No. 705,960. Patented July 29, 1902.

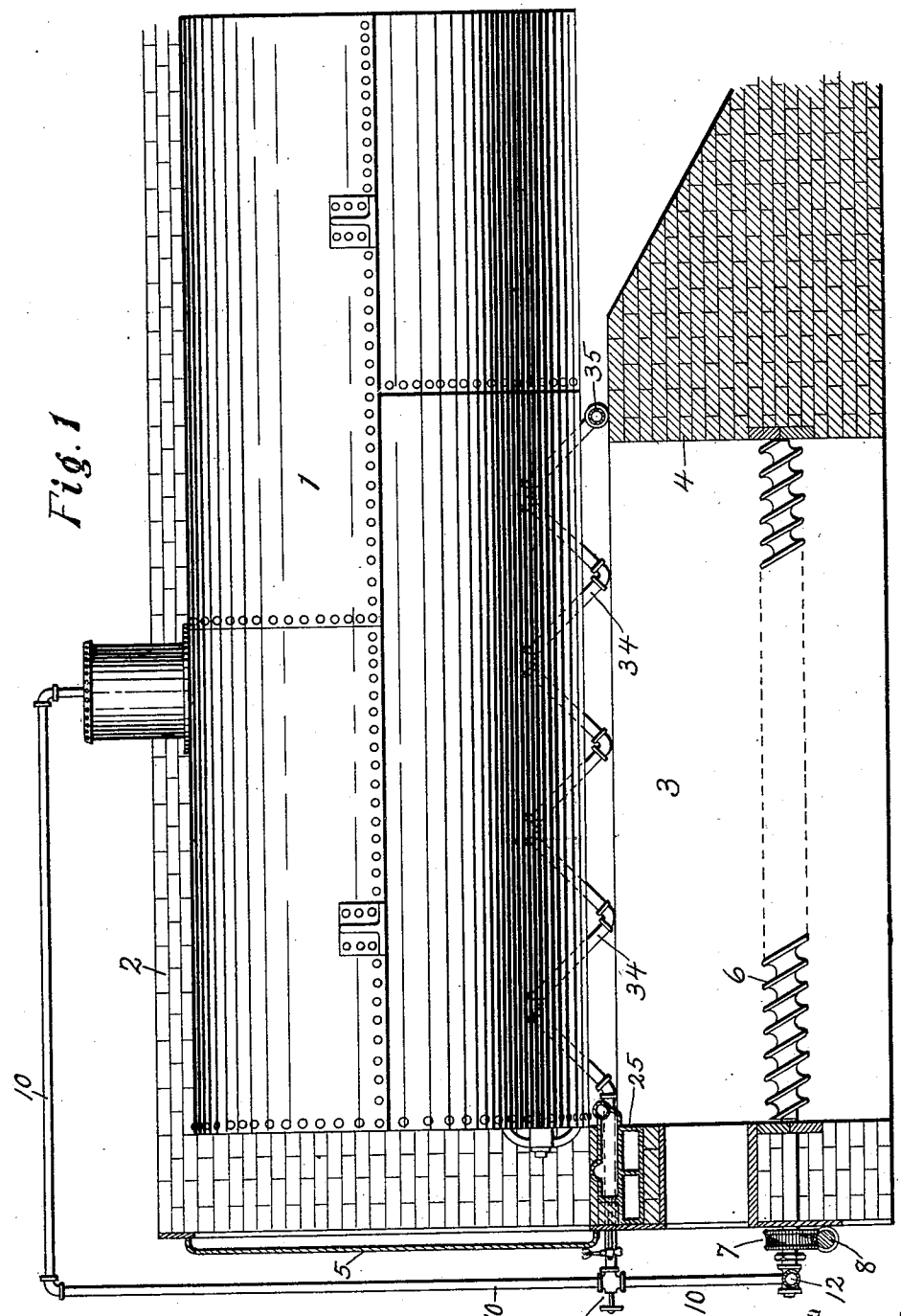
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BOILER FURNACE.

