

No. 667,549.

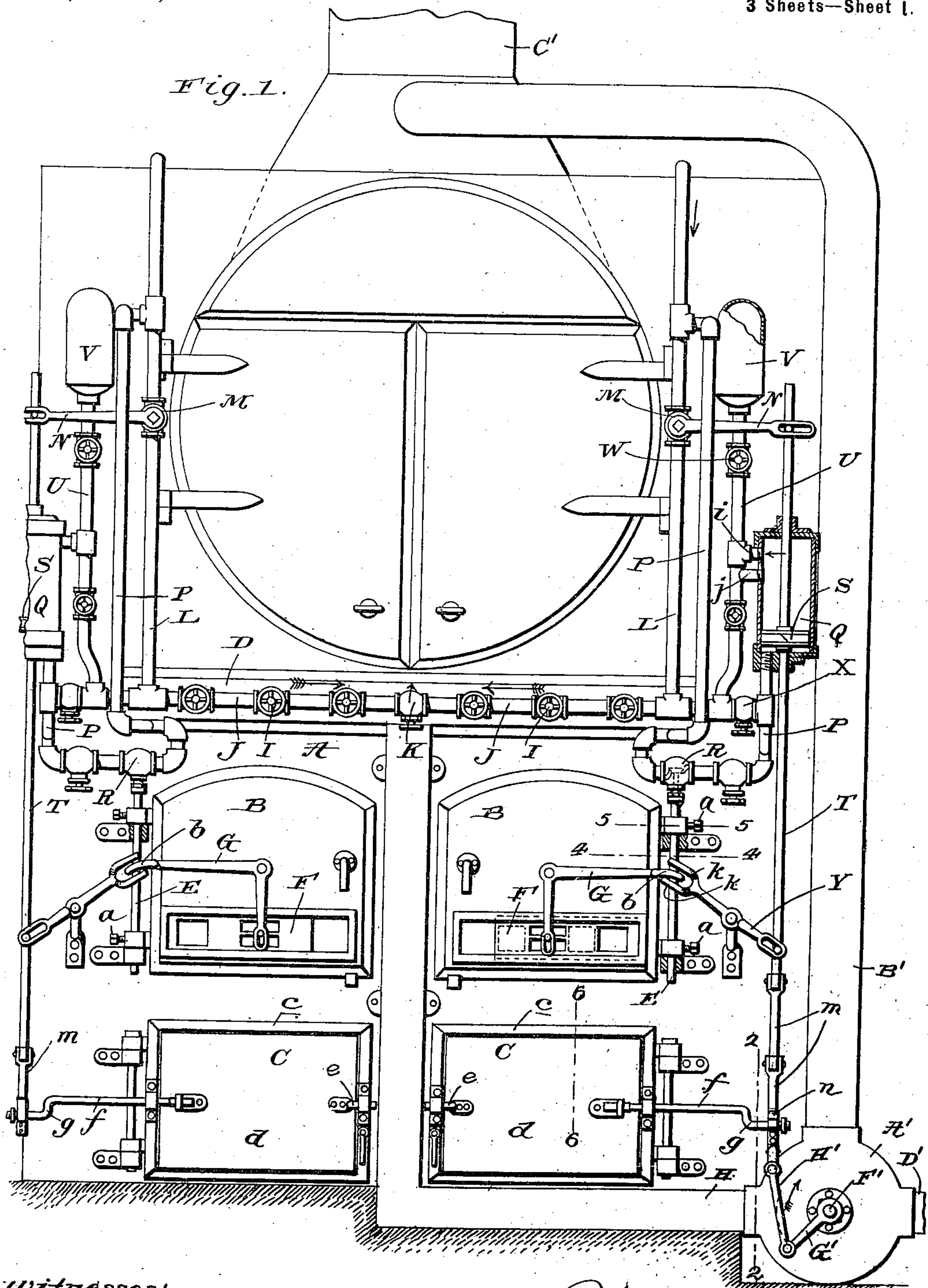
W. E. MINSHALL.
FURNACE.

Patented Feb. 5, 1901.

