

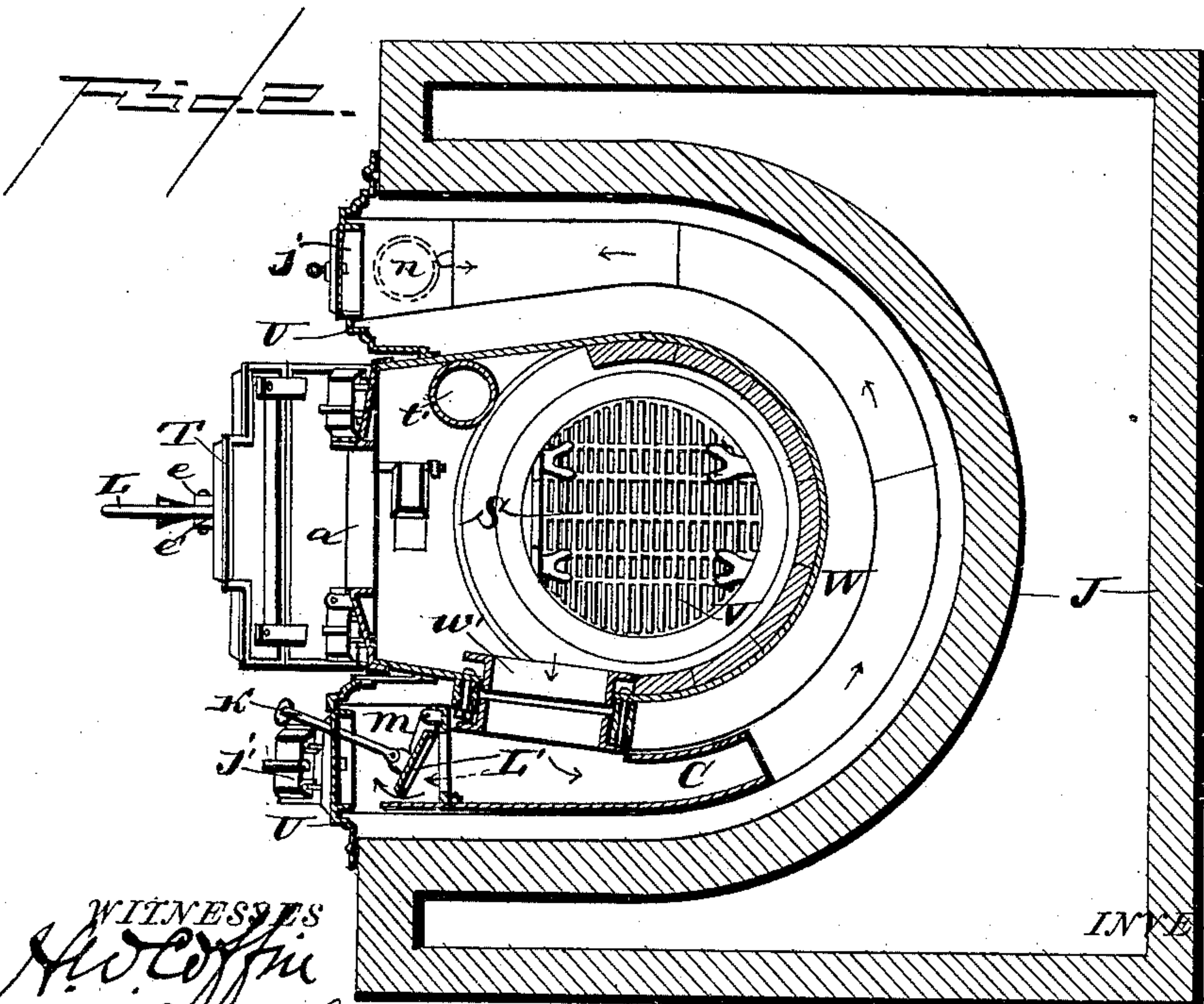