Application filed Sept. 20, 1901.

(No Model.) 4 Sheets—Sheet 1.

Fig. 1



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Fig. 3

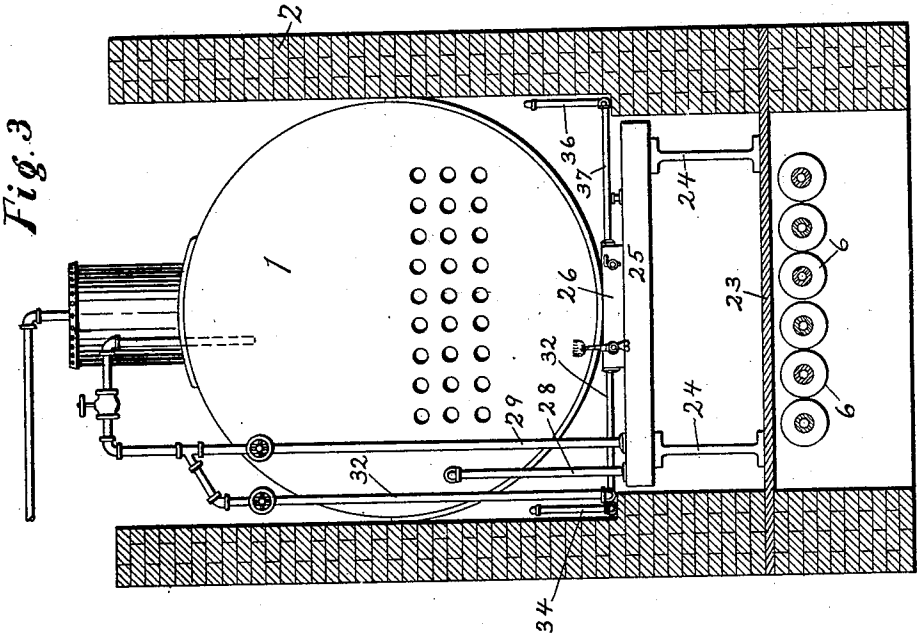
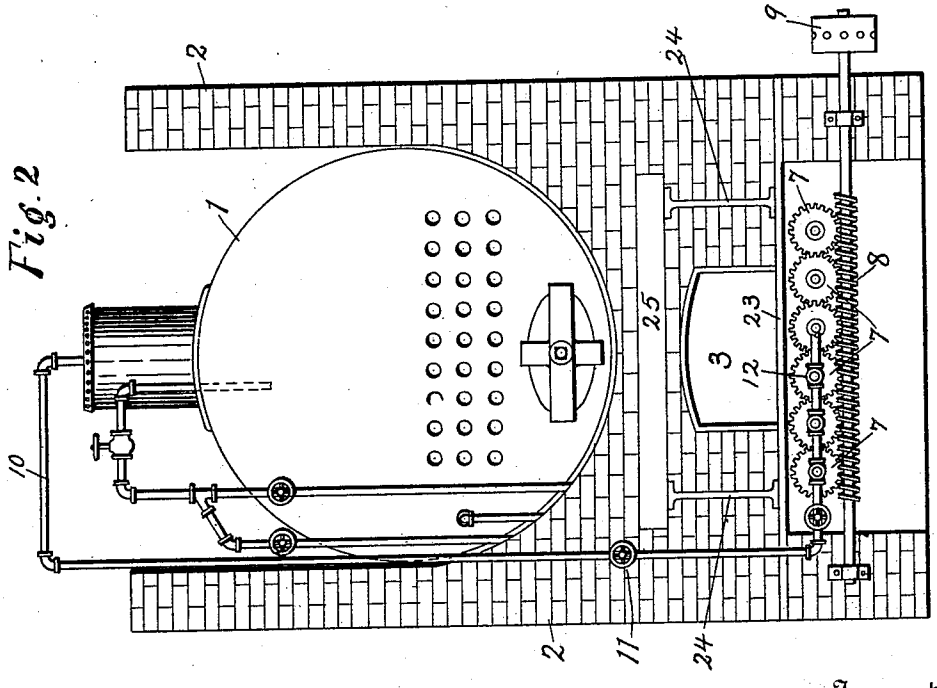


