No. 781,032. PATENTED JAN. 31, 1905.

M. J. SULLIVAN.

FURNACE.

APPLICATION FILED AUG. 6, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

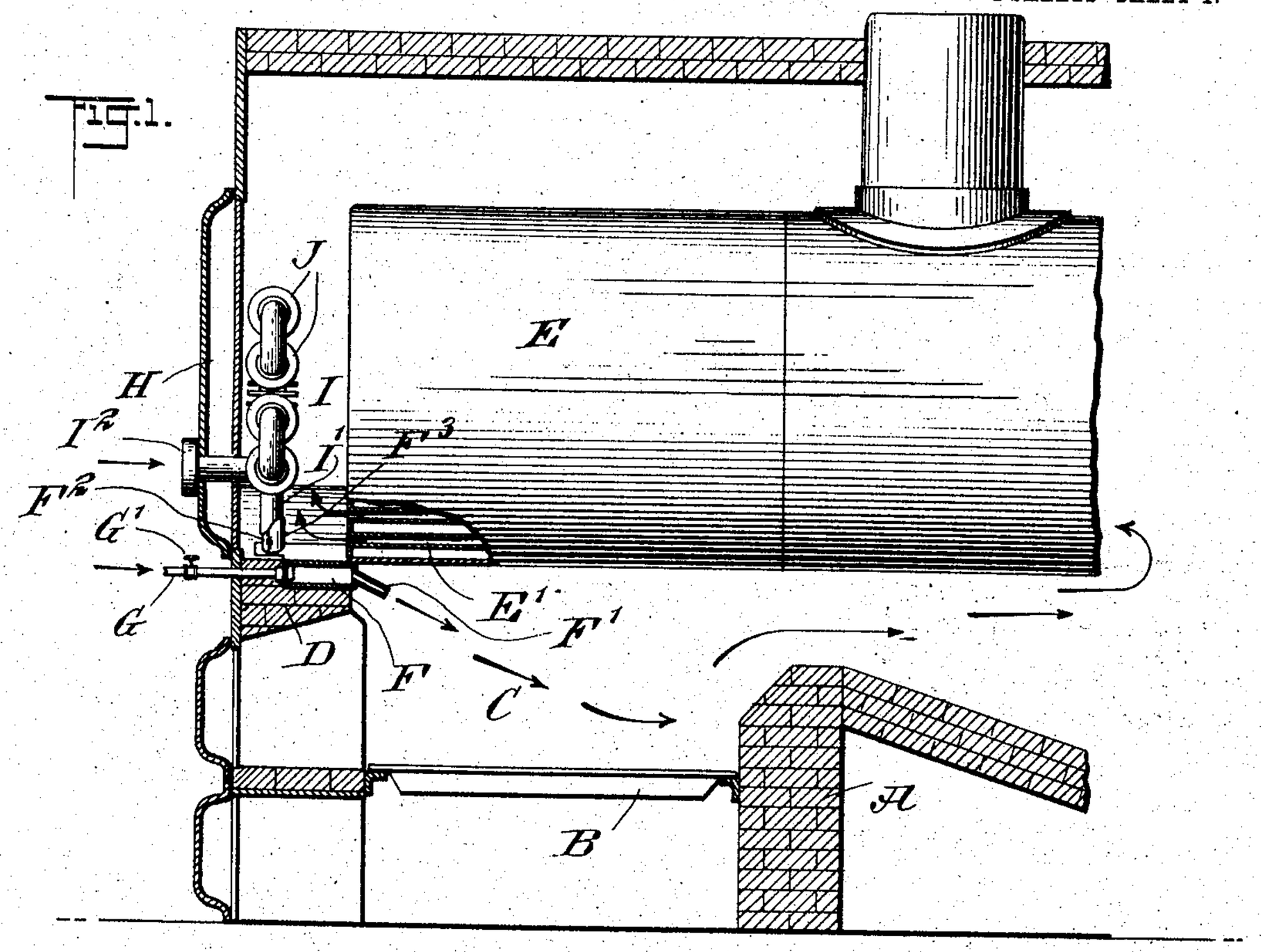

Fig. 2.