(Application filed Oct. 18, 1900.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses:
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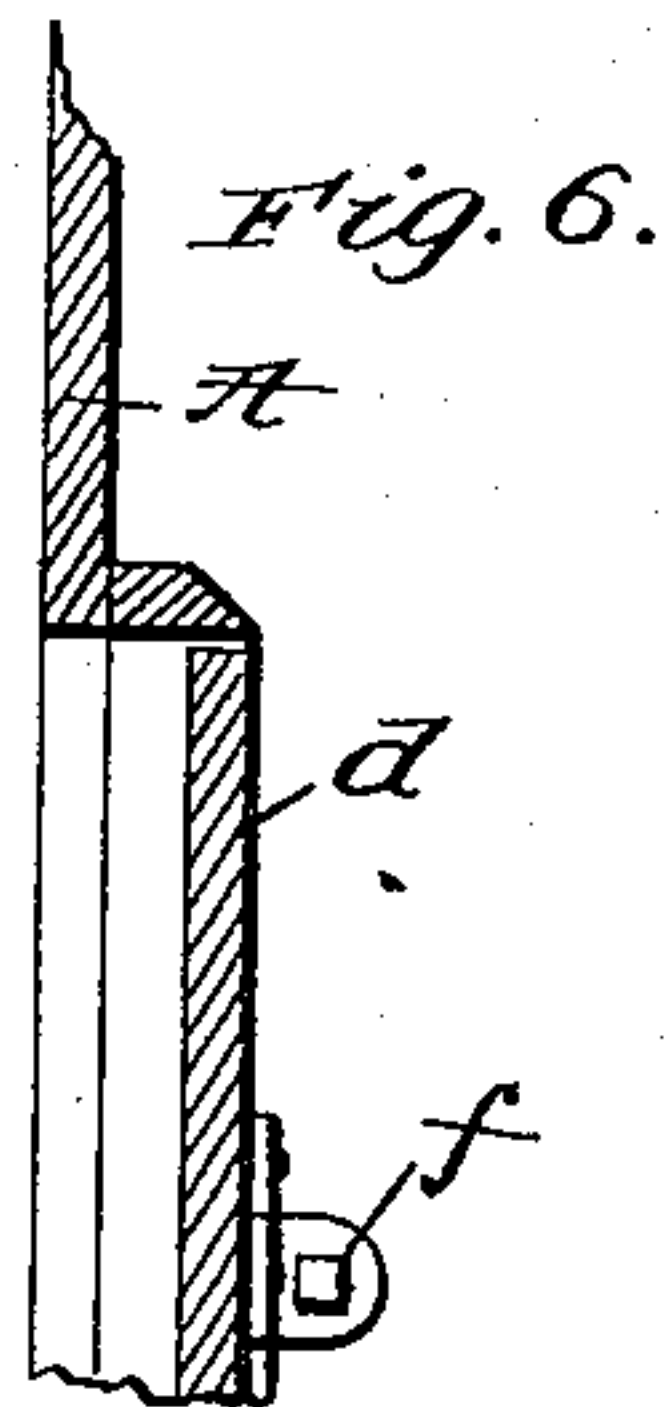
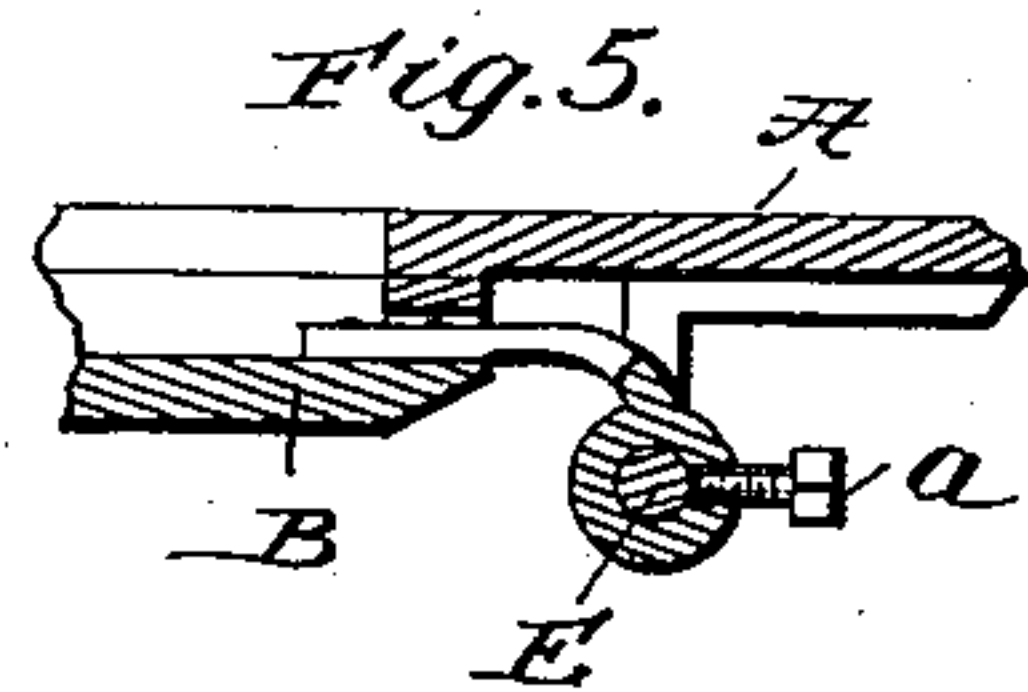
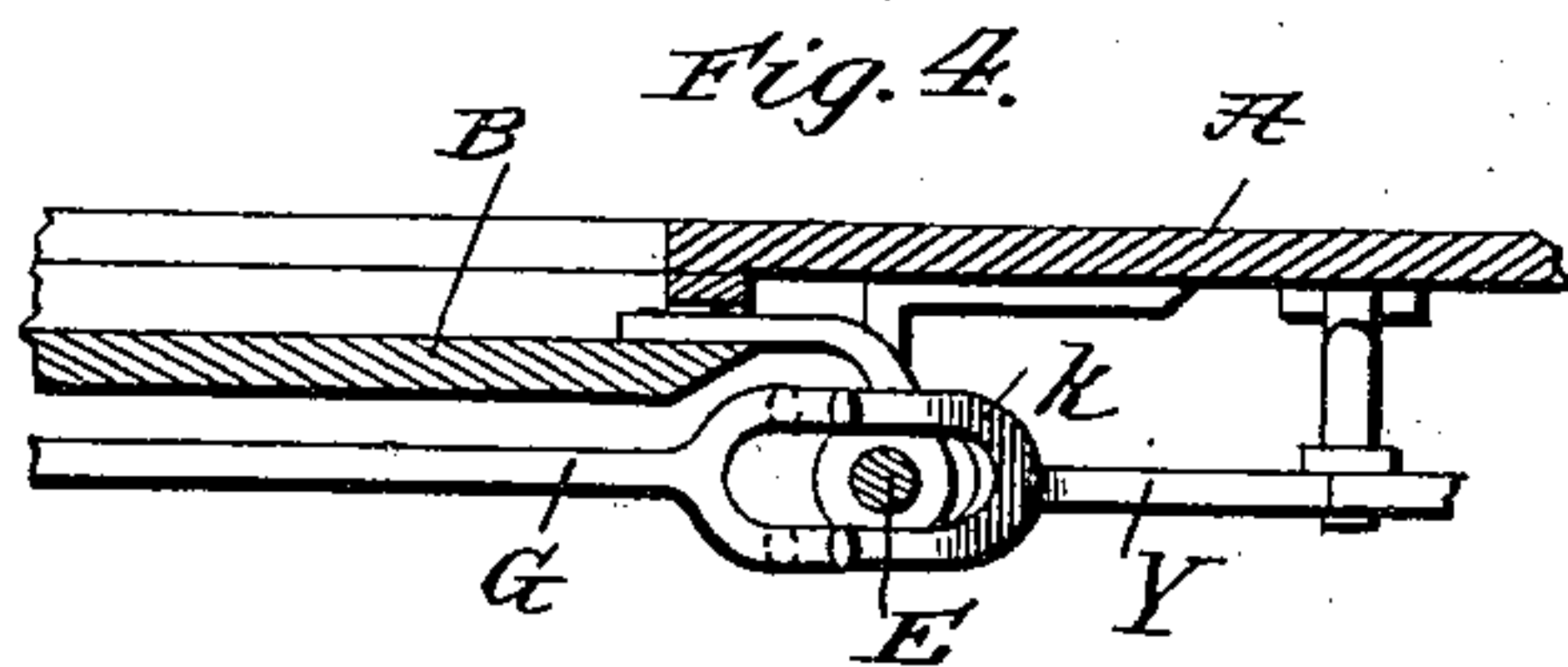