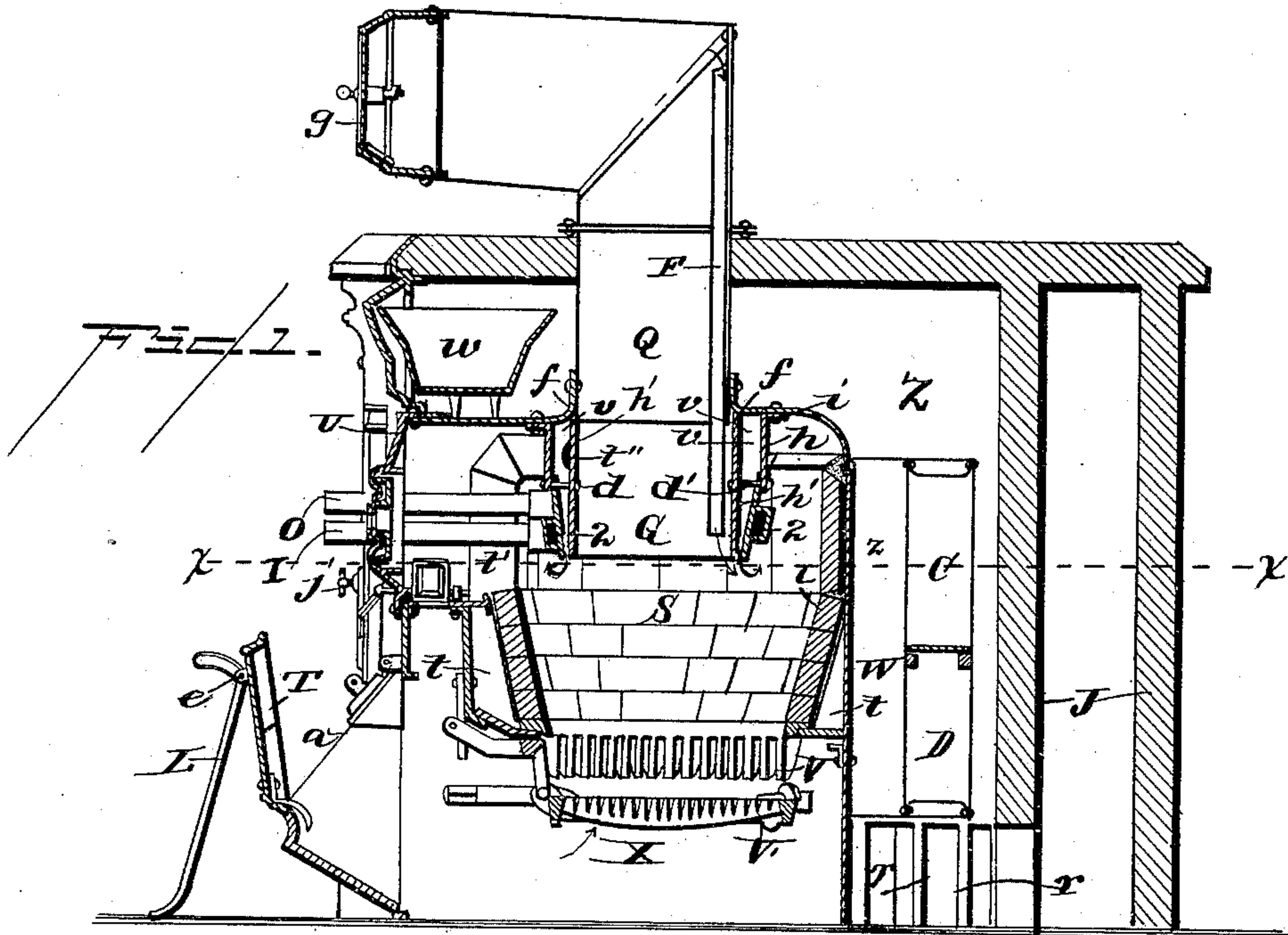
(No Model.)

