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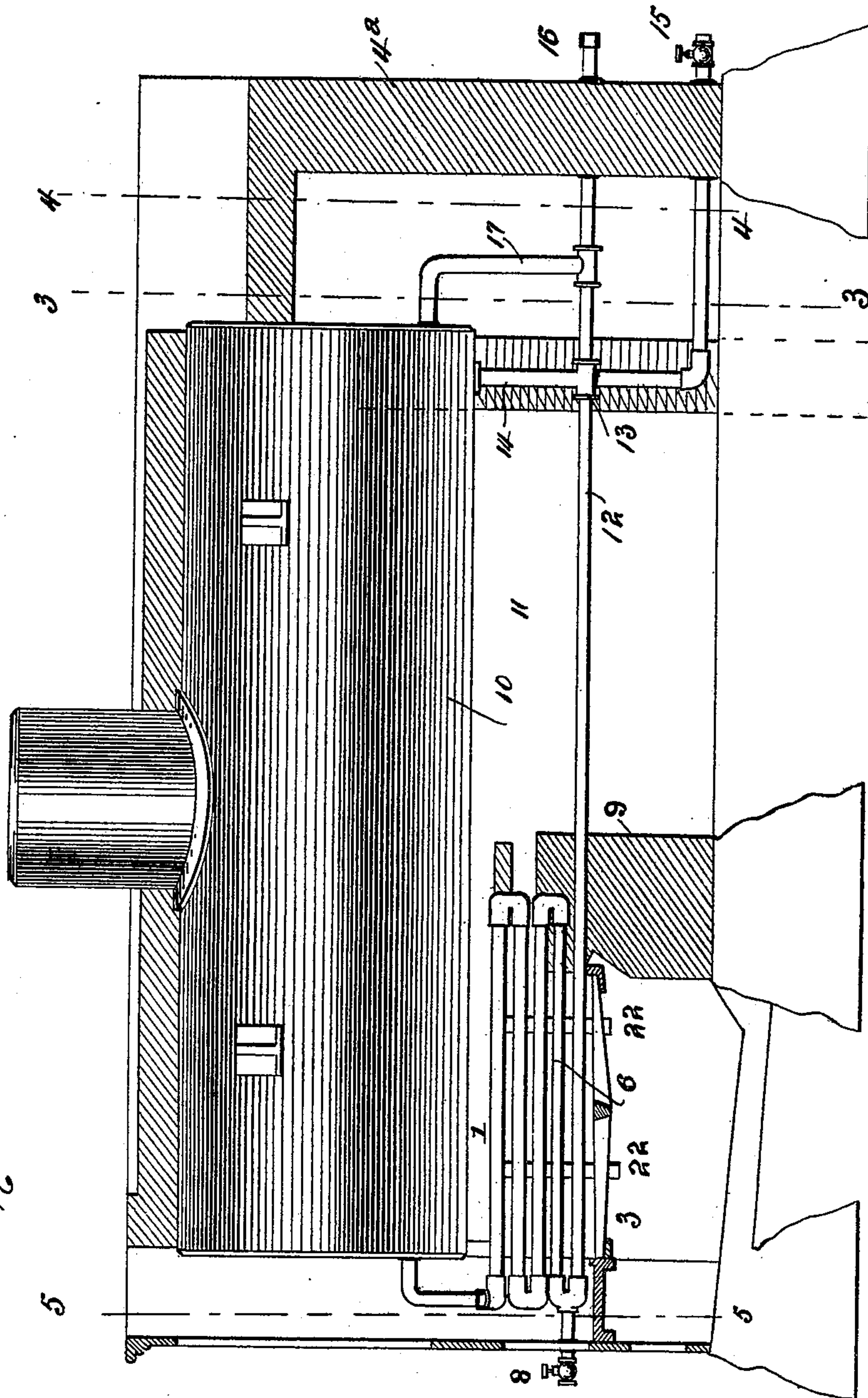
Patented May 2, 1899.

H. SIEBEN.
STEAM BOILER FURNACE AND CONNECTIONS.

(Application filed Jan. 13, 1899.)

(No Model.)