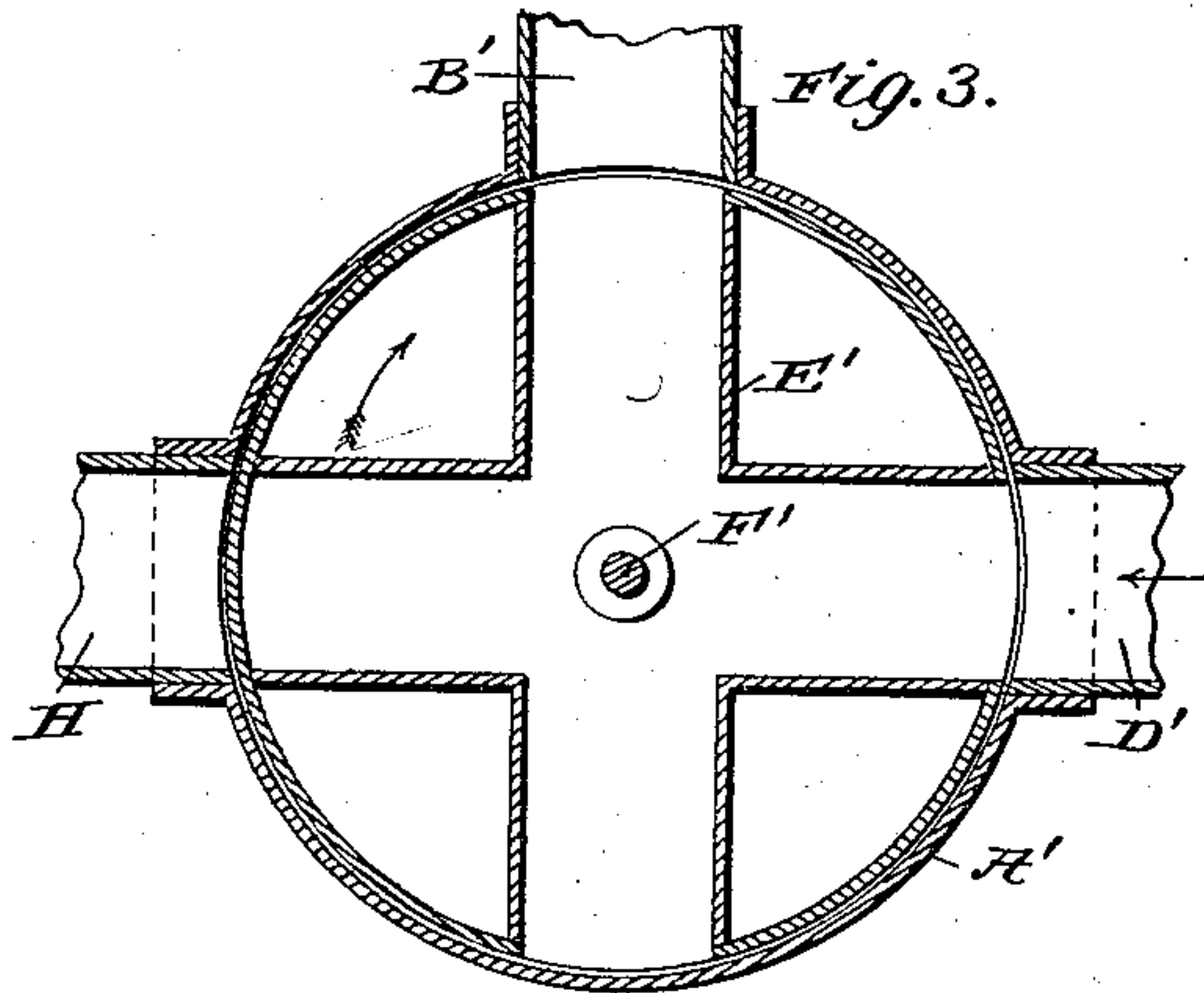
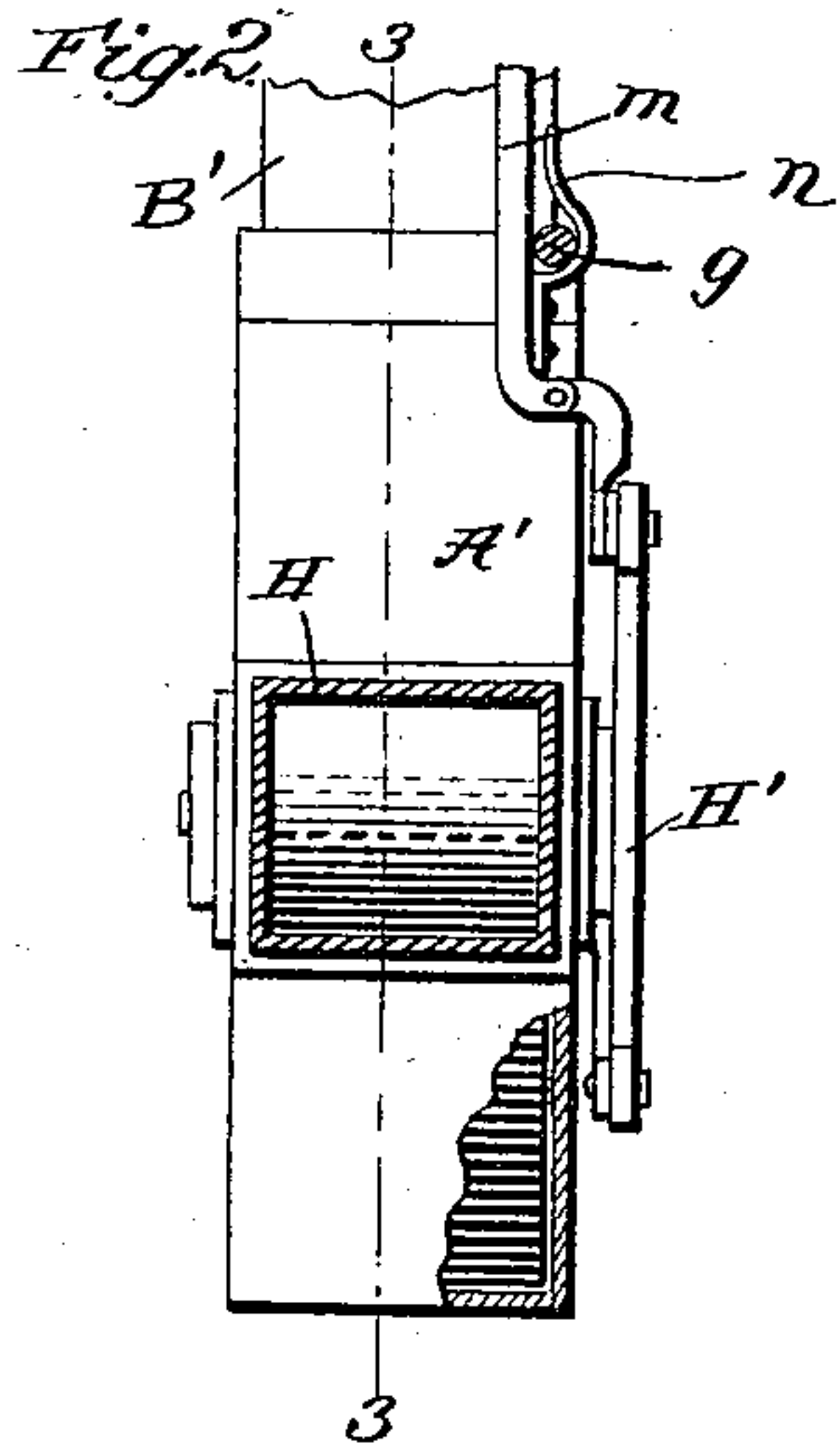
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(No Model.)