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HOT AIR AND HOT WATER HEATER.

No. 409,740.

Patented Aug. 27, 1889.



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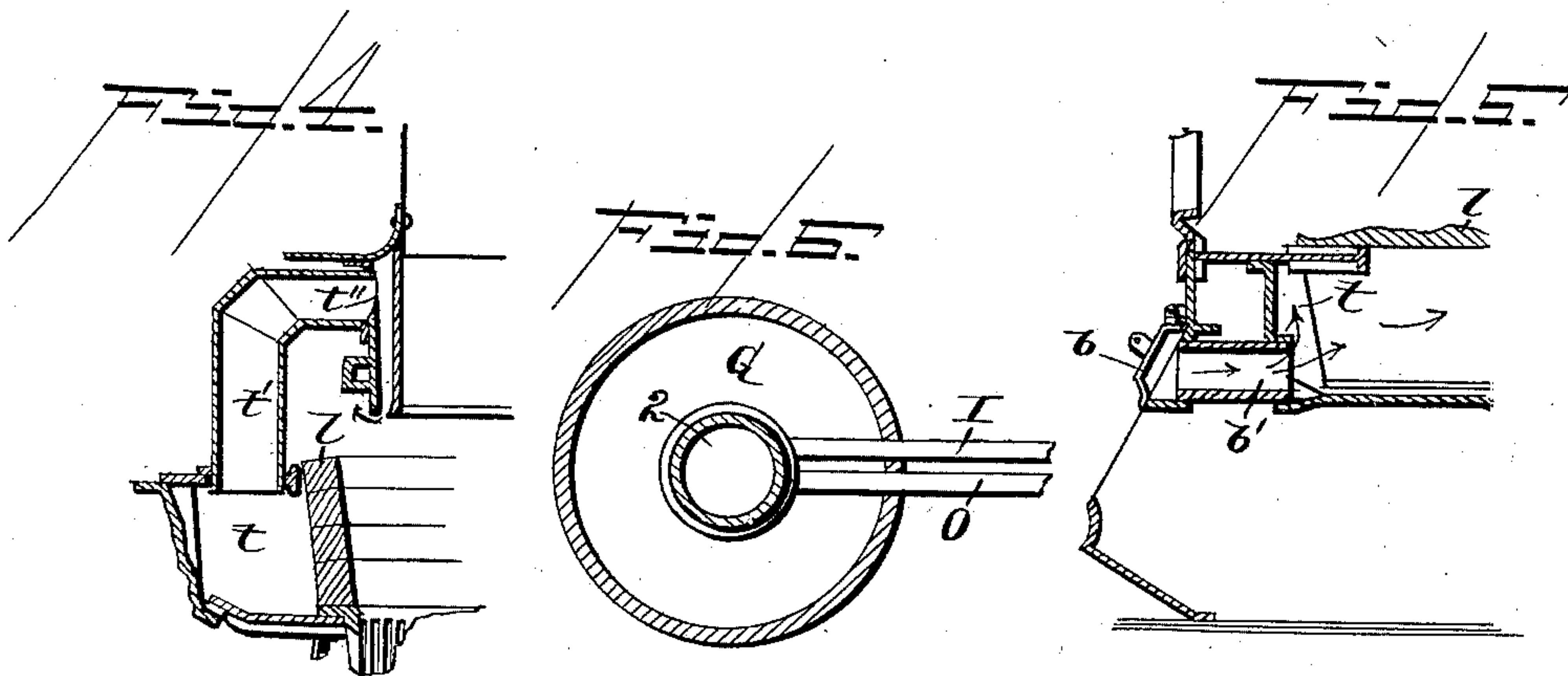
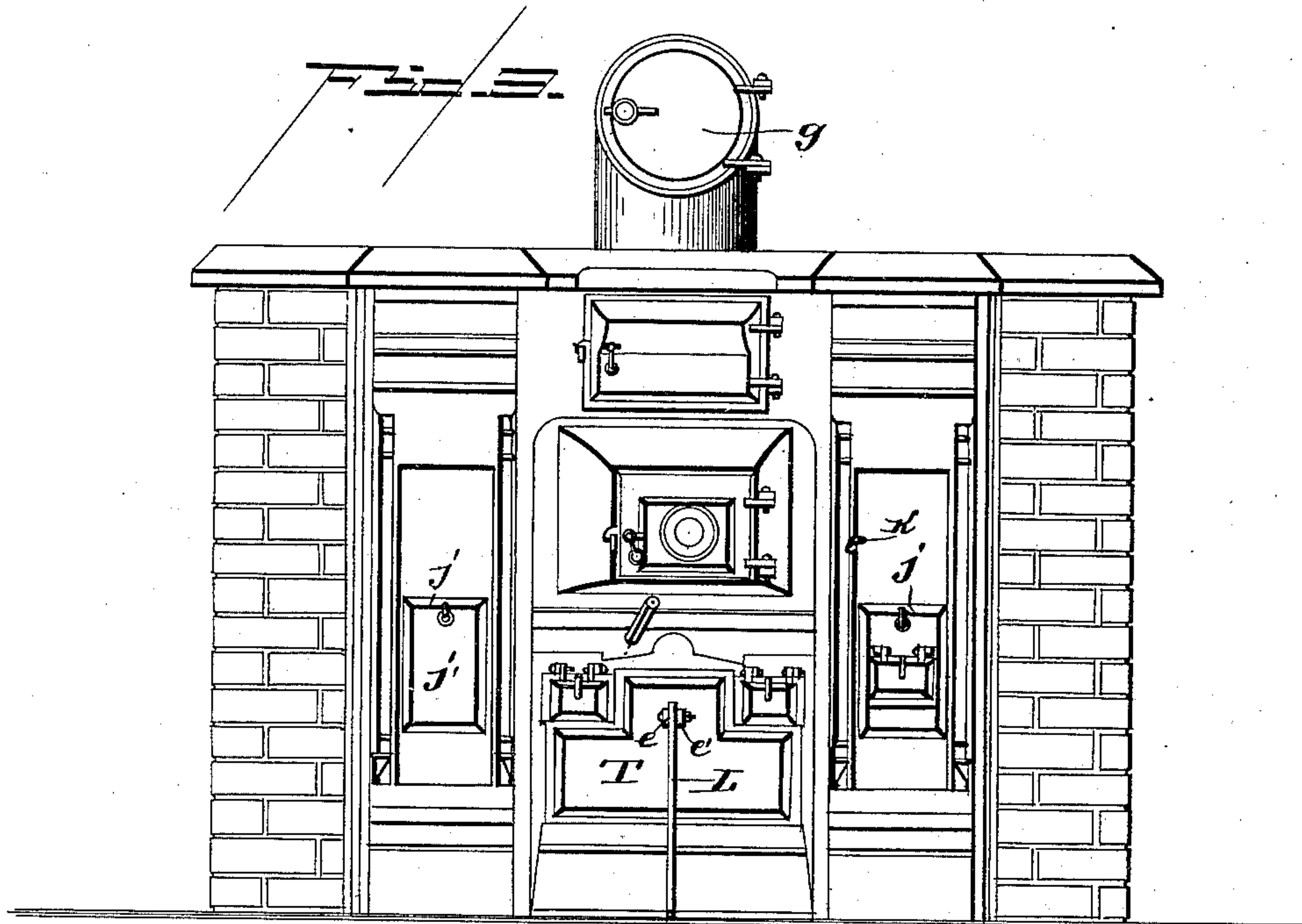
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# UNITED STATES PATENT OFFICE.

