

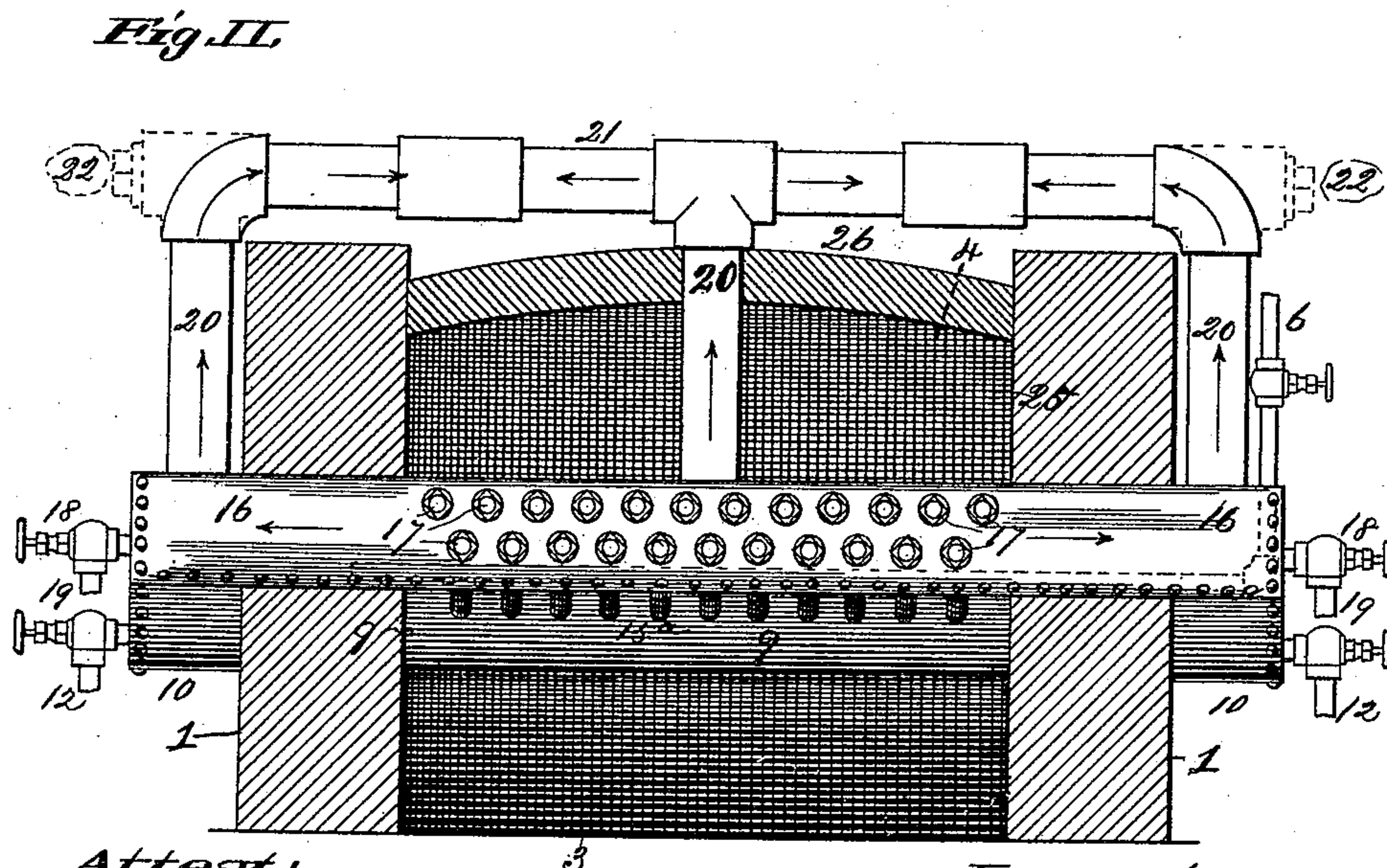