3 Sheets—Sheet 1.



WITNESSES
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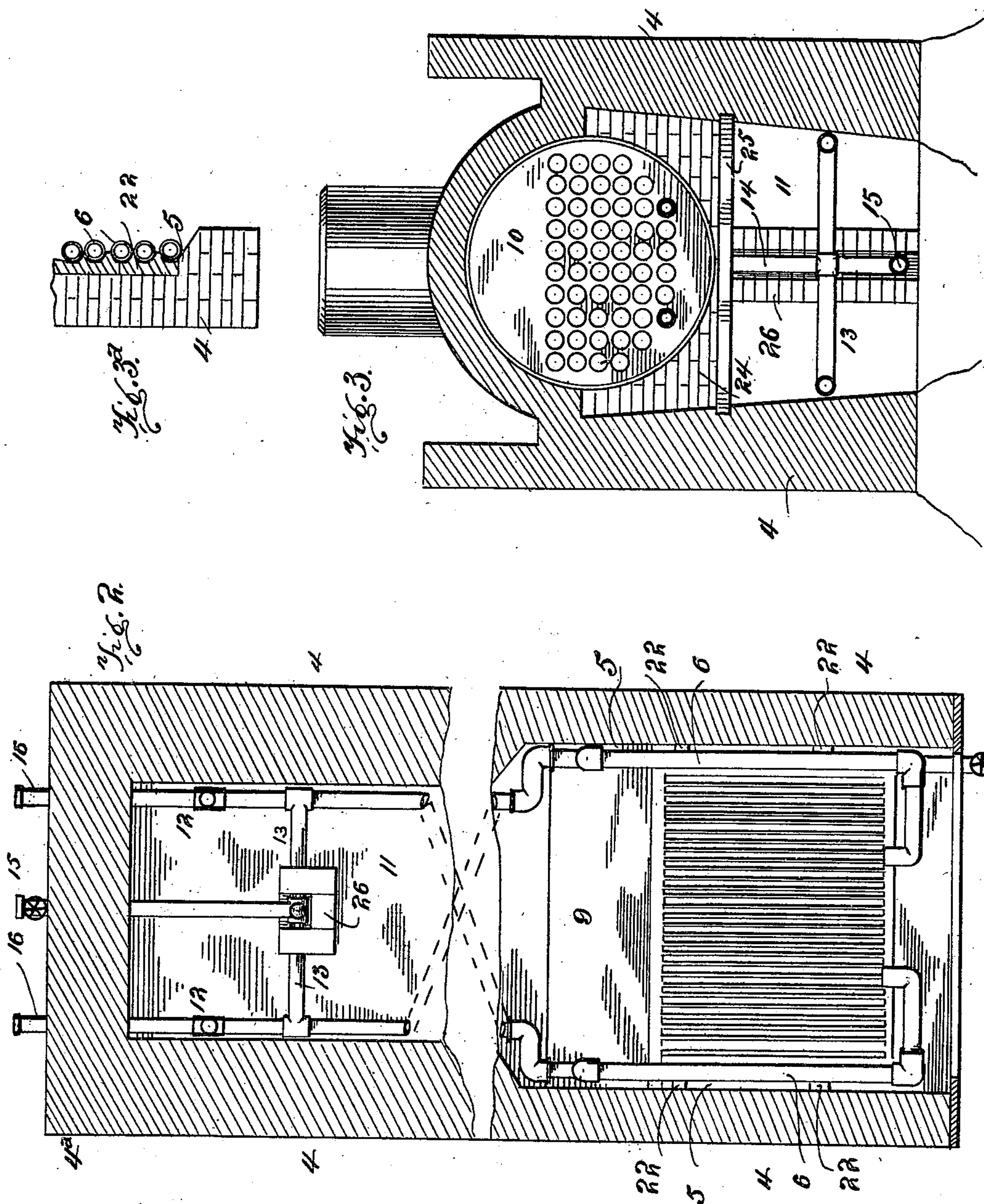
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Fig. 4.