3 Sheets—Sheet 2.



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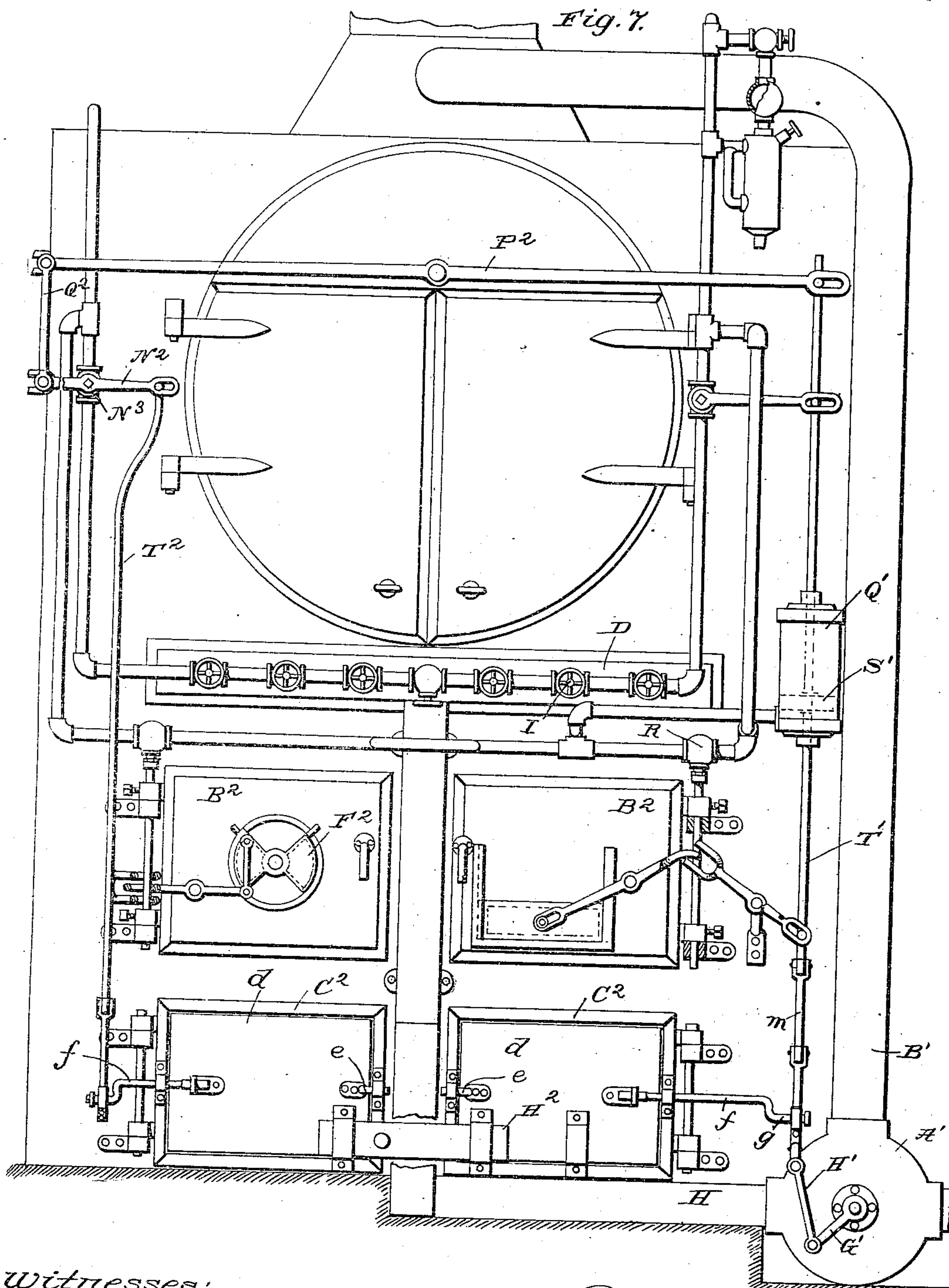
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(Application filed Oct. 18, 1900.)

(No Model.)

3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

WILLIAM E. MINSHALL, OF MINONK, ILLINOIS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 667,549, dated February 5, 1901.

Application filed October 18, 1900. Serial No. 33,509. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. MINSHALL, a citizen of the United States, residing at Minonk, in the county of Woodford and State of Illinois, have invented new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to apparatus for automatically supplying steam and air to furnaces coincident with the opening of the fuel-doors and the firing thereof with a view of promoting the combustion of smoke. Its novelty and advantages will be fully understood from the following description and claims when taken in conjunction with the accompanying drawings, in which—

Figure 1 is a front elevation, partly in section, of a steam-boiler furnace equipped with my improved apparatus. Fig. 2 is a detail section taken in the plane indicated by the broken line 2 2 of Fig. 1 and illustrating the air-controlling valve and its casing. Fig. 3 is a section taken in the plane indicated by the broken line 3 3 of Fig. 2. Figs. 4 and 5 are detail sections, on enlarged scales, taken in the planes indicated by the broken lines 4 4 and 5 5, respectively, of Fig. 1. Fig. 6 is a detail section taken in the plane indicated by the broken line 6 6 of Fig. 1. Fig. 7 is a front elevation of a steam-boiler furnace equipped with a modified form of apparatus.