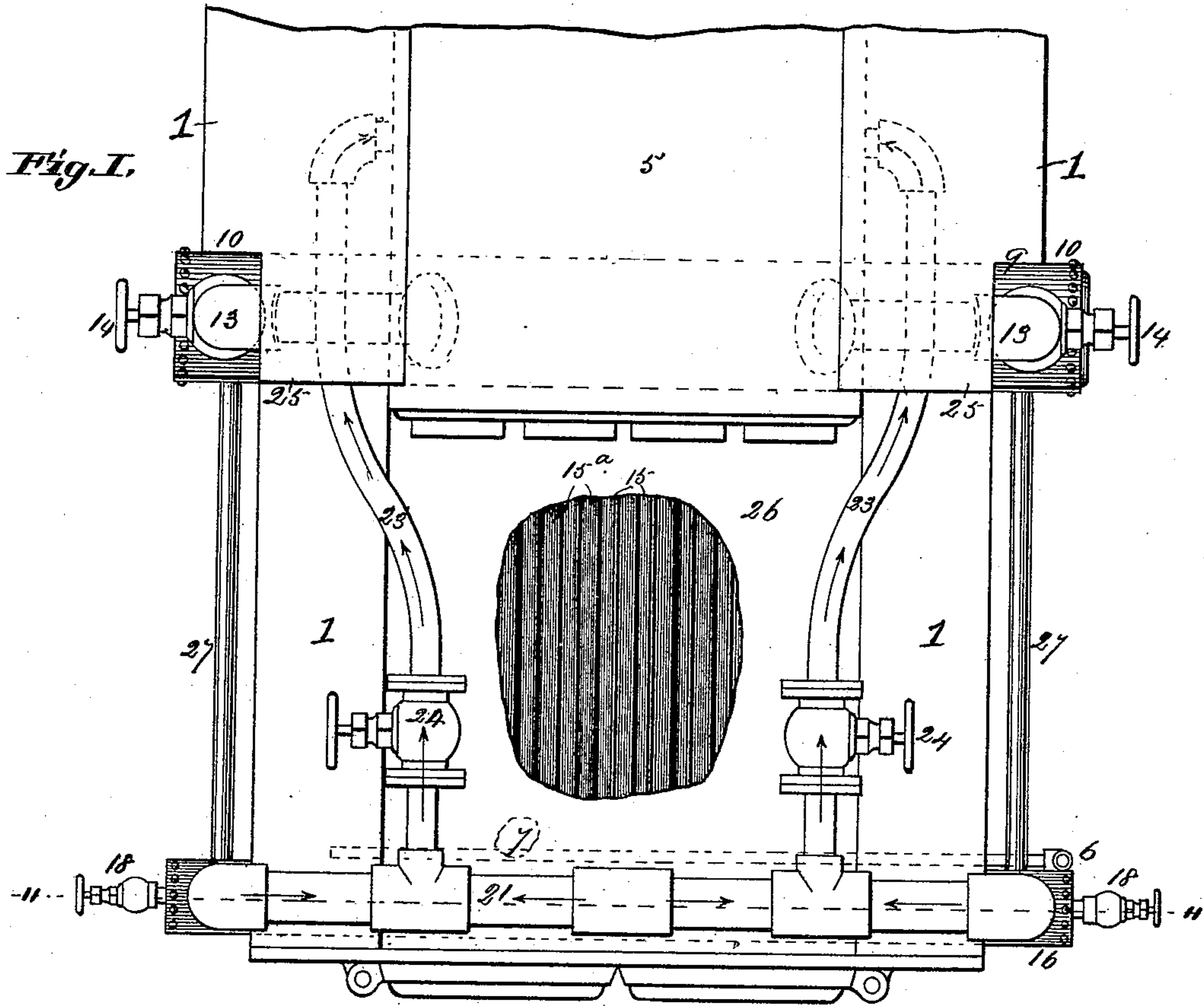
(No Model.)