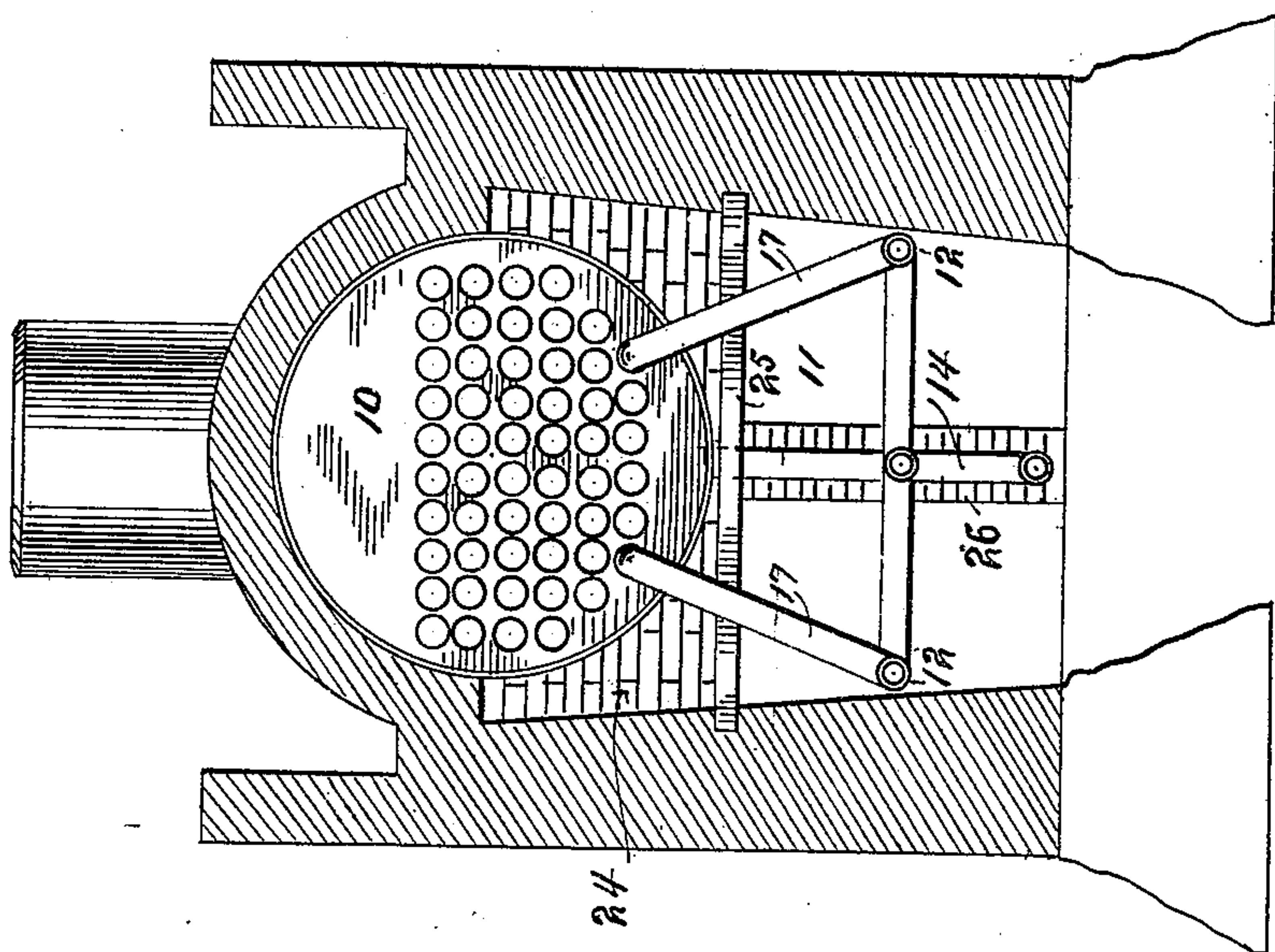