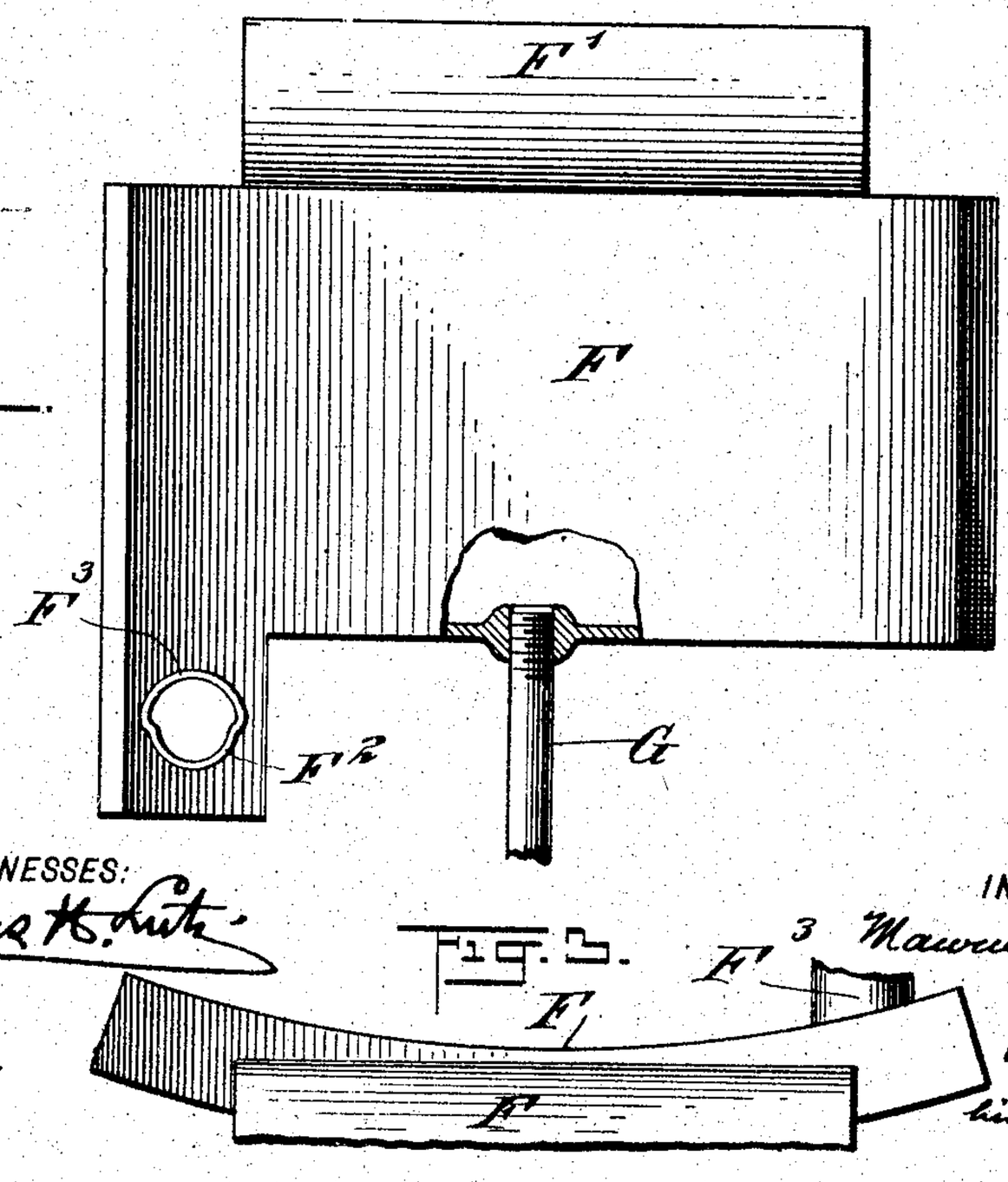

Fig. 3.

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2 SHEETS—SHEET 2.

Fig. 4.