2 Sheets—Sheet 1.

M. A. FOSTER.  
BOILER FURNACE.

No. 471,966.

Patented Mar. 29, 1892.



Attest:  
*S. H. Knight*  
*S. Carter*

Inventor:  
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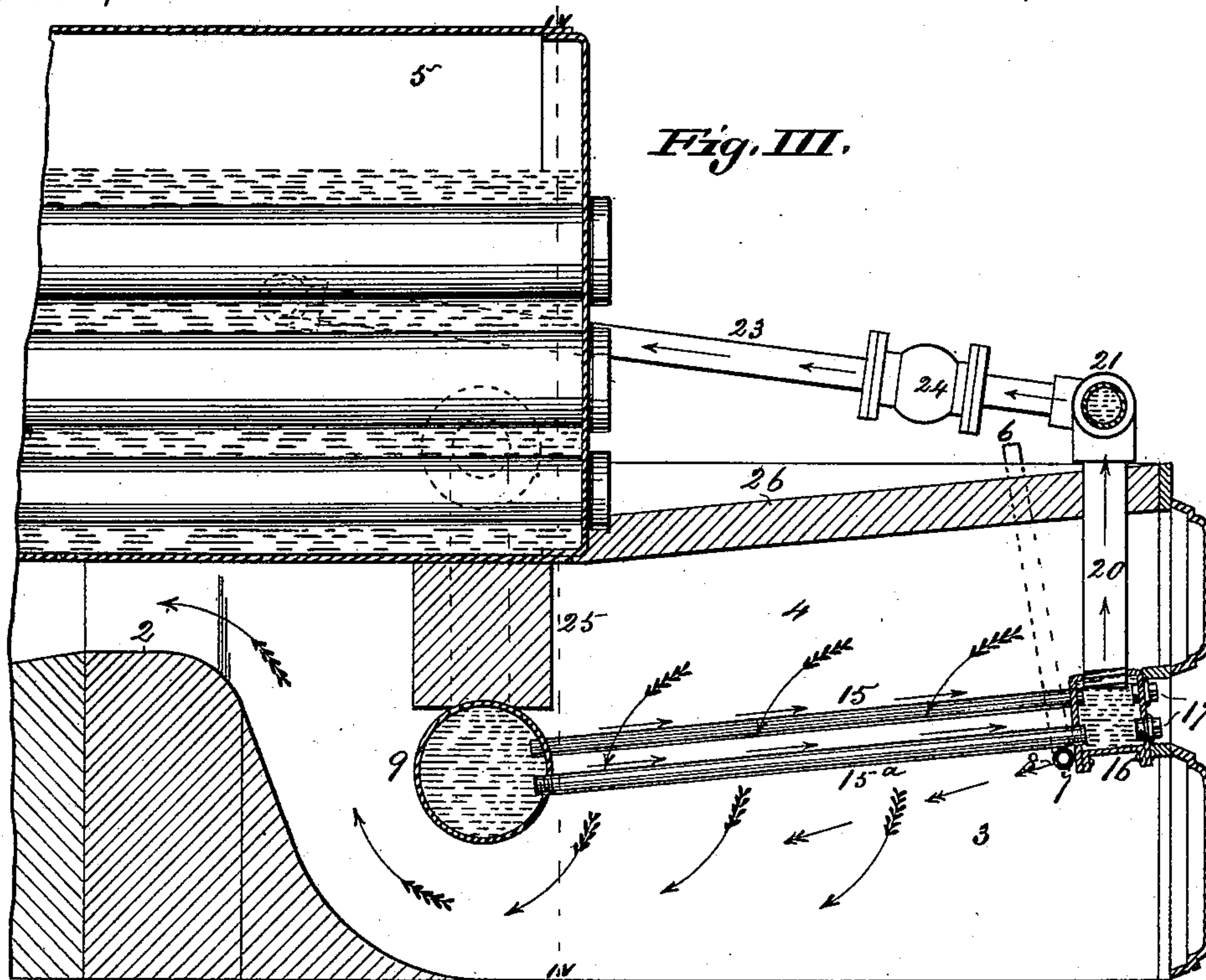