Referring by letter to the said drawings, and more particularly to Figs. 1 to 6 thereof; A is the face-plate of a steam-boiler furnace; B B, the fuel-doors; C C, the ash-pit doors, and D a casing which is preferably similar to the casing disclosed in my Letters Patent No. 661,379, of November 6, 1900, and need not therefore be described in detail herein.

The fuel-doors B are connected in a fixed manner by set-screws *a* or other suitable means to vertical rock-shafts E, journaled in bearings on the face-plate. They are provided with slidable dampers F, connected to the inner arms of bell-crank levers G, the outer arms of which terminate in bifurcated portions *b*, as best shown in Figs. 1 and 4, for a purpose presently described.

The ash-pit doors C comprise rectangular frames *c*, connected at their outer ends in a hinged manner to the face-plate, and swinging portions *d*, which are arranged in the

frames and are designed to be swung in and with respect to the same. The door portions *d* are provided at their inner ends with trunnions *e*, journaled in bearings on the frames *c*, and at their outer ends they have coincident trunnions *f*, also journaled in bearings on the frames *c*. The trunnions *f* have cranks *g* at their outer ends, and at their inner ends they have portions of angular form in cross-section arranged and adapted to slide in correspondingly-shaped bearings on the door portions *d*, as best shown in Fig. 6. The peculiar connection described between the trunnions *f* and the door portions *d* enables the said trunnions when in the position shown to swing the door portions and also permits of the trunnions *f* being pushed inwardly or toward the inner ends of the doors for a purpose presently pointed out.

The casing D is connected with a cold-air-supply conduit H and also with the combustion-chamber of the furnace preferably in the manner pointed out in my before-mentioned contemporary application. It is also provided in its front wall with apertures to receive jet-tubes (not shown) after the manner disclosed in said contemporary application. The jet-tubes are connected to valves I in a steam-supply pipe J, which is also provided at its middle with a valve K for a purpose presently pointed out. The pipe J is connected at the points shown to pipes L, leading from the boiler or other source of steam-supply, and these pipes L are provided at about the points shown with valves M, which have cranks N on their stems, as illustrated.

P P are pipes which are connected at one end to the pipes L at points between the valves M and the boiler and at their opposite ends communicate with the lower portions of piston-cylinders Q. These pipes P are provided with valves R, the stems of which are arranged coincident with and connected to the rock-shafts E, whereby it will be seen that when the fuel-doors B are opened to fire the furnace or supply the same with coal or other fuel the valves R will be opened and steam permitted to pass from the boiler into the lower portions of the cylinders Q.

S S are piston-heads arranged in the cylinders Q, and T T are rods connected to said

piston-heads and extending through the upper and lower heads of the cylinders Q. When steam is let into the lower portions of the cylinders Q, it will act against the piston-heads S and force said piston-heads and the rods T upwardly. The rods T are connected, preferably in the manner shown, to the cranks N of the valves M, and hence it follows that when the rods and piston-heads are raised the valves M will be opened and steam let into the furnace through the several valves I.

When desirable, the steam-supply pipes L may be provided with suitable lubricators for supplying lubricant to the piston-cylinders Q coincident with the admission of steam therein; but as these lubricators are common and form no part of my invention I have not deemed it necessary to illustrate the same.

U U are pipes which have air-chambers V at their upper ends and are connected at their lower ends to the pipe J. These pipes U are also connected, by means of branch pipes ij, with the piston-cylinders Q, whereby it will be seen that when the piston-heads S assume positions between the branch pipes j i steam will be admitted to the cylinders above the piston-heads S to cushion the upward thrusts thereof. The pipes U serve to convey exhaust-steam and lubricant to the pipe J, and hence such exhaust-steam and lubricant is carried into the combustion-chamber of the furnace by the live steam admitted thereto and is not wasted.

The descent of the piston-heads S and rods T subsequent to the closing of the fuel-doors B is regulated by the air-valves W in pipes U and the drip-valves X in the pipes P.

The bifurcated portions of the bell-crank levers G straddle the rock-shaft E and are interposed between upper and lower bifurcated portions k at the inner ends of levers Y, which bifurcated portions k also straddle the rock-shafts. The levers Y are fulcrumed on the face-plate and are loosely connected at their outer ends to the rods T. From this it follows that when the piston heads and rods are moved upwardly, as before described, the dampers F will be opened; also, that said dampers will remain open subsequent to the closing of the doors B and until the piston heads and rods have resumed the positions shown in Fig. 1. This is obviously advantageous, because it insures the supply of a certain quantity of air to the combustion-chamber for a considerable length of time subsequent to the firing of the furnace and the closing of the doors B.

The piston-rods T are provided with lower hinged portions m, which are detachably connected by clips n (see Fig. 2) to the cranks g at the outer ends of the trunnions f of the portions d of the ash-pit doors, whereby it will be seen that when the pistons are forced upwardly to open the valves M and admit steam to the combustion-chamber of the furnace the portions d of doors C will also be opened to admit air to the ash-pit. The de-

tachable connection between the trunnions f and the lower portions m of the piston-rods is desirable, since it admits of the trunnions being slid inwardly after the manner before described when it is desired to open the doors C by hand to remove ashes from the pit.