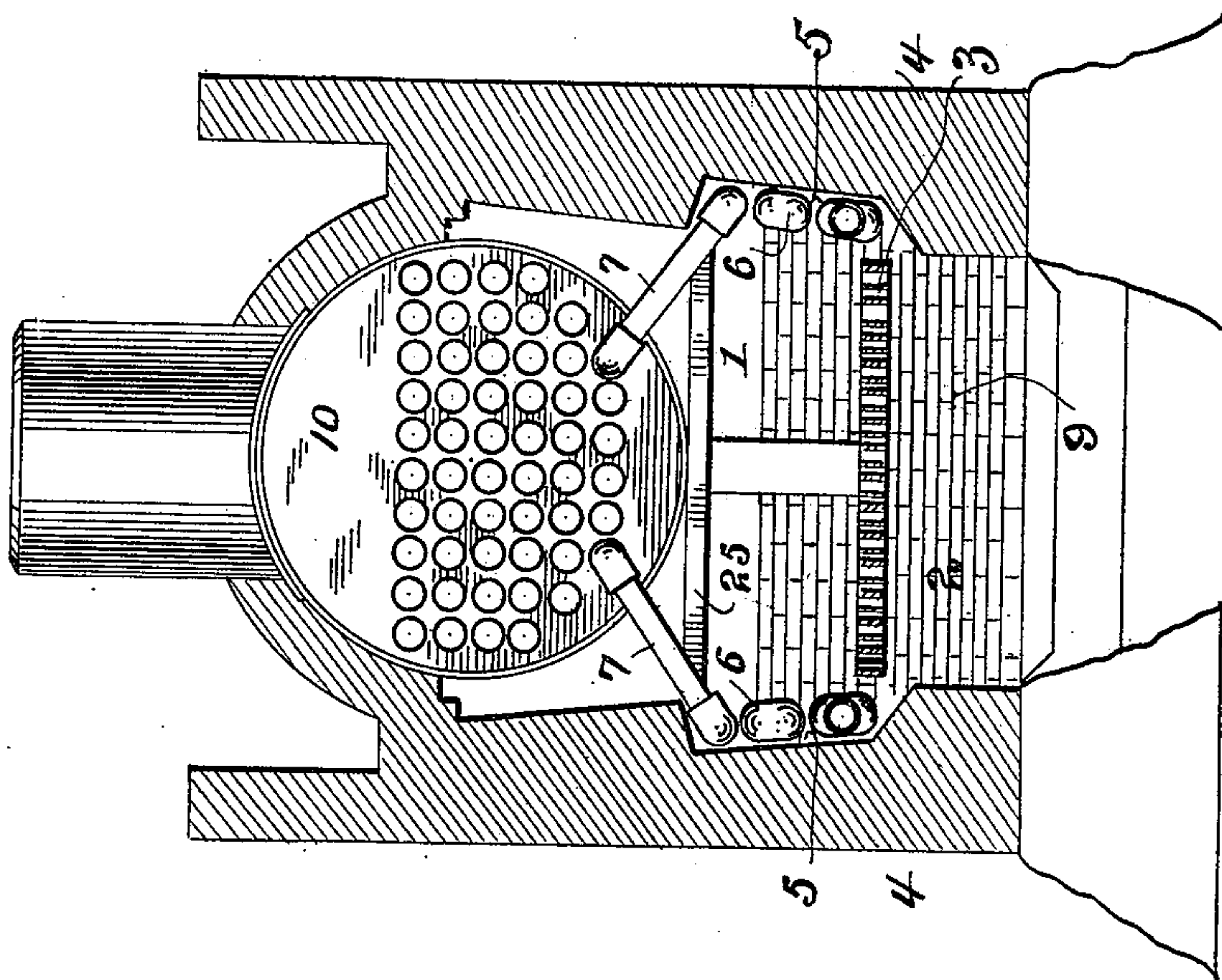