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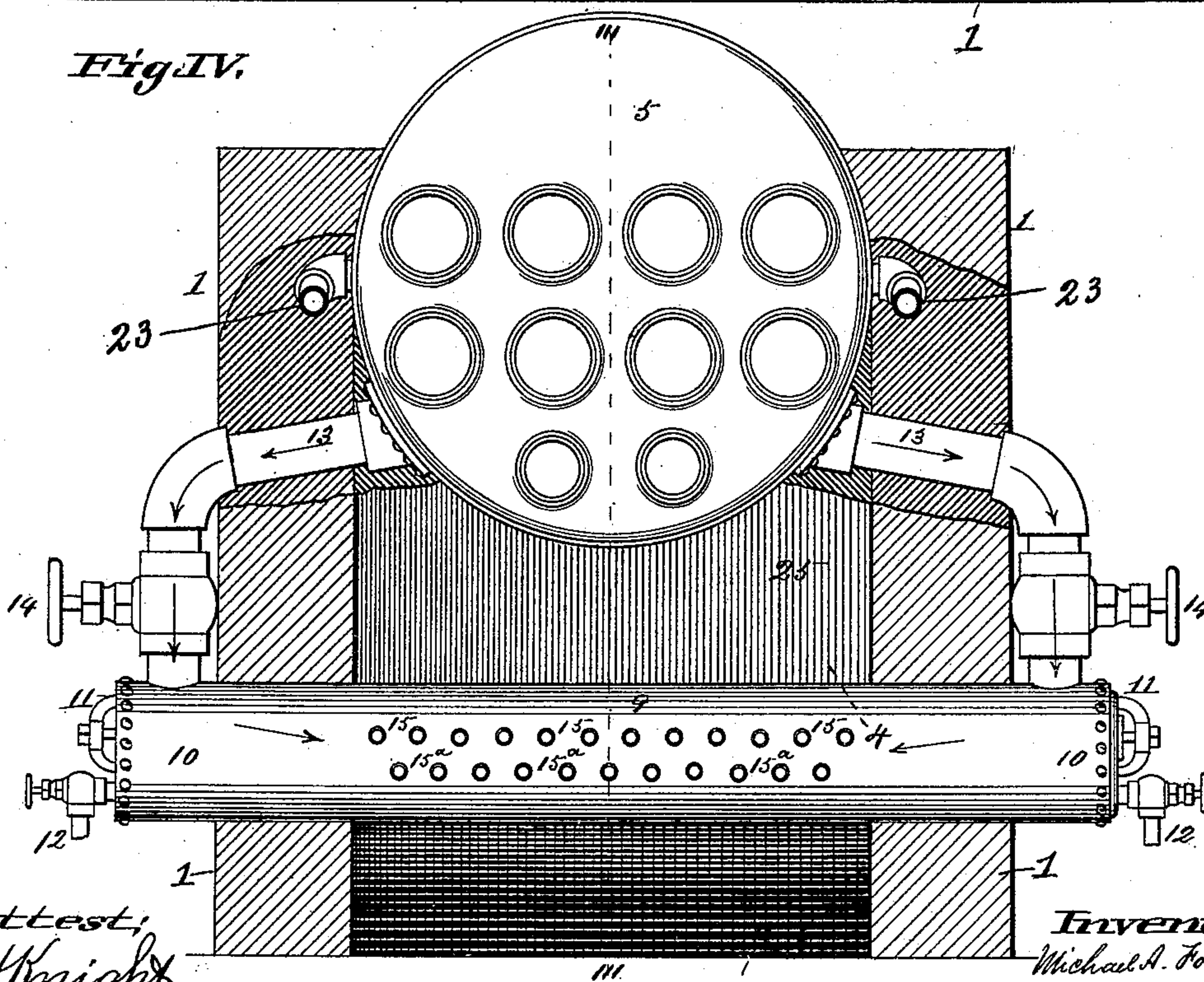
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*Fig. IV.*



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# UNITED STATES PATENT OFFICE.

