4. A water back bridge wall for boiler furnaces having a plane surface on its top for a portion of its width, adapted to make a joint with the wall of a boiler setting, and recessed or shouldered below said plane surface for the remainder of its width, connections for circulating pipes on the plane surface of its top and on its bottom, and one or more tubular gas conduits extending from the shouldered portion of its top to its bottom, substantially as set forth.

In testimony whereof I have hereunto set my hand.

EDWIN POWELL.

Witnesses:

J. SNOWDEN BELL,
F. E. GAITHER.