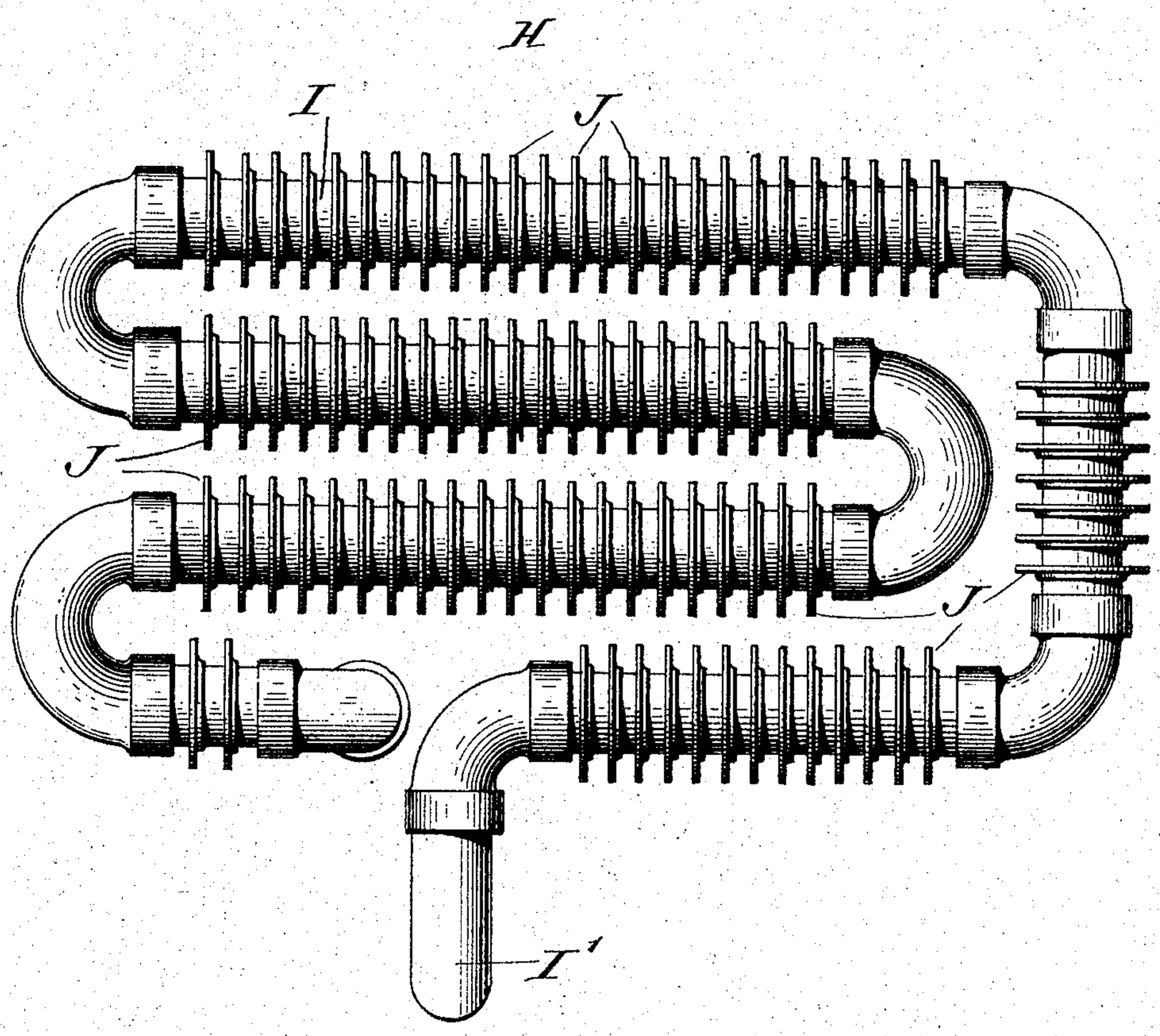


Fig. 7.