MICHAEL A. FOSTER, OF ST. LOUIS, MISSOURI.

## BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 471,966, dated March 29, 1892.

Application filed March 3, 1891. Serial No. 383,539. (No model.)

*To all whom it may concern:*

Be it known that I, MICHAEL A. FOSTER, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Boiler-Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

This invention belongs to that class of boiler-furnaces having water-pipes filling the office of grate-bars.

The features of novelty will be set forth in the claims.

Figure I is a top view of a furnace and part of a boiler having the improvement applied thereto. Fig. II is a vertical transverse section taken at II II, Fig. I. Fig. III is a longitudinal section taken at III III, Fig. IV. Fig. IV is a transverse section taken at IV IV, Fig. III.

1 are the side walls of the furnace.

2 is the bridge-wall.

3 is the combined ash and combustion chamber, the passage of air being downward through the fire, as shown by the feathered arrows in Fig. III.

4 is the fire-chamber. The fire-chamber is not below the boiler 5, but extends forwardly from the front end thereof, the flames not coming in contact with the boiler until they leave the combustion-chamber. The passage from the combustion-chamber is curved, as shown, so as not to obstruct the passage of the flames.

6 is a steam-jet pipe, one end of which communicates with the steam-space of the boiler, while the portion 7 of the pipe extends transversely across the front of the combustion-chamber and has in its inner side a number of small jet-holes 8, from which fine jets of steam are injected forwardly into the combustion-chamber, as indicated by the featherless arrows in Fig. III.

9 is a water-pipe one foot (more or less) in diameter, extending transversely across the furnace, its ends 10 extending outside the side walls. These ends have hand-holes 11 and blow-off pipes 12.

13 are pipes extending from the water-space of the boiler to the ends 10 of the pipe and serving to convey water from the former to the latter.

14 are valves in the pipes 13.

15 and 15<sup>a</sup> are two series of pipes at different elevations extending from the pipe 9 at the inner end of the fire-chamber to a transversely-extending pipe 16 at the outer end of the fire-chamber and in communication with the inside of both pipes 9 and 16, so as to form a water communication between them. The pipes 15 15<sup>a</sup> incline upward toward the front end of the fire-chamber from pipe 9 to pipe 16, so that the water flows from the former to the latter. These pipes fill the office of a grate, the pipes 15 and 15<sup>a</sup> forming the grate-bars four feet (more or less) in length, and may properly be made of one and one-quarter-inch pipe.

The pipes 9 and 16 I purpose to make of boiler-plate riveted, the pipe 9 being cylindrical and the pipe 16 rectangular in cross-section; but I do not limit myself as to shape, size, or material. In the outer side of the pipe 16 are holes stopped with inclined screw-plugs 17, giving means of access to the inside of the pipes 15 and 15<sup>a</sup>, so that they may be scraped out for the removal of scale. I purpose to screw the inner ends of the pipes 15 15<sup>a</sup> into the pipe 9 and to expand the outer ends of the pipes in the pipe-holes of the pipes 16, the plug-holes being of larger diameter than the pipes and giving access to the expander.

18 are blow-off cocks in pipes 19 at the ends of the pipe 16. The pipes 15<sup>a</sup> are placed vertically beneath the spaces between the pipes 15, so that the two rows of pipes form a zig-zag series, as seen in Figs. II, III, and IV of the drawings.

20 are upright pipes (two located outside of the furnace) carrying water from the pipe 16 to an equalizing-pipe 21 above the furnace. The ends of the pipe 21 may be closed with screw-plugs 22, so that access may be had to scrape it out, as shown by broken lines in Fig. II.

23 are upwardly-inclined pipes extending from the pipe 21 to the boiler and discharging into the water-space of the same at a higher level than the pipes 13.

24 are valves in the pipes 23.