It will be readily appreciated from the foregoing that the opening of the doors B operates to open the valves R and admit steam to the cylinders Q to raise the pistons, and thereby open the valves M and admit steam to the combustion-chamber of the furnace. The upward movement of the rods T also effects an opening of the dampers F and an opening of the portions d of the ash-pit doors, thus insuring the admission of an ample supply of air as well as steam to the combustion-chamber while the same is being supplied with fuel as well as subsequent to such operation. When the doors B are closed by the fireman, the valves R are closed and the supply of steam to the cylinders Q cut off, with the result that the piston heads and rods, by virtue of the air-chambers at the upper ends of the pipes U, will be slowly forced downwardly, and incident to such movement will close the valves M, the dampers F, and the portions d of doors C.

The cold-air-supply conduit H is connected to a valve-casing A', which, in turn, is connected by a conduit B' to the smoke-stack C' of the furnace and by a conduit D' with a cold-air source of supply. In the casing A' is a three-way valve E', the shaft F' of which is provided with a crank G', between which and the lower portion m of the adjacent rod T a link H' is interposed and suitably connected, as shown. When the parts are in the positions shown in Fig. 1, the valve E' is in the position shown in Fig. 3, and hence air is free to pass from conduit D' through the valve E' and conduit B' to the smoke-stack. When, however, the piston-rod T is raised, as before described, the valve E' is turned so as to close the conduit B' and establish communication between the conduit D' and the conduit H. As a result of this it will be seen that cold air is supplied to the combustion-chamber coincident with the supply of steam and also that when the supply of steam is cut off the supply of cold air is also cut off, and the latter is transferred to the smoke-stack with a view of creating a draft therein. The transfer of the cold-air supply to the stack after the smoke has been consumed is desirable, because there is approximately from five to fifteen minutes between fires after combustion of the smoke has been completed, and the exclusion of the cold-air supply from the fire-box during this time enables the furnace to retain heat much longer than would otherwise be the case.

Experience has shown that the most perfect results are obtained by firing one side of the furnace at a time. When this is done, the valve K is closed. With this done, when the steam is turned on in the manner described

the steam and air are injected into the combustion-chamber at one side thereof, with the result that a suction is created at such side and the smoke and other products of combustion are drawn from the other side of the chamber over the bed of hot fire and completely consumed.

In Fig. 7 of the drawings I have shown a modification of my improved apparatus which embodies but a single piston-cylinder Q' , piston-head S' , and piston-rod T' . The modified construction is similar to that shown in Fig. 1, with the exception that in lieu of the piston-rod at the left of Fig. 1 a rod T^2 is interposed between the valve-crank N^2 and the trunnion f of the ash-door portion d to open the latter coincident with the opening of said valve, and the valve N^3 is opened by the rod T' through the medium of a lever P^2 and a link Q^2 , which latter is connected to the outer end of the crank N^2 . The fuel-door B^2 at the left of Fig. 7 has a rotary damper F^2 , designed to be opened by the rod T^2 through the medium of the lateral projections thereon, the lever on the door, and the link interposed between said lever and the damper. The damper on the fuel-door B^2 at the right of Fig. 7 differs from the dampers F of Fig. 1 in that it is vertically movable. The portions d of the ash-pit doors C^2 (shown in Fig. 7) are connected by a slip-bolt H^2 . By virtue of this the doors or door portions d may be connected by the bolt H^2 so as to move together when the door portion d at the right is opened by the movement of the rod T' . When the bolt H^2 is used, the rod T^2 may be connected to the trunnion of the door portion d at the left or not, as desired. On the other hand, the rod T^2 may, when desired, be depended upon to open the door portion d , and the slip-bolt H^2 may be omitted.

From the foregoing and the description of the operation of the construction shown in Fig. 1 the operation of the construction shown in Fig. 7 will be apparent and need not therefore be described.

I have entered into a detail description of the construction and relative arrangement of the parts of my improved apparatus in order to impart a full, clear, and exact understanding of the same. I do not desire, however, to be understood as confining myself to such specific construction and arrangement of parts, as such changes or modifications may be made in practice as fairly fall within the scope of my claims.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a furnace, the combination of a fire-box, a smoke stack or outlet, a valve-casing connected with a source of air-supply and also with the combustion-chamber and smoke-stack, a valve in said casing arranged in one position to effect communication between the source of air-supply and the combustion-chamber and in another position to establish

communication between the source of air-supply and the smoke-stack, a steam-supply conduit leading to the combustion-chamber, a steam-controlling valve in the latter conduit, a fuel-door, and means whereby when the fuel-door is opened the steam-controlling valve is also opened and the air-controlling valve is moved to close communication between the source of air-supply and the smoke-stack, and establish communication between the source of air-supply and the combustion-chamber.