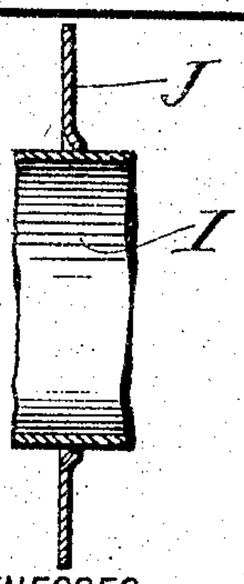


Fig. 5.

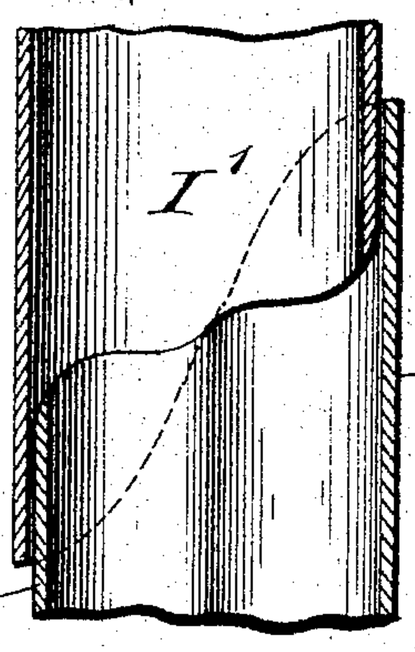
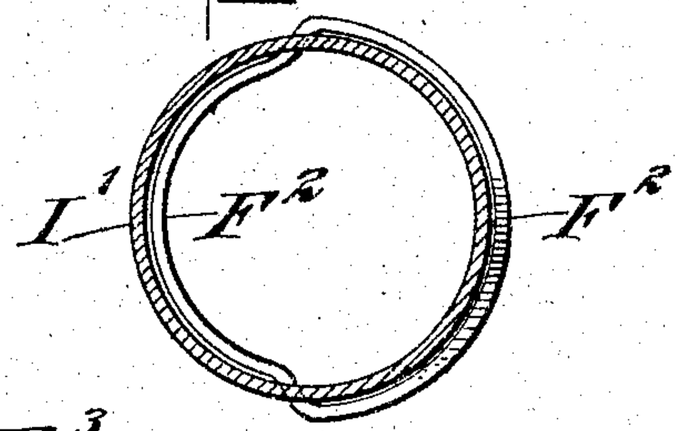


Fig. 6.



WITNESSES:

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No. 781,032. Patented January 31, 1905.

UNITED STATES PATENT OFFICE.

MAURICE J. SULLIVAN, OF MOUNT VERNON, NEW YORK, ASSIGNOR TO FLORENCE M. SULLIVAN, OF MOUNT VERNON, NEW YORK.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 781,032, dated January 31, 1905.

Application filed August 6, 1903. Serial No. 168,410.

To all whom it may concern:

Be it known that I, MAURICE J. SULLIVAN, a citizen of the United States, and a resident of Mount Vernon, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Furnaces, of which the following is a full, clear, and exact description.

My invention relates to furnaces, and particularly to boiler-furnaces, and has for its object to improve the combustion so as to secure a practically smokeless combustion and utilize the entire heating capacity of the fuel. For this purpose I provide a novel construction, such as will be described in detail hereinafter, in which the medium adapted to support combustion is introduced or injected into the furnace and preferably into the fire-box thereof, and in order that the combustion-supporting medium may be effectively preheated I provide an arrangement of a heating-pipe carried by a door of the furnace and adapted to register when the said door is closed with certain stationary guides or channels which receive the heated medium from said pipe and convey it to that place of the furnace where such heated medium is actively utilized.

One specific embodiment of my invention is represented in the accompanying drawings, it being understood that various modifications may be made without departing from the nature of my invention.

Figure 1 is a sectional elevation of a portion of a boiler-furnace having the improvement applied thereto. Fig. 2 is a plan of the casing from which the combustion-supporting medium is discharged. Fig. 3 is an inside end view of said casing. Fig. 4 is an inside view of the door carrying the heating-pipe. Fig. 5 is a detailed sectional elevation showing the joint between the discharge end of the heating-pipe and the inlet of the casing. Fig. 6 is a cross-section taken on line 6 6 of Fig. 5, and Fig. 7 shows in section a portion of the heating-pipe and one of the heat-absorbing disks or rings mounted thereon.