FRANCIS FARQUHAR, MILTON J. FARQUHAR, AND HENRY B. FARQUHAR,  
OF WILMINGTON, OHIO.

## HOT-AIR AND HOT-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 409,740, dated August 27, 1889.

Application filed December 5, 1888. Serial No. 292,732. (No model.)

*To all whom it may concern:*

Be it known that we, FRANCIS FARQUHAR, MILTON J. FARQUHAR, and HENRY B. FARQUHAR, citizens of the United States, residing at Wilmington, in the county of Clinton and State of Ohio, have invented certain new and useful Improvements in Combined Hot-Air and Hot-Water Heaters; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to heating apparatus for buildings. It combines in one apparatus a warm-air furnace and a hot-water heater, and is an improvement upon the apparatus described in our previous United States patent, No. 366,944, granted July 19, 1887.

It consists in the construction, combination, and arrangement of parts hereinafter fully described, and illustrated by the accompanying drawings, in which—

Figure 1 is a vertical section of our heater. Fig. 2 is a horizontal section of the same, taken on line  $x\ x$  of Fig. 1. Fig. 3 is an elevation of the front of the heater. Fig. 4 is a detail view of the hot-blast flue. Fig. 5 is a section through the hot-blast inlet. Figs. 6 and 7 illustrate modifications in the relative arrangement of the magazine, hot-blast flue, and water-chamber.

In the drawings illustrating our invention, W is a metal casing with a cylindrical back, but having its sides extending forward to the front wall U of the furnace. This casing W incloses the ash-pit X, the fire-pot S, having the grates V V', the magazine G, and the water-chamber 2. The casing W is provided with a dome-like top  $f$ , which communicates with or forms part of the tube Q, extending through the top of the furnace. This tube Q is provided with a hinged cover  $g$ , and constitutes a chute leading to the magazine G, suspended within the cylinder W above the fire-pot. In some cases the magazine and the chute may be one structure.