Fig. 5.



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UNITED STATES PATENT OFFICE.

HENRY SIEBEN, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO
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STEAM-BOILER FURNACE AND CONNECTIONS.

SPECIFICATION forming part of Letters Patent No. 624,110, dated May 2, 1899.

Application filed January 13, 1899. Serial No. 702,027. (No model.)

To all whom it may concern:

Be it known that I, HENRY SIEBEN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have
5 invented certain new and useful Improvements in Steam-Boiler Furnaces and Connections, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to steam-boiler furnaces.

The object of the invention is to produce a furnace for steam-boilers in which the complete combustion of coal shall so far do away
15 with smoke as to prevent any considerable escape of smoke from the smoke-stack.

In my Patent No. 507,938, of October 31, 1893, I describe an apparatus which I have largely and successfully put into operation,
20 and reference is made to such patent as showing some features of construction which may be used in conjunction or coöperation with the devices herein claimed.

In Patent No. 532,105, of January 8, 1895, to
25 myself and H. Wagner certain devices are shown and described whereby air and steam can be fed to a furnace to increase combustion, and some of said devices are applicable as auxiliaries to the present invention.

30 In my Patent No. 613,785, of November 8, 1898, I describe certain improvements in boiler-furnaces.

The present invention is largely an improvement on and supplementary to the improvement described in the last-mentioned
35 patent.

As the result of much study and experiment and the construction of several hundred furnaces now in practical use I find that where
40 there is complete combustion of coal in a furnace under a boiler there is little or no smoke produced and practically no smoke passes from the stack or chimney. Complete combustion of coal in a furnace can be produced
45 if a sufficient supply of air is introduced into the furnace at the proper localities. A supply of steam to the fire will stimulate combustion; but many engineers object to the use of steam for such purpose for various reasons
50 alleged, perhaps the most important be-

ing that the steam-supply is variable and the apparatus likely to get out of order; and I have found that where a sufficient supply of air can be forced to the fire-chamber to produce complete combustion and smoke de-
55 struction (or non-production) the most satisfactory results are attained in very many cases without the use of a steam-jet.

The present invention is supplementary to the patented inventions referred to and in-
60 volves devices for utilizing the furnace heat to good advantage, as shown in the drawings.

Figure 1 is a vertical longitudinal section of a steam-boiler furnace according to the present invention, the boiler and some of the pipes
65 and parts being shown in elevation and some parts not necessary to the understanding of the invention being omitted. Fig. 2 is a broken horizontal section or plan looking down into the furnace, the boiler being omitted
70 and parts broken away to permit details to appear on larger scale. Fig. 3 is a cross-section on line 3 3, Fig. 1, looking toward the front of the boiler. Fig. 3^a is a sectional detail showing partition in relation to furnace-
75 grate pipes. Fig. 4 is a cross-section on line 4 4, Fig. 1, looking toward the front of the boiler. Fig. 5 is a cross-section on line 5 5, Fig. 1, looking toward the rear of the boiler.

In my Patent No. 613,785, above referred
80 to, I show side walls or partitions of the fire-box, behind which air passes up from the ash-pit and thence through the perforations in these walls to the fire-chamber. These walls
85 are generally of fire-brick and are liable to injury from the fire and may accumulate clinker. In some instances these brick walls or partitions have to be often replaced at considerable expense. In the present device I
90 substitute water-pipes for such side partition-walls, as I will now explain.

The numeral 1 indicates the fire-chamber of this furnace, 2 the ash-pit, and 3 the grate-bars, the general arrangement of the same being common and well known.
95

In the brick side walls 4 4 of the fire-box are chambers 5 5, very similar to the chambers referred to in my Patent No. 613,785. In these chambers are manifold tubes or pipes
100 6 6, the same being arranged horizontally in

as close proximity as tubes can be conveniently placed, but on account of the end couplings or bends permitting some air-passages between the horizontal pipes. Each manifold 5 6 communicates with the water-space of the tubular boiler 10 by a tube 7. Each manifold 6 at its lowermost turn has a cock 8, projecting to the front of the casing and serving as a blow-off or cleaning cock for the folds of the 10 manifold, if needful, and also as a convenient connection for feed-water or for other purpose. The lower fold of each manifold pipe 6 is carried to the rear through the bridge-wall 9, and in rear of said bridge-wall these 15 pipes cross the combustion-chamber, so that the right-hand manifold connects with the left-hand pipe 12, and vice versa. From the crossing the pipes 12 extend back near the walls of the chamber, and near the rear of 20 the boiler-pipes 12 are connected by cross branches 13 with the down-pipe 14, which leads down from the boiler 10 near the rear end thereof and extends to from the blow-off at 15. The pipes 12 13 in the combustion-chamber afford considerable heating-surface, 25 entirely surrounded by hot gases. The side tubes 12 do not terminate at the cross branches 13, but continue to the rear outside the boiler-setting, where they are stopped by 30 plugs 16. By removing these plugs the tubes 12 may be cleaned, if needful, by the passage of a rod therein. Between the cross branches 13 and the plugs 16 pipes 12 are connected to the water-space of the boiler by pipes 17 35 within the rear wall or casing 4^a. The natural course of circulation in manifolds 6 is by the down passage of water from the boiler through pipe 14, branches 13, and side pipes 12, through the manifold, and up by pipes 7 40 to the water-space in the boiler, but should pipe 14 become stopped by scale or sediment circulation then takes place through branches 17 and pipes 12 to the manifolds and so in return to the boiler, and by reason of this com- 45 pound connection there is less likelihood of the obstruction of the down-pipe 14, leading to the blow-off, than when there is no such duplication of connections. There is little tendency to obstructions in pipes 6, but should 50 any take place the openings at 8 and 16 afford effective means of relief. With manifolds 6 so constructed and connected the pipes of manifolds 6, although exposed to the extreme heat of the furnace, become as durable as the 55 boiler itself.