2. In a furnace, the combination of a combustion-chamber, a fuel-door, an air-supply conduit leading to the combustion-chamber, a steam-supply conduit also leading to the combustion-chamber, valves in said conduits for controlling the supply of air and steam, respectively, a piston-cylinder connected with a source of steam-supply, a piston in said cylinder connected with the air and steam controlling valves, and a valve for controlling the supply of steam to the piston-cylinder; said valve being connected with and adapted to be operated by the fuel-door whereby when said door is opened the air and steam valves will also be opened to supply air and steam to the combustion-chamber.

3. In a furnace, the combination of a combustion-chamber, a smoke stack or outlet, a valve-casing connected with a source of air-supply and also with the combustion-chamber and the smoke-stack, an air-controlling valve in said casing adapted in one position to establish communication between the air-supply and the combustion-chamber and in another position to establish communication between the air-supply and the smoke-stack, a steam-supply conduit leading to the combustion-chamber, a valve in the latter conduit for controlling the supply of steam, a piston-cylinder, a conduit leading from a source of steam-supply to the cylinder, a valve in the latter conduit connected with and adapted to be operated by a fuel-door, the said fuel-door, and a piston in the cylinder connected with the air and steam controlling valves, substantially as specified.

4. In a furnace, the combination of a combustion-chamber, a smoke stack or outlet, an air-supply conduit leading to the combustion-chamber, a valve for controlling the passage of air through said conduit, a steam-supply conduit leading to the combustion-chamber, a valve in said conduit for controlling the supply of steam, a piston-cylinder, a piston arranged in said cylinder and having a rod connected with the air and steam controlling valves, a fuel-door having a damper, a steam-supply pipe leading to the piston-cylinder, a valve in said pipe connected with and adapted to be operated by the opening of the fuel-door, and a driving connection between the piston-rod and the damper of said door, substantially as specified.

5. In a furnace, the combination of a combustion-chamber, a smoke stack or outlet, an

air-supply conduit leading to the combustion-chamber, a valve for controlling the passage of air through said conduit, a steam-supply conduit leading to the combustion-chamber, a
 5 valve in said conduit for controlling the supply of steam, a piston-cylinder, a piston in said cylinder having a rod connected with the air and steam controlling valves, a fuel-door having a damper, an ash-pit door having a portion
 10 adapted to be opened, a steam-supply pipe leading to the piston-cylinder, a valve in said pipe connected with and adapted to be operated by the opening of the fuel-door, and driving connections between the piston-rod
 15 and the said damper of the fuel-door and portion of the ash-pit door, respectively, substantially as specified.

6. In a furnace, the combination of a combustion-chamber, an air-supply conduit leading thereto, a valve in said conduit, a steam-supply conduit leading to the chamber, a valve in said conduit for controlling the supply of steam, a piston-cylinder, a piston in said cylinder having a rod connected with the
 25 air-controlling valve, a fuel-door having a damper, a steam-supply pipe leading to the piston-cylinder, a valve in said pipe connected with and adapted to be operated by the opening of the fuel-door, a lever connection
 30 between the piston-rod and the steam-controlling valve, a lever fulcrumed on the fuel-door and connected to the damper thereof, and a lever fulcrumed on the furnace-wall and having one of its ends arranged in engagement with the lever on the fuel-door and its
 35 opposite end connected to the piston-rod, substantially as specified.

7. In a furnace, the combination of a combustion-chamber, a smoke stack or outlet, a
 40 valve-casing connected with a source of air-supply and also with the combustion-chamber and the smoke stack or outlet, a valve in said casing, a fuel-door, and means whereby, when the fuel-door is opened, the valve is
 45 moved to establish communication between the air-supply and the combustion-chamber,

and, when the fuel-door is closed, the valve is moved to cut off the supply of air to the combustion-chamber and establish communication between the source of air-supply and
 50 the smoke-stack.

8. In a furnace, the combination of a fuel-door, a piston-cylinder, a piston therein having a rod, a steam-supply pipe leading to said cylinder, a valve in said pipe connected with
 55 and adapted to be opened by and coincident with the opening of the fuel-door, and an ash-pit door comprising a hinged frame, a swinging portion mounted in said frame, and a slidable trunnion for the swinging portion,
 60 journaled in the frame and terminating at its outer end in a crank detachably connected with the piston-rod.

9. In a furnace, the combination of a combustion-chamber, a smoke-stack, a valve-casing
 65 connected with a source of air-supply and also with a chamber in communication with the combustion-chamber, and the smoke-stack, a valve in said casing, a steam-supply pipe having a plurality of valved discharges
 70 into the chamber which communicates with the combustion-chamber, a valve in the steam-supply pipe, a piston-cylinder, a piston therein having a rod connected with the air and steam controlling valves, a pipe leading from
 75 the source of steam-supply to the piston-cylinder, a fuel-door, a valve in said steam-supply pipe connected with and adapted to be operated by the opening of the door, a branch connected with said steam-supply pipe and
 80 the piston-cylinder and terminating in an air-chamber, and a valve in said branch for regulating the descent of the piston, substantially as specified.

In testimony whereof I have hereunto set
 85 my hand in presence of two subscribing witnesses.

WILLIAM E. MINSHALL.

Witnesses:

JOHN SNEDDEN,

LOUIS J. BURGDOERFER.