The magazine G consists, as shown, of two concentric cylinders—that is, an outer tapering cylinder  $h$ , having a flange  $i$  for the passage of bolts, by which it is bolted to the top

$f$ , and an inner cylinder  $h'$ , suspended by bolts  $d\ d'$  to the outer cylinder  $h$ .

At the bottom of the outer cylinder  $h$  is a water-chamber 2, preferably of cast-iron, also bolted to cylinder  $h$ . As shown in the drawings, the same bolts  $d\ d'$  serve to support the water-chamber and the inner cylinder forming the fuel-magazine. The cylinder  $h$  and the water-chamber 2 are both larger than the cylinder  $h'$ , so as to leave an intervening air-chamber  $v$ , wider at the top, but having a very narrow opening at the bottom through which the air-blast is discharged downward in thin jets into the combustion-chamber, where it becomes thoroughly mixed with the gases which are evolved by the heating of the fuel beneath the mouth of the magazine G. The air is supplied to the chamber  $v$  by an opening  $t''$  in the cylinder  $h$ , to which opening the air is conducted by the blast-flue  $t'$ , which communicates at its lower end with an air-chamber  $t$ , between the fire-pot lining  $l$  and the casing W, as shown in Fig. 4. The blast of air is admitted to the heater by the hinged valve  $b$ , thence through the air-duct  $b'$  to the chamber  $t$ , all as illustrated in Fig. 5.

The water-chamber 2 is provided with an inlet I and an outlet O, by which a constant circulation is maintained in the said chamber. The water entering by the pipe I absorbs heat from the walls of the chamber 2 and passes out in a liquid or vaporous form, or in both forms together, through the pipe O. In the form of construction which is herein illustrated it is proposed to arrange a system of pipes connecting therewith, which will convey the hot water to suitable radiators located in the building to be warmed. The water, having parted with its heat by radiation, will then return again through the pipe I to the water-chamber 2, where it will again absorb heat from the walls of said chamber, all in a manner well known to those skilled in the art of heating by hot-water circulation.

It is evident, of course, that the hot-blast flue might be at one side of the magazine, as indicated at Fig. 6, or it might be within the magazine, as indicated at Fig. 7. The application of the water-jacket would, however, still be the same in principle, and we consider



all these forms to be within the scope of our invention. In place of the said system for heating by hot water the apparatus herein described may also be used as a feed-water heater for any ordinary steam-boiler. The boiler for which the water is thus heated may have its separate furnace, or it may be heated by the fire in our heater, which would then be specially adapted for the generation of steam. When used as a feed-water heater, the cold water would enter at the inlet I, be heated in the chamber 2, and pass onward to the boiler through the outlet O, in the manner previously described.

In Fig. 1 *w* is an evaporating-pan for water, from which the necessary moisture for the heated air is supplied. Within the fuel conduit or chute Q, and near the back of the same, is a small gas-flue F, through which the gases which may accumulate in the top of the chute Q are allowed to pass downward and be discharged at the mouth of the magazine G, where they will be brought into contact with the blast of heated air and burned.

The ash-pit X is closed by a door T, hinged at the bottom and fitting when closed against an inclined face *a*. Two ears *e e'* at the top of the door T have hinged between them an L-shaped lever L, which swings to a vertical position when the door is open and supports the same, as clearly shown. The products of combustion pass from the combustion-chamber through an opening *w'*, at one side of the casing W and above the fire-pot, to a U-shaped flue C, the ends of which extend through a front wall or plate U, where they are closed by doors *j j'*. An uptake or smoke-pipe *m* communicates with flue C near one end, so that the products of combustion will pass directly from the opening *w'* to the pipe *m*. In order, however, to secure the full benefit of the heat of the gases, we use one or more additional flues D, similar in shape to the flue C and communicating therewith, and cause the heated gases to traverse all the said flues before passing to the smoke-pipe. The said flues, as well as the remaining portions of the heater, are arranged within a chamber Z, to which cold air is admitted, so as to pass in contact with the heated surfaces.