The coal on grate 3 comes directly in contact with manifold pipes 6. The chambers 5 5 supply air from the ash-pit to the sides of the fire-box and over the upper fold of the 60 manifold toward the center of the fire-box. The tubes of the manifold are held a little away from walls 4 and the chambers 5 are divided by the vertical partitions 22, which partitions may be bricks or fire-bricks notched 65 to fit snugly against the sides of the tubes. (See Fig. 3^a.) By these partitions the air rising at the sides of the fire-box is prevented

from tending too much to the rear, as might otherwise be the case.

The manifolds 6 serve not only to heat the 70 water which circulates therein, and thus add largely to the steam-making power of the boiler, but these pipes serve to heat the air rising behind them and convey it to the upper portion of the fire-box in condition for 75 immediate and rapid combustion.

The bridge-wall and central part of the grate may have air-supply devices, as described in either of my patents referred to, and preferably such is the case, so that an 80 ample supply of heated air is conveyed to the fire-box to cause complete combustion of fuel therein, and, as explained particularly in my patent of latest date above referred to, such a supply and combustion will prevent the 85 production of smoke in the fire-box.

When the gaseous products of combustion pass over the bridge-wall 9, the tendency of the gases is to move along the sides and bottom of the boiler toward the rear. A better 90 utilization of heat is effected and danger from fire diminished by placing under the rear end and sides of the boiler the deflector-wall 24. This wall 24 is supported on a tile or girder 25, extending across the rear of the combustion-chamber 11 and supported centrally by 95 the brickwork pier 26, which pier may form a support or cover for the down-pipe 14. The deflector-wall 24 causes the backwardly-moving currents of heated gases to curve down- 100 wardly and then rise up between the rear wall 4^a and the end of the boiler on the way to pass through the boiler-flues to the front. Such an eddy in the gas-currents tends to mingle the currents and reduce sparks. The branch 105 pipes 17 are located in this eddy and tend to break up the currents while getting the benefit of the heat to accelerate circulation.

From the foregoing, in connection with the patents referred to, it will be understood that 110 my invention contemplates changes according to the circumstances of the case in adapting the device to the conditions of use with boilers of different constructions and dimensions. 115

As will be understood by a competent constructing engineer, the dimensions of the air-supply will depend somewhat on the draft, due to the conditions of the special case.

The present invention is believed to be as 120 broad as the following claims.

I claim—

1. In a steam-boiler furnace, the combination with the fire-box, of the side walls having air-chambers therein separated by vertical partitions, horizontal manifold pipes lying 125 in such chambers at each side of the fire-box and in contact with such partitions, and front and rear connections of such manifold pipes with the water-space of the boiler, whereby 130 water-heating pipes are provided at the sides of the fire-box, and air-heating passages between said pipes and the walls of the furnace, all substantially as described.

2. In a steam-boiler furnace, the boiler, fire-box, and side walls having chambers therein, the horizontal manifold pipes lying in said chambers and separately connected at the 5 front to the boiler, and at rear connected to each other and to the boiler, and the vertical air-passages between said manifolds and the side walls, all substantially as described.

3. In a steam-boiler furnace, the fire-box 10 having side chambers said chambers separated from the fire-box by partitions and having manifold pipes therein, the separate front connections of such manifolds to the water-space of the boiler, and the intermediate 15 joined connection of pipes from said manifolds to each other and to the water-space of the boiler, substantially as described.

4. In a steam-boiler furnace, the combination with the boiler having a front fire-box and a plurality of water-pipes therein, of the 20 blow-off pipe connected to the water-space of the boiler and to each of the pipes of the fire-box, and the separate connections from each water-tube of the fire-box to the boiler from each end of said water-tube and connecting 25 with the water-space at each end of the boiler, all substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY SIEBEN.

Witnesses:

W. A. BARTLETT,
M. E. BROWN.