A indicates the bridge-wall of the furnace; B, the grate; C, the fire-box or combustion-chamber; D, the arch at the front end of the furnace, and E the boiler, which, as shown, has return-flues E′, so that the combustion products from the chamber C first travel rearwardly over the bridge-wall A to reach the rear end of the boiler and then pass forwardly through the return-flues E′. Upon the arch D is located a casing F, made of cast-iron or other suitable material and provided at the rear end, which faces the combustion-chamber C, with a discharge spout or outlet F′. The casing F is preferably curved to correspond to the shape of the arch D; but the spout F′ is preferably straight, as shown best in Fig. 3, and is so arranged that the current of heated medium discharged from said spout will be directed toward the rear end of the grate B or toward the bridge-wall A.

The casing F is provided with a steam-inlet pipe G, preferably provided with a regulating-valve G′. There is also provided an inlet-pipe projecting upwardly from the casing F, and this inlet-pipe in the particular instance shown is made of two diameters, the front portion F^2 being of smaller diameter than the rear portion F^3. This rear portion extends upwardly beyond the front portion F^2. Adjacent to the inlet-pipe formed by the sections F^2 and F^3 is located a door H, secured to the boiler-setting in any suitable manner—for instance, the customary hinged door may be employed. This door carries a heating-pipe I, the discharge end of which, I′, is of uniform cross-section, circular, as shown, and has its edge formed practically in reverse fashion to that of the inlet-pipe F^2 F^3. Thus when the door is closed and the discharge end of the heating-pipe I comes into registry with the inlet-pipe F^2 F^3 of the casing F the two pipes connect with a practically air-tight joint, since the rear portion of the discharge end I′ fits into the larger portion F^3, while the front portion of the discharge end I′ fits around the smaller portion F^2 of the inlet-pipe. It will be observed that this construction of the joint allows the two pipes to slide one lengthwise of the other during expansion or contraction without impairing the tightness of the joint. The heating-pipe I receives a supply of air from any suitable source. In the drawings air

is supplied to said pipe directly, the inlet end of the pipe extending through the door H to the outside thereof, and a butterfly or like arrangement (indicated at 12) may be placed at the inlet end of the pipe to regulate the amount of air drawn in. It will be observed that the outlet I′ of the heating-pipe I, as well as the inlet of the stationary pipe F^2 F^3, is arranged in a direction parallel with the hinge of the door. Thus as the door swings to its closed position the two pipe ends come into alinement by a sidewise movement, as it were, and the discharge end of the heating-pipe remains parallel with its original position during its entire movement. An easy and perfect fitting together of the pipe ends is thus obtained. Furthermore, I have ascertained that the vertical arrangement of the discharge end I′ is of considerable practical importance, inasmuch as the heated air if traveling downward where the pipe-outlet I′ joins the inlet F^2 F^3 will have no tendency to escape at the joint; but such objectionable tendency is found to exist when the meeting pipe portions are horizontal. The vertical arrangement is therefore conducive to the production of a reliable joint. I have found by experiments that there is a relative vacuum at the front portion of the fire-box or discharge-chamber C. Thus by arranging the outlet F′ at this portion of the fire-box I insure the supply of the gaseous medium (in this case steam and heated air) for supporting combustion.

It will be understood that the air drawn through the heating-pipe I becomes heated owing to the fact that the combustion-gases pass into space between the boiler and the door H. In order that the heat may be effectually absorbed, I preferably provide a coil construction of the pipe I, said pipe consisting of straight members and curved members or elbows connecting them. Upon the straight members I mount heat-absorbing disks or rings J, the inner edges of which are bent to one side, so as to form a dished construction or a flange, which flange lies against the outer surface of the pipe I. This flange presents several important advantages. First, it provides a better contact-surface between the rings J and the pipe I; second, it facilitates the placing of the rings on the pipe, inasmuch as the flange is somewhat yielding; third, the rings are held in position more firmly than they would be if the flange were omitted. It will be seen by reference to Fig. 7 that the amount of lateral bend given to the central portion of the ring is very slight, being approximately equal to the thickness of the metal of which the ring is made. Thus the air has free access to the surface of the pipe I, except at the small portions in contact with the rings J, and the extent of contact-surface is no larger than when straight or plane rings are used. Therefore a very effective transference of heat is obtained, and at the same time the rings are securely held in place. It will be understood that the improved construction of heat-absorbing disks is applicable to other kinds of heat-exchange apparatus, whether the disks or rings be employed to absorb heat or to radiate it.