As shown, the flues C and D are arranged so as to encircle the casing *w* so far as their shape will permit, but with an intervening space *z* for the upward passage of air. The flue C at the end opposite to that which communicates with the pipe *m* communicates through a pipe *n* with the adjacent end of the flue D, and the opposite end of the flue D communicates by a suitable pipe with the adjacent end of the flue C, and a valve L' is arranged between the opening *w'* and the pipe *m*. When the valve L' is opened, as shown in Fig. 2, the products of combustion can pass directly from the combustion-chamber to the smoke-pipe; but when the valve L' is closed the heated gases must traverse the flue C

from the opening *w'* to the other end of said flue, then pass downward to the flue D, and traverse the latter to its opposite end, after which they will pass upward through the pipe leading into the uptake or smoke-pipe *m*.

The valve L' may be operated in any suitable manner—as, for instance, by means of a rod *k*, jointed to the valve and extending through an opening in the front plate.

The heater above described may be arranged in any suitable casing—as, for instance, in a chamber formed by walls J of brick-work, and provided with one or more passages *r*, through which cold air can enter the chamber Z below the lower flue D and pass freely upward in contact with all the heated plates to the top of the chamber Z, from which it is conducted by means of suitable pipes through the different places to be heated.

It will be noticed that all of the radiating-flues are arranged around casing W below the top of the latter, so as to reduce the height of the furnace and avoid the necessity of carrying the products of combustion to any great distance vertically which would interfere with the draft, and so as to insure the heating of the air immediately after it has entered the chamber Z. One object of this arrangement is that by passing the products of combustion through the lower flue D the last thing before they are conducted to the chimney a greater amount of heat will be extracted by contact with the incoming air, thus utilizing the heat which would otherwise be carried off up the chimney and wasted. Another advantage of placing the radiating-flue low down and near to the bottom of the chamber Z is the increased height of the heated-air column thus obtained, which increases the upward pressure in the said column and insures a better delivery of the heated air.

It is understood that the use of a fuel-magazine provided with an air-chamber *v*, arranged to discharge the air into the combustion-chamber for the purpose of completing the combustion of the gases, is not new; also, that the use of a water-chamber around or adjacent to a tuyere for the discharge of air (either cold or heated) into a combustion-chamber in which, by the circulation of water, the material of the tuyere is prevented from being melted, burned, or warped out of shape in consequence of the intense heat produced by the fire, is not new or novel; but by the form of construction and organization of parts herein described, in which practical success is the result of the combination of the fuel-magazine, the air-blast chamber, and the water-chamber, great benefit is obtained.

The principal advantage of this our invention consists in the fact that it enables the construction of heater described in our previous patent, No. 366,944, to be employed without the burning out and melting down of the parts through the excessive heat generated.



On the contrary, this otherwise injurious excess of heat is carried off by the water, so that it can be usefully employed elsewhere.

Having therefore described our invention, what we claim as new, and desire to protect by Letters Patent, is—

1. In a heater, the combination, with any suitable fire-pot and any suitable fuel-magazine, of the hot-blast flue which surrounds the fire-pot, a second hot-blast flue connected with the first and arranged adjacent to the fuel-magazine, and a water-jacket about the mouth of the second hot-blast flue, substantially as described.

2. In a heater, the combination, with any suitable fire-pot and any suitable fuel-magazine, of the hot-blast flue which surrounds the fire-pot, a second hot-blast flue connected to the first, which surrounds the fuel-magazine and is annular in form, together with a water-jacket about the mouth of the said annular hot-blast flue, substantially as described.

3. In a heater, the combination, with a fuel conduit or magazine, of a hot-blast flue arranged adjacent to the fuel conduit or magazine, together with a water-jacket about the

mouth of the hot-blast flue, substantially as described.

4. In a heater, the combination, with a fuel conduit or magazine, of an annular hot-blast flue which surrounds the same and has an annular mouth which is adjacent to the mouth of the fuel-magazine, together with a water-jacket about the mouth of the hot-blast flue, substantially as described.

5. In a heater, the combination of the fuel conduit or magazine with the hot-blast flue arranged adjacent to the lower edge of the same, the water-jacket surrounding the hot-blast flue, the gas-chamber at the top of the fuel-magazine, and the pipe leading from said gas-chamber back to or nearly to the mouth of the fuel-magazine, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

FRANCIS FARQUHAR.  
MILTON J. FARQUHAR.  
HENRY B. FARQUHAR.

Witnesses:

MELVILLE HAYES,  
NATHAN MOORE LINTON.