25 is an inverted bridge-wall supported on the pipe or tank 9 and closing the space between the pipe 9, and the boiler and forcing the draft and products of combustion to de-



scend from the fire-chamber to the combustion-chamber, so that the furnace has a downdraft.

26 is the upwardly and outwardly inclined arch or tile over the fire-chamber.

27 are stay-pipes extending from the ends 10 of the pipe 9 to the ends of the pipe 16, outside the side walls 1, and serving to hold these ends at the proper distance asunder and also to furnish passages for the flow of water from pipe 9 to pipe 16.

The equalizing-pipe 21 and the arrangement of connections of the pipes 20 and 23 therewith serve to equalize the flow of water through the pipes 15 15<sup>a</sup>, as the mouths of the pipes 21 and 23 are not opposite each other, so that the currents in the pipe 21 are opposed to each other, as indicated by the arrows in Fig. II, and eddies are formed which increase in violence as the speed of the currents increases. Thus if there should be a more rapid current through some of the pipes 15 15<sup>a</sup> than others this increased flow would be checked and the current equalized.

By means of the valves 14 and 24 the water-circulating apparatus may be disconnected from the boiler and cleaned out without discharging the water from the boiler, a feature of great practical value, as the pipe 9 would perform the office of a mud-drum and access may be had to it and the mud removed at any time when the fire is out.

The furnace receives the water through pipes 13 about a quarter up from the bottom of the boiler. The water passes down through valves into the pipe or tank 9, thence through the series of pipes 15 and 15<sup>a</sup> to the square pipe or tank 16, which has the inclined screw-plugs 17. The water passes up through the vertical pipes 20 into the equalizing chamber or pipe 21, where steam and water pass together through valves 24 and pipes 23 near the front of the boiler under the water-line, producing a circulation of the water in the boiler. The upper part of the water circulates from the front to the rear end, passes down and forward to the front, supplies the pipe or tank 9, and steam is generated very quickly.

The steam-pipe 6 is very useful in connection with a downdraft-furnace. The grate being inclined upwardly and outwardly, the

fuel placed on the grate-bars will settle toward the inner end against the inner pipe or tank 9.

I claim herein as new and of my invention—

1. The combination, in a boiler-furnace, of the pipes 9 and 16, extending transversely of the furnace, the circulating-pipes 13, 20, 21, and 23, communicating with these pipes and the interior of the boiler, and pipes inclined upward from the pipe 9 to the pipe 16, substantially as set forth.

2. The combination, in a boiler-furnace, of the pipes 9 and 16, extending transversely of the furnace and through the side walls 2, and the pipes 15, 15<sup>a</sup>, and 27, respectively, within and without the furnace and communicating at their ends with the pipes 9 and 16, substantially as and for the purpose set forth.

3. The combination, in a boiler-furnace, of the boiler, the transverse pipes 9 and 16, in communication with the interior of the boiler, and pipes 15 15<sup>a</sup>, communicating with the pipes 9 and 16, the inverted bridge-wall closing the space between the pipe 9 and the boiler, and the steam-pipe 6, having a part parallel with and in proximity to the pipe 16 and having steam-jet holes 8 for directing steam into the descending flame, passing into the combustion-chamber beneath the grate, as set forth.

4. In a boiler-furnace, a fire-chamber extending forwardly from the front end of the boiler, a water-pipe 9, extending transversely across the rear end of the fire-chamber, pipes 13, connecting the interiors of the pipe, and boiler-pipe 16, extending transversely across at the outer end of the fire-chamber, inclined pipes 15, extending from the pipe 9 to the pipe 16, upright pipes 20, equalizing-pipe 21, and pipes 23, communicating with the pipe 21 and the boiler, all substantially as set forth.

5. In a boiler-furnace, the pipes 13, with valves 14, the pipes 9, 15, and 16, vertical pipes 20, equalizing-pipe 21, and pipes 23, with valves 24, all combined and arranged substantially as and adapted to operate as set forth.

MICHAEL A. FOSTER.

In presence of—

SAML. KNIGHT,  
BENJN. A. KNIGHT.