Fig. 2



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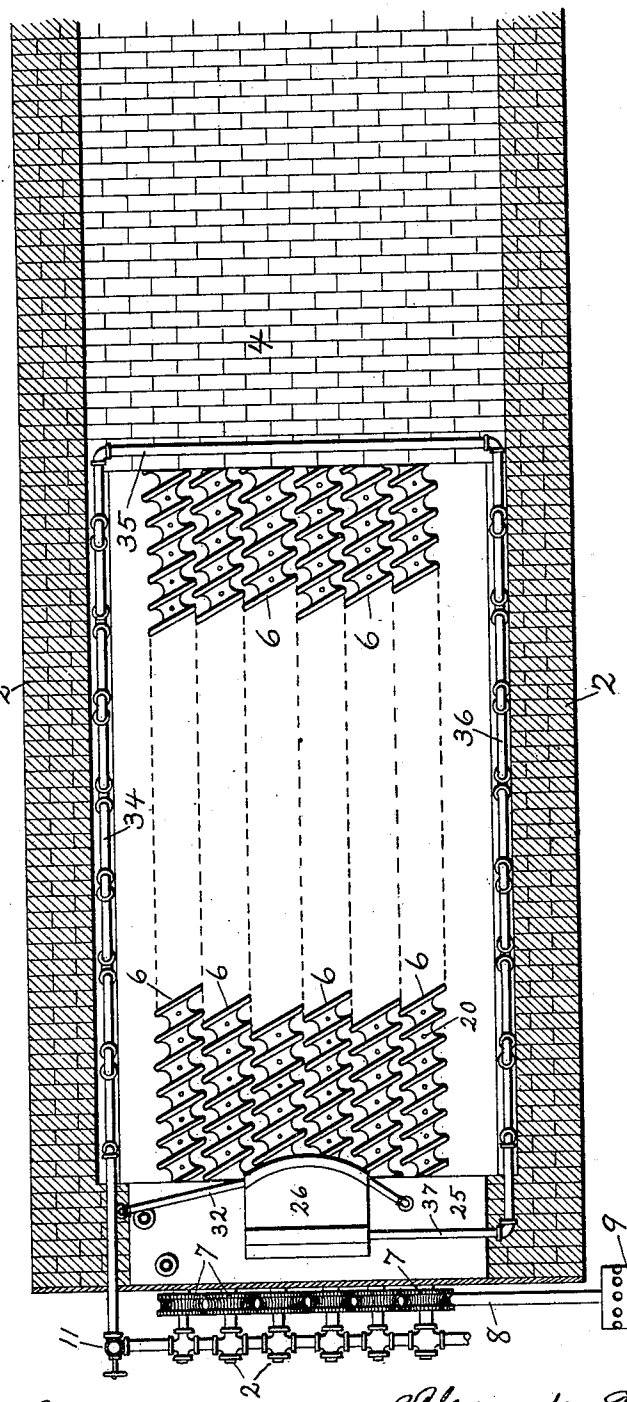
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Fig. 4



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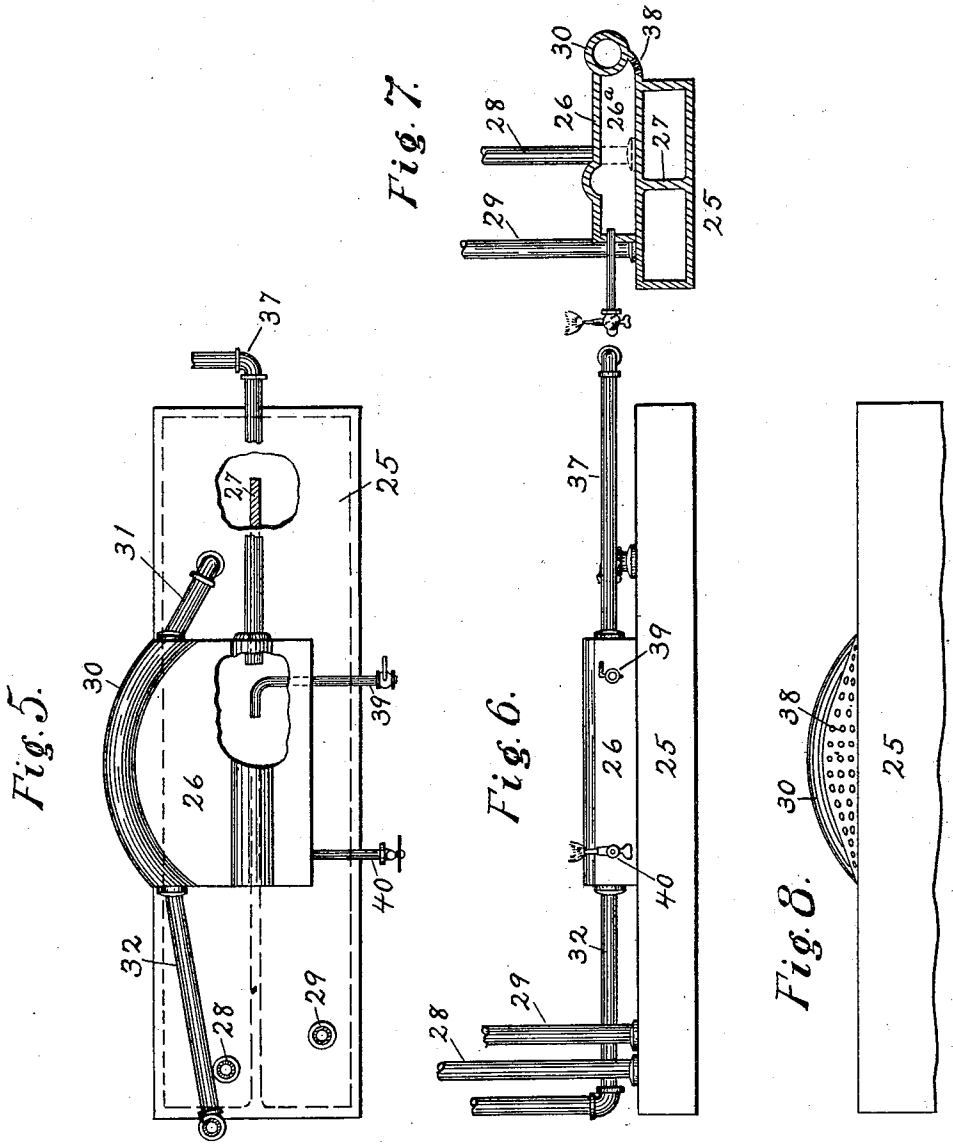
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(No Model.) 4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

ALEXANDER M. RANKIN, OF NEW YORK, N. Y., ASSIGNOR TO OSCAR E. MADDEN, OF NEW YORK, N. Y.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 705,960, dated July 29, 1902.

Application filed September 20, 1901. Serial No. 75,786. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER M. RANKIN, a citizen of the United States, residing in the city of New York, borough of the Bronx, county and State of New York, have invented certain new and useful Improvements in Boiler-Furnaces, of which the following is a specification.

This invention, while primarily designed for use as a furnace for a boiler or steam-generator and while herein shown as adapted for that purpose or use, may be applied to any use for which such a furnace is suited, and it belongs to that class of furnaces wherein the grate-bars are rotative or oscillative and steam is admitted to the fire-bed through them. It also belongs to the class of furnaces wherein a steam-pipe is disposed in the combustion-chamber in such a position that the steam therein will become highly superheated or gasified, after which it is admitted to the combustion-chamber above the bed of fuel.

The novel features of the invention reside mainly in this superheating or gasifying means, which will be hereinafter fully described. These features will be carefully defined in the claims.

In the accompanying drawings, which illustrate an embodiment of the invention, Figure 1 is a vertical longitudinal mid-section of the furnace. Fig. 2 is in substance a front elevation with the metal front omitted in order to better show the parts that would be obscured thereby. Fig. 3 is a similar view to Fig. 2, but with the front brickwork omitted and showing the gas-head and water-base in elevation, together with the connecting-pipes. Fig. 4 is a horizontal section through the combustion-chamber. Fig. 5 is a plan of the gas-head and water-base detached. Fig. 6 is a front elevation of the same, and Fig. 7 is a cross-section. Fig. 8 is an under side view of the gas-head and water-base.

Referring to the principal views primarily, 1 represents a boiler mounted in brickwork 2 in a known way.

3 is the combustion-chamber, 4 is the bridge-wall, and 5 is the metal front of the furnace.

The grate which supports the fuel is composed of a series of spirally-flanged tubular grate-bars 6, placed side by side, as seen in Fig. 4, and journaled at the ends, so that they may be rotated wholly or partially and simultaneously, so as to carry the bed of fuel thereon back toward the bridge-wall and so as to remove the ashes and cinders by shaking. The means illustrated for rotating or shaking the bars 6 consists of a series of like worm-wheels 7, one on each bar, and a screw 8, gearing with said wheels, said screws having bearings on the furnace-front and being provided with a capstan-head 9, by which to rotate the screw. The steam from the boiler is admitted to the bars 6 by means that will now be described.

A pipe 10 from the dome on the boiler and provided with a stop-valve 11 extends down in front to a level with the grate and is there coupled to a cross-pipe 12, from which branches lead the steam to the respective bars.

The means for gasifying steam and admitting it to the combustion-chamber above the fuel will now be described, with special reference to Figs. 5, 6, and 7 for details.

Mounted on a metal plate 23, set in the brickwork of the furnace-front, are two metal posts 24, Fig. 2, which support a metal box 25, which I call for convenience the "water-base," and cast integrally with this base and superposed thereon is a box 26, which I call for convenience the "gas-head." The base 25 has in it a partition 27, Figs. 5 and 7, which extends only part way of the length of the chamber within the base, as indicated where the base is broken away in Fig. 5. Water from the water-space in the boiler is led to the base 25 by a pipe 28, entering the base at the front of the partition 27, flowing about the end of latter and back to where a pipe 29 is connected, which leads it back to the upper part or steam-space of the boiler. Thus the chamber in the base 25 forms a part, in substance, of the boiler. About the inner covered edge of the head 26 is formed a tubular chamber or conduit 30, which is not connected with the gas-chamber in the head, but is connected by a branch pipe 31 at one end with the water-base 25 and at the other end by a pipe 32 with the steam-space in the

boiler. Thus the chamber of the conduit 30 also forms in substance a part of the boiler, and it is interposed between the body of the gas-head 26 and the fierce heat of the furnace. The chamber 26ª in the gas-head forms a terminus of a steam-pipe or system of pipes which extend about the interior of the fire-box, as will be described. A branch from the pipe 10 at the stop-valve 11 or about the level of the bridge-wall is coupled to one end of a zigzag pipe 34, which extends from front to rear of the fire-box along one side wall of the combustion-chamber. At the bridge-wall this pipe 34 is connected with one end of a cross-pipe 35, which rests on the bridge-wall and is connected at its other end with a zigzag pipe 36, like the pipe 34, but which extends to the front along the other side wall of the combustion-chamber. At its front end this pipe 36 is connected by a pipe 37 with the chamber in the gas-head 26. By the time the steam flowing through the pipes 34, 35, and 36 reaches the gas-head it will have been very highly superheated and practically gasified, and from the chamber in the gas-head it escapes into the combustion-chamber through jet-apertures 38 in the front of the same under the projecting conduit 30, as seen in Figs. 7 and 8.

This furnace is especially designed for burning soft coal and similar fuels which produce smoke or free carbon under normal conditions, and it is adapted to produce substantially complete combustion of such fuels without smoke.

In order to determine whether the steam in the head 26 is gasified properly, the latter may be provided with the following-described device: A cock-controlled air-inlet 39 is adapted for admitting air in proper quantity to the gas-chamber 26ª, and a gas-jet and tube 40 is provided to be supplied from said chamber. At any time during the operation of the furnace air may be admitted to the chamber and the gas at the burner 40 ignited. In order to produce induction of air at the inlet 39, the tube forming the inlet may extend in about to the axis of the inlet-pipe 37 and then turn or bend in the direction in which the gaseous steam is flowing. This is a known form of device for inducing injection of air, and specific illustration will not be required.

This invention is designed, primarily, as before stated, to enhance the combustion of fuels rich in hydrocarbons and to combine with the oxygen of the decomposed steam and admitted air all of the carbon, thus avoiding the formation of smoke and attaining a high percentage of yield from the fuel.

It will be understood that I do not claim rotatable spirally-flanged hollow grate-bars, as these are not new with me, nor do I claim, broadly, the extension of steam-pipes about the inner walls of the fire-box to supply highly-heated steam to the combustion-chamber above the fuel, as these have been before employed. I have invented special means for carrying out in a more perfect manner what has been attempted before in the burning of soft coal and similar fuels and have herein illustrated my improvements as applied to a furnace having a known form of fire-bed, as it is especially well adapted for use with such a furnace.

Having thus described my invention, I claim—

1. A furnace having a gas-head at the center of the front of the fire-box above the level of the grates, said head having jet-apertures opening to the fire-box, means for supplying highly superheated or gasified steam to said gas-head, water-receptacles situated, respectively, above and below the jet-apertures therein, and means for supplying said receptacles with water, substantially as set forth.

2. A furnace having a steam-pipe, or series of connected steam-pipes, extending about the fire-box along the sides and bridge-wall of same, and a gas-head at the front of the fire-box above the fuel-bed and connected to the end of said series of pipes, said gas-head having in its side next the fire-bed a series of jet-apertures for the escape of the gasified steam, and a protecting water-conduit above said apertures.

3. A furnace having a water-base 25, mounted in its front wall, in combination with a boiler, pipes connecting said water-base with the boiler, a steam-pipe extending about the fire-box and connected at one end with the boiler and at the other end with a gas-head, 26, on the water-base, the said gas-head provided with jet-apertures 38 for the escape of the gasified steam to the fire-box, and provided with a protecting water-conduit 30, and the pipes connecting said conduit with the water-space of the boiler.

4. The combination with the boiler, the fire-box thereunder, and the grate-bars forming the fire-bed, of the water-base in the front wall of the fire-box, pipes connecting said water-base with the water-space in the boiler, a gas-head mounted on said water-base and having jet-apertures opening into the fire-box, means for supplying said gas-head with superheated or gasified steam, a water vessel or conduit on said gas-head above and adjacent to the said jet-apertures, and pipes connecting said conduit at one side with the water-base and at the other side with the water-space in the boiler, substantially as set forth.

5. The combination with the boiler, the furnace under the same, the gas-head at the front of the combustion-chamber, the superheating-pipes about the combustion-chamber and connected at one end with the boiler and at the other end with said gas-head, and the burning-jet on said gas-head, as and for the purpose set forth.

6. A furnace having a gas-head 26, in the front wall of its fire-box, zigzag steam-pipes 34 and 36 extending from the front of the fire-box back to the bridge-wall at the sides of

the fire-box, the pipe 35 on the bridge-wall connecting said pipes 34 and 36, and the pipe 37 connecting the pipe 36 with the gas-head, in combination with a boiler over the furnace, and a pipe connecting the steam-space in the boiler with the pipe 34, substantially as set forth.

In witness whereof I have hereunto signed my name, this 5th day of September, 1901, in the presence of two subscribing witnesses.

ALEXANDER M. RANKIN.

Witnesses:

HENRY CONNETT,

PETER A. ROSS.