It will be observed that the air heated in the pipe I, before it is discharged through the spout F′, passes into the casing F. The cross-section of this casing or chamber is much greater than that of the pipes I F^3, and thus the air is given an opportunity to expand in the casing F, and this I find is of importance in establishing a good draft through the heating-pipe I. Furthermore, the casing F serves as a mixing-chamber for the air entering through pipe F^3 and the steam admitted through pipe G. The provision of the casing or chamber F in the connection from the pipe I to the discharge-spout F′ is therefore an important feature of my furnace, and the result obtained with this interposed casing or chamber is much better than if the pipe F^3 were simply continued to the discharge-spout F′ with a uniform diameter.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a furnace, a door, a heating-channel connected with said door and exposed to hot gases, and a casing or expansion-chamber set in the walls of the furnace and having an inlet connected with said heating-channel and an outlet leading to the combustion-chamber, said expansion-chamber being located at the top of the front arch of the boiler-setting and having a curved surface engaging and partially supporting the boiler.

2. In a furnace, a door provided on its inside with a heating-pipe exposed to a heated gaseous medium and carrying a series of heating-rings, the central portions of which are dished or bent laterally to about the extent of the thickness of said rings, in combination with a stationary guide or channel communicating with the combustion-chamber, and having an inlet arranged to register with the outlet portion of said heating-pipe.

3. In a furnace, a door carrying an exposed heating-channel on its inner surface, a stationary pipe, the inlet end of which is arranged to register with the outlet of said heating-channel, and a casing or expansion-chamber set in the walls of the furnace and having an inlet connected with said stationary pipe, and an outlet leading to the combustion-chamber.

4. In a furnace, the combination, with stationary guides or channels for a combustion-supporting medium, said channels comprising an inlet-pipe the receiving end of which is longer at one side than at the other, of a door carrying a heating-pipe arranged to fit into said inlet-pipe, so as to be capable of sliding lengthwise thereof, to form a joint with said pipe when the door is closed.

5. In a furnace, the combination with stationary guides or channels provided with an inlet-pipe having two portions of different diameters, the portion of large diameter projecting beyond that of smaller diameter, of a door carrying a heating-pipe which has a discharge end of uniform cross-section, said discharge end being adapted to fit around the portion of the inlet-pipe which is of smaller diameter and into the portion of the inlet-pipe which is of larger diameter, so as to connect with said inlet-pipe when the door is closed.

6. In a furnace, a door provided with a heating-channel terminating in an outlet-pipe, in combination with a stationary channel communicating with the combustion-chamber and having an inlet-pipe arranged to register with the outlet-pipe of the heating-channel, one of said pipes having its end longer at one side than at the other, and the end of the other pipe being formed reversely, the longer side of each pipe being arranged to fit around the shorter side of the other pipe, so as to form a double overlapping joint.

7. In a furnace, a heating-channel exposed to hot gases, and a casing or expansion-chamber set in the front wall of the combustion-chamber and having an inlet connected with said heating-channel and an outlet leading to the combustion-chamber, said expansion-chamber being located at the top of the front arch of the boiler-setting and having a curved surface engaging and partially supporting the boiler.

8. In a furnace, a door having an air-supply opening, a heating-channel located within the furnace adjacent to said door and connected with the air-supply of the door, said channel being freely exposed to a heating medium, a stationary pipe having connection with the outlet of said heating-channel, and a casing or expansion-chamber set in the walls of the furnace and having an inlet connected with said pipe and an outlet leading to the combustion-chamber.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MAURICE J. SULLIVAN.

Witnesses:
JOHN LOTKA,
JOHN A. KEHLENBECK.