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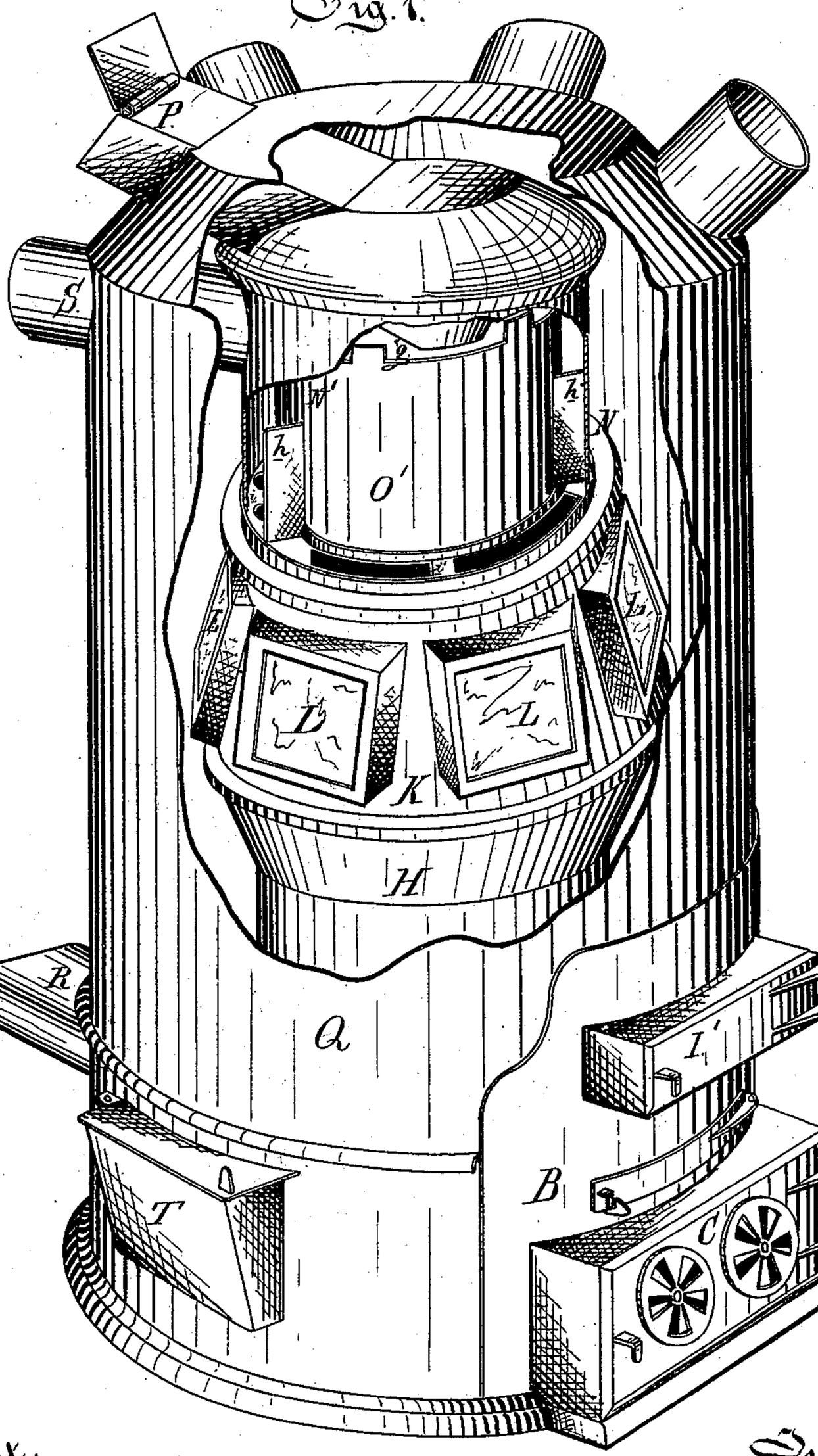
G. H. JOHNSON.

HOT-AIR FURNACE.

No. 176,964. Patented May 2, 1876.

Fig. 1.



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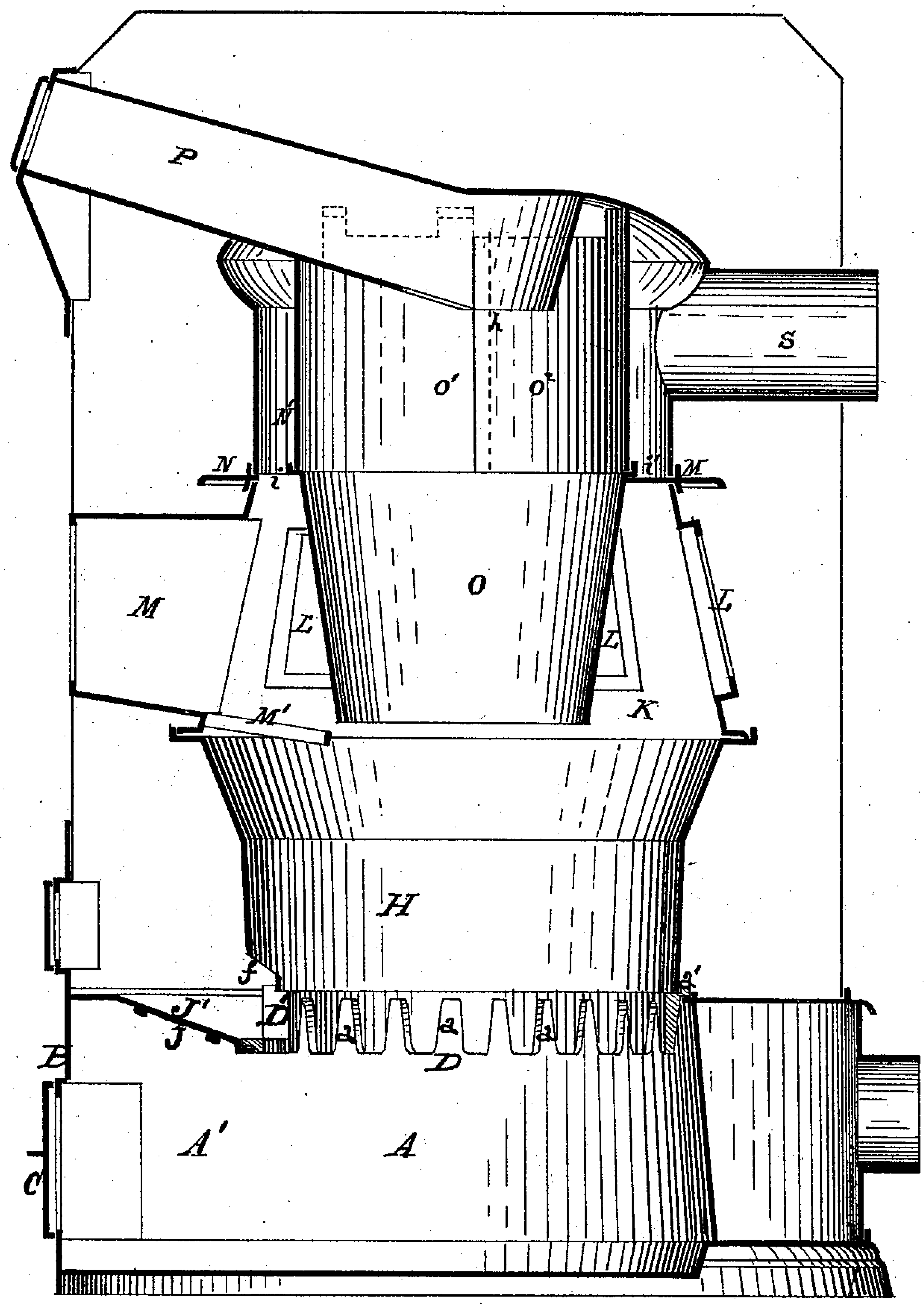
HOT-AIR FURNACE.

No. 176,964. Patented May 2, 1876.

Fig. 2.



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HOT-AIR FURNACE.

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Fig. 3.

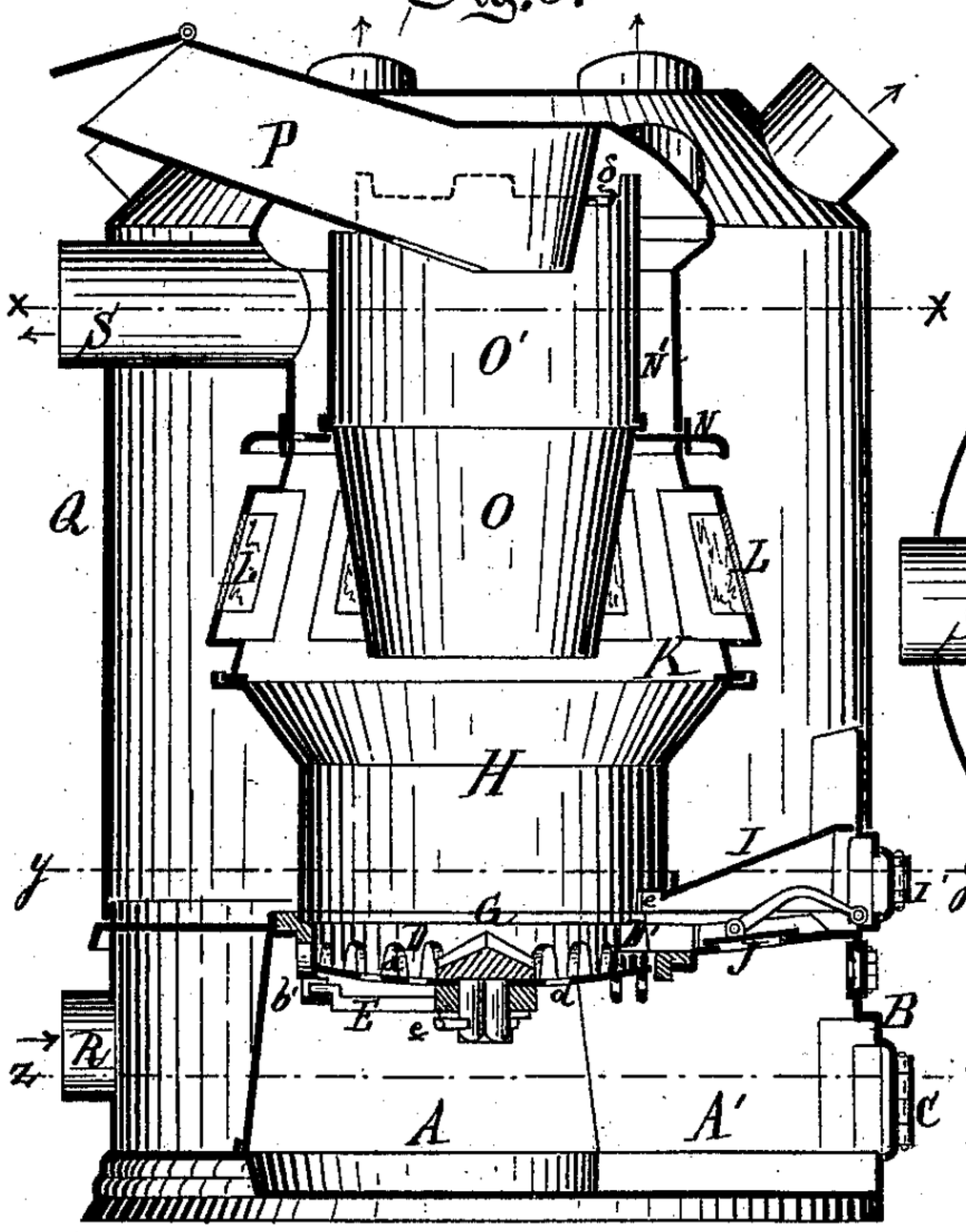


Fig. 4.

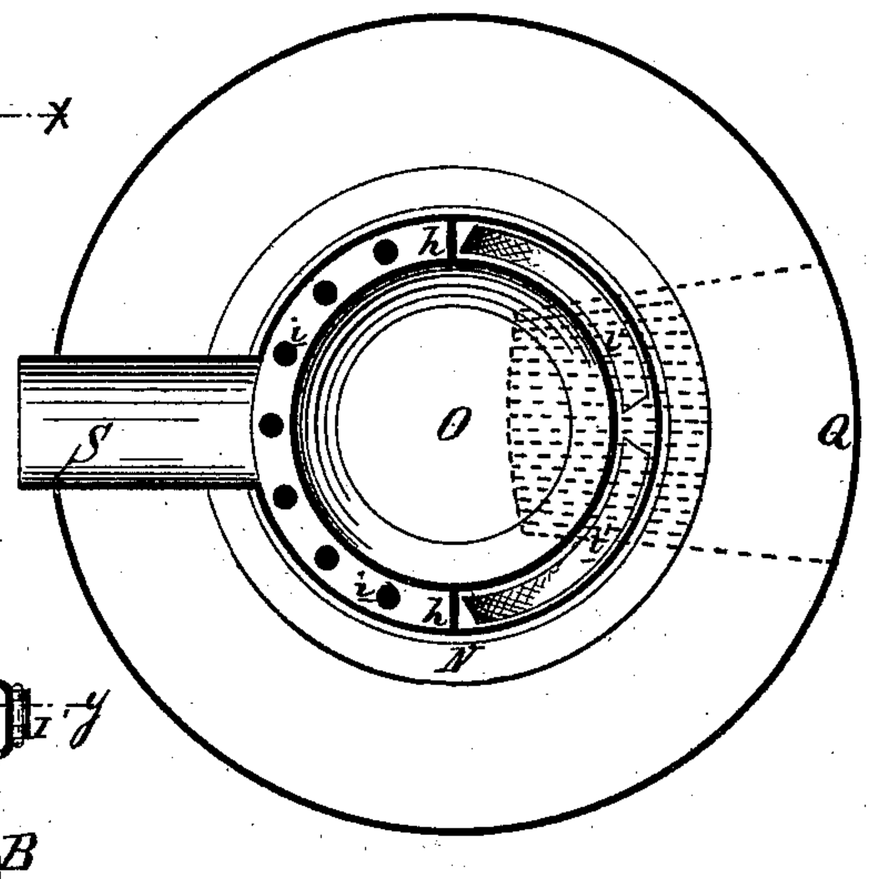


Fig. 5.

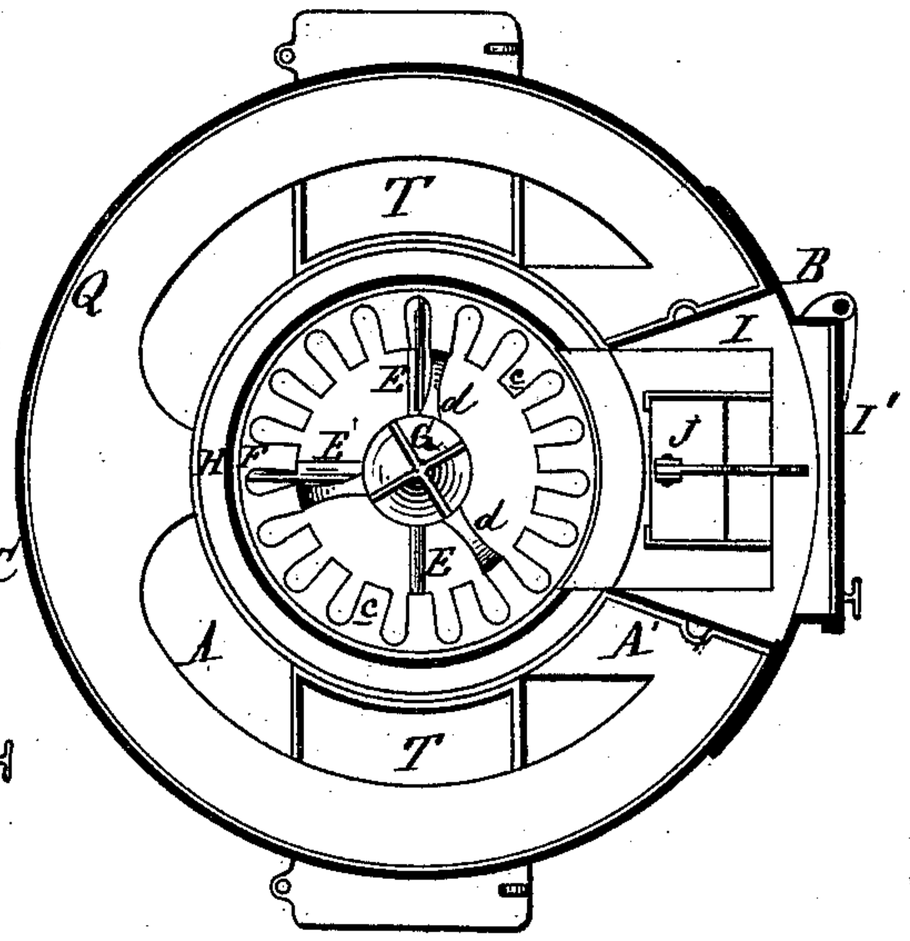
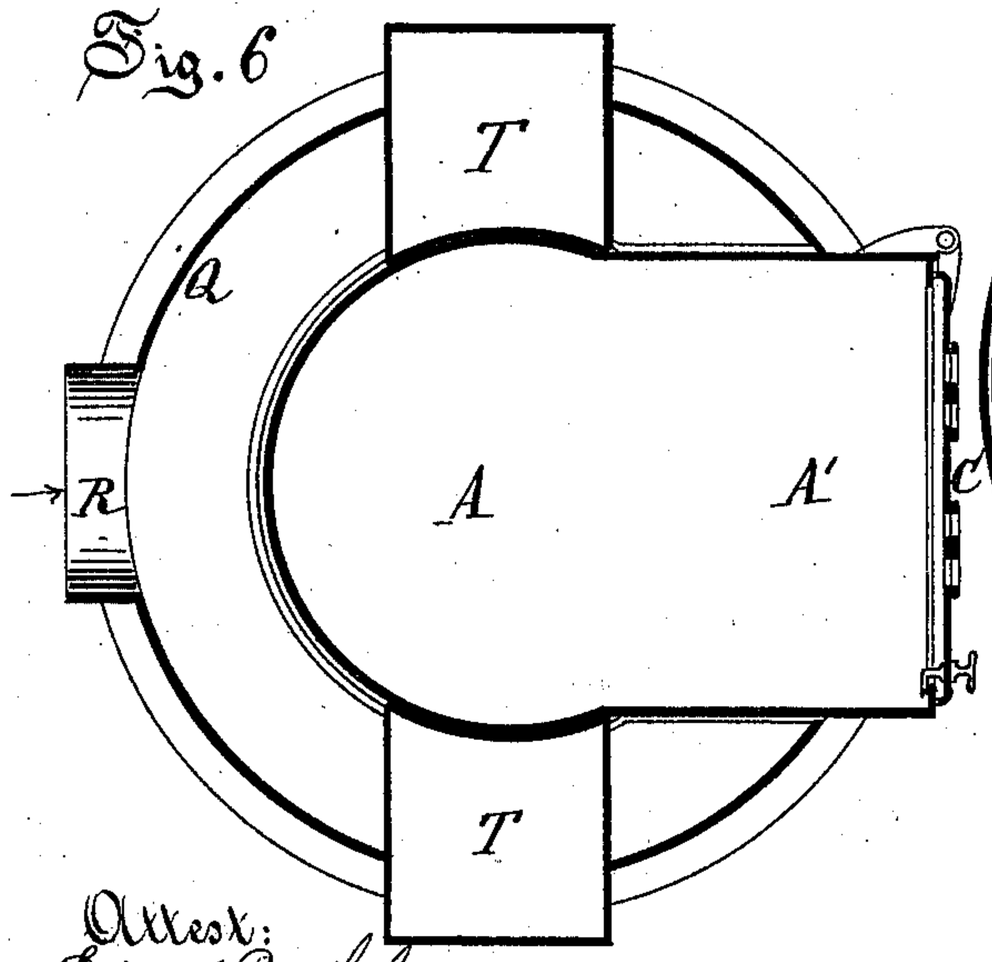


Fig. 6



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HOT-AIR FURNACE.

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Fig. 7.

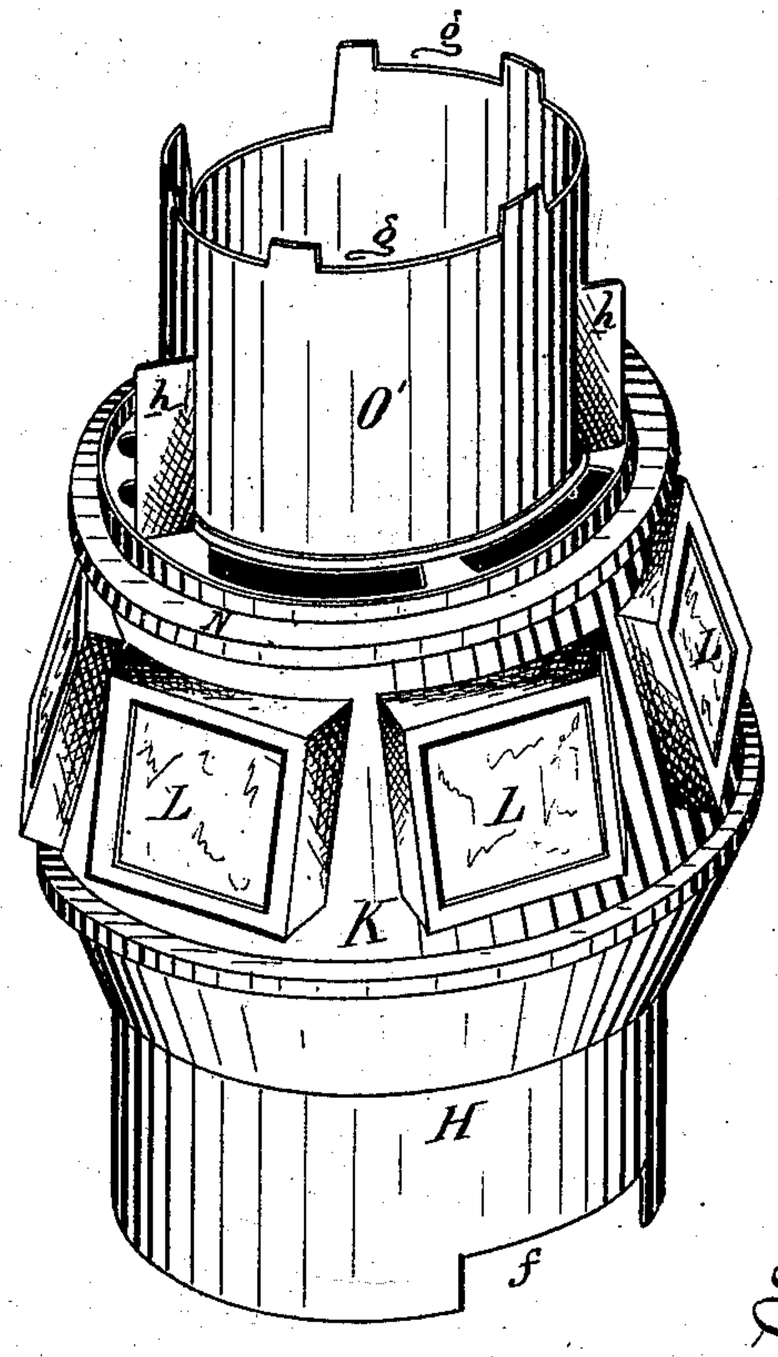


Fig. 8.

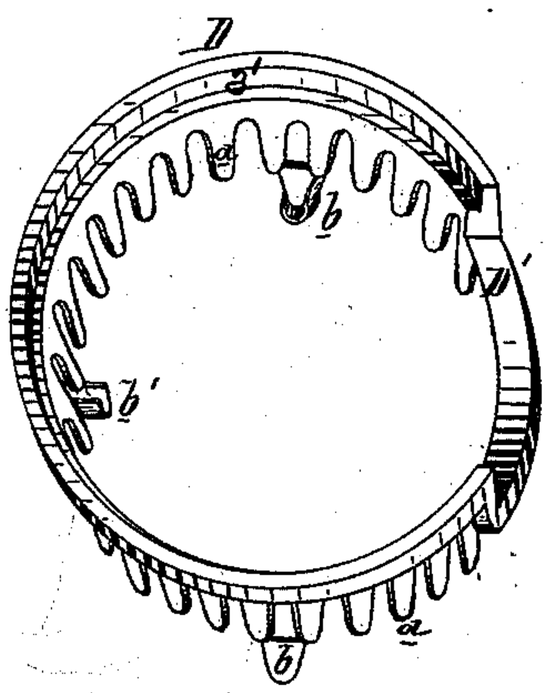


Fig. 10.

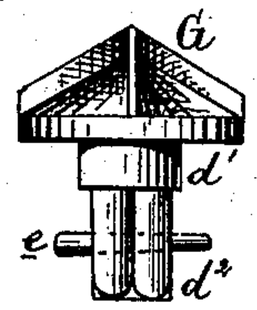
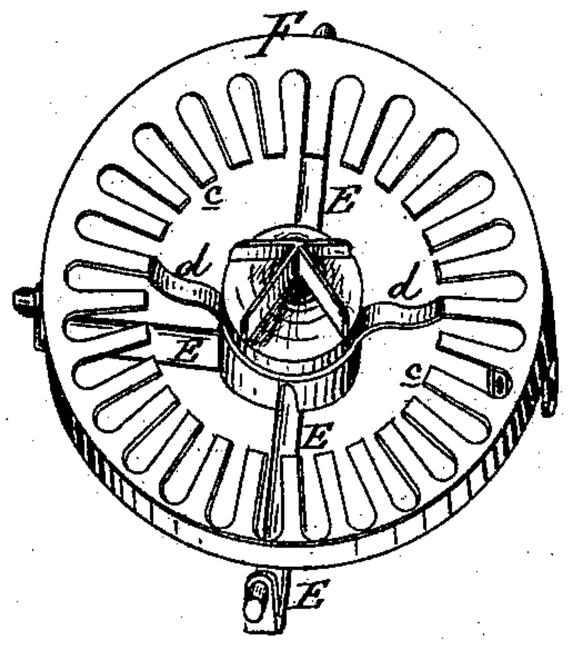


Fig. 9.



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UNITED STATES PATENT OFFICE.

GROVE H. JOHNSON, OF ERIE, PENNSYLVANIA.

IMPROVEMENT IN HOT-AIR FURNACES.

Specification forming part of Letters Patent No. **176,964**, dated May 2, 1876; application filed June 17, 1875.

To all whom it may concern:

Be it known that I, GROVE H. JOHNSON, of Erie, in the county of Erie and State of Pennsylvania, have invented certain Improvements in Hot-Air Furnaces; and I do hereby declare that the following is a description thereof, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a perspective view of the furnace embodying my improvements, with parts broken away. Fig. 2 is a sectional elevation from front to rear. Fig. 3 is a sectional elevation illustrating the heater modified in some of its parts. Fig. 4 is a horizontal sectional view, taken at line *x x* in Figs. 2 and 3. Fig. 5 is a similar view, taken at line *y y*, Figs. 2 and 3. Fig. 6 is a horizontal view, taken at line *z z*, Figs. 2 and 3. Fig. 7 is a detached perspective view of the fire-pot, combustion-chamber, and fuel-reservoir. Fig. 8 is a perspective view of the lower end of the fire-pot. Fig. 9 is a perspective view of the grate and its supporting-spider. Fig. 10 is a perspective view of the central boss of the grate.

My invention relates to hot-air furnaces, or furnaces for heating air to be introduced in other rooms for warming the same, and consists:

First, in a combustion-chamber having its walls partially made with mica lights, and inclosed by an outer casing, standing off at a distance from the said combustion-walls with a space between for the passage of air upward from below to its point of exit, whereby the heat from the incandescent coals, and the flame in the combustion-chamber may be permitted to radiate out into the space surrounding the combustion-chamber to more highly heat the air passing up within.

The object of this part of my invention is to permit the heat accompanying the light from the glowing surface of the coals in the fire-pot and the flame in the combustion-chamber to act more powerfully on the air to be heated within the space surrounding the combustion-chamber, by its direct passage from the combustion-chamber to the said space without being forced to pass through metal plates, as heretofore, thereby increasing the heating power of the furnace about twenty-five per cent.

Second, a fire-pot having a fingered termination extending down into the ash-chamber, with the solid portion of the fire-pot having a tight-fitting joint, with the walls of the said ash-chamber and its fingered terminations, capable of permitting the heat from the coals between the fingers to radiate outward to impinge on the walls of the ash-chamber to highly heat the same, and thereby cause the walls of the said ash-chamber to operate more effectively for heating the air passing upward through the space between the said walls and the outer casing of the furnace.

Third, a fuel-reservoir, comprised by a lower section, suspended from the ring above the combustion-chamber, and an upper section made in halves and supported above the said ring, in combination with flue-strips cast with either of the said half upper sections, whereby the fuel-reservoir will be made to have a ventilating-joint at about on a plane with the said ring for the escape of the gases generated within the lower section of the reservoir, and side ventilating-joints for the escape of the gases generated in the upper section, while the several sections may themselves be readily removed for repairs when required.

Fourth, water-evaporating vessels, located on a plane with the ash-chamber, with their rear walls in contact with the wall of the said ash-chamber, whereby the evaporation of the water may be had at a low point, and the vapor be carried upward through the whole vertical length of the air-space of the heater, while the said vessels will be mainly heated from their rear walls, and their sides be held at a lower temperature, thereby preventing an excessive evaporation.

In the drawings the same letters of reference indicate like parts.

A represents the ash pit or chamber, located beneath the fire-pot, and made with the extension A′ carried out to the outer wall of the heater, as shown, and provided with a front plate, B, in which is made a door, C, through which access may be had to the interior of the said chamber. D is the terminating lower end of the fire-pot, made fingered or slotted, as at *a*, and projecting downward into the ash-chamber to a short distance, so that the upper ends of the slots will be below the top edge of the wall of said the ash-chamber. The front portion of the said fingered terminating end is made with the opening D′, which opening is extended up to a little dis-

tance in the solid portion of the fire-pot H, as at *f*, in Fig. 7.

If desired, the said lower terminating end may be made solid with the fire-pot, or be made to consist of a separate piece, D, in which latter case I would have the said piece set with the top edge of the said ash-chamber from a suitable flange, *a'*, cast with the same, and set the solid portion of the fire-pot in a seat made in the top surface of the said flange, as shown in Figs. 2 and 8. When the fire-pot H, with its terminating end D, are cast together as one piece, the said flange *a'*, or its equivalent, should be cast with it to receive the edge of the ash-chamber wall, to tightly close the same from all communication of the ash-chamber to the space outside. Supported in the ash-chamber by the socket-lugs *b b* is the three-armed spider E, capable of being tilted down in front. A lug, *b'*, supporting the rear arm of the spider, prevents the same from being tilted down at the rear.

The grate F is a simple annular plate, provided with fingers and slots in its inner periphery, as at *c*, and is connected with a central hub by the spokes *d*. G is a large-headed bolt, having a round shank, d^1, below the head, and a square point, d^2, which passes through the center of the spider and enters into a socket in the same, where it is secured by the pin *e*. The grate, by its hub, is capable of being rotated on the rounded portion of the central bolt.

The portion of the ash-pit A' extending out from the portion A to the front plate B is covered over, as shown, and is provided with a large opening, J, and covered over by a detachable plate or cover. The said opening J is covered over by the cover J', starting from the upper margin of the opening D' and extending outward from the same to the door I' and closing in the sides so as to cut off all communication of the space or passage-way between the said cover and the cover of the ash-pit section A' and the air-space within the outer casing of the heater. K is the combustion-chamber supported over the fire-pot, the outer walls of which are set with mica lights L, which face the air-space between the outer casing or wall of the heater and the walls of the combustion-chamber, so that the heat evolved from the combustion of the fuel in the fire-pot and said combustion-chamber may readily pass out, accompanied by the light from the glowing coals and the flame within, into the air-space surrounding the combustion-chamber, to act directly with the air passing up, to heat the same in a more powerful manner than if the heat from within had to pass from metal plates by radiation, as heretofore practiced. M is a chute extending from the outer casing of the heater to the combustion-chamber, as shown. Made continuous with the bottom of the said chute, is the grated extension M', which projects into the combustion-chamber and is intended to deliver the coals central into the fire-pot by causing them to fall from the chute from a line within the combustion-chamber and remote from the walls of the same, that the fuel may not become banked in the front portion of the fire-pot, as heretofore, where the chute with its bottom terminates at the wall of the combustion-chamber.

The perforations or gratings of the extended bottom M' permits the hot gases to ascend upward without being deflected, as would be the case if the said bottom was solid.

N is a flanged ring resting on the upper edge of the walls of the combustion-chamber, and separating the said chamber from the space N' surrounding the fuel-reservoir. Made in the front half of the said ring are the openings *i i*, and in the rear half the perforations *i' i'*, the front openings in their aggregate being nearly the full width of the space N' surrounding the fuel-reservoir. Extending upward from the ring N, and from the rear terminations of the openings *i i*, are the flue-strips *h*, terminating a little below the upper margin edge of the fuel-reservoir, so as to divide the space N' in two parts, the front portion or part being thus made to operate as a flue to lead the hot gases from the combustion-chamber to the dome-chamber, and cause them in their upward passage to impinge on the wall or casing intervening between the said flue or space and the outer air-chamber in front. The small perforations *i' i'* in the rear portion permit an escape of a small portion of the hot gases up the rear flue or space direct to the exit-pipe *s*.

The fuel-reservoir is comprised by the sections O, O^1, and O^2, the lower section O being made in a tapering form, and is suspended from the ring N by a suitable flange cast to the upper margin of the said section. The sections O^1 and O^2 each form a half of the upper portion of the reservoir, and are supported from the seat made in the flange of the lower section, or from the ring N. The flue-strips *h h* are cast solid to one of the said half upper sections, and serve as steadying-pieces to preserve the section in place from lateral misplacement, as well as dividing the space N^1 into flues. The upper ends of the sections O^1 and O^2 are slotted or cut out under the dome, to permit the gases rising in the fuel-reservoir to pass out into the dome-chamber.

The joint at the upper end of the lower section O, with the upper sections O^1 O^2, permits the escape of the gases forming in the said lower section, while the vertical joints of the two half sections O^1 and O^2 permit the escape of a major portion of the gases from the fuel in the upper section to the space N^1.

P is a coal-chute entering the dome, and communicating with the fuel-reservoir, for filling the same with fuel. Q is the outer wall or casing, which may be made of sheet metal or brick. R is the cold-air pipe. Suitable hot-air pipes may be variously placed in the top of the said casing to conduct the air

warmed within to any room or rooms variously located. T T are water-vessels set at the sides of the ash-pit, with their rear sides against the walls of the same. The said rear sides of the said vessels are made with a form to correspond with the outer surface of the walls of the said pit or chamber, and are intended to be heated by the heat radiated from the said walls, as they are heated by the heat radiated from the surface of the fuel burning in the spaces or slots between the fingers of the projecting terminating end of the fire-pot. A portion of the said water-vessels projects outward from the said outer casing, and is covered by a suitable cover, swinging or otherwise.

It is evident that, by the improvements in this invention, the heater is made to act more powerfully on the air passing up through the space between the heater and the outer wall of the casing, as the walls of the combustion-chamber are largely formed of mica lights, which will not absorb the heat, but permit its free passage from the incandescent coals and flame within the said chamber into the air-space surrounding the same, and be only arrested or reflected back from the wall or casing, thereby giving the heat a full opportunity for warming the air by a direct impingement of the same, and without that loss heretofore attending the use of full metal walls of combustion-chambers of heaters, as heretofore constructed.

It will be observed that the outer walls of the heater inclosing the air-space are made solid throughout, and without any mica or other transparent portions, so that the great amount of heat passing from the interior of the furnace, accompanied by light, will not be in any measure lost except by natural absorption by the outer walls.

It is also evident that by causing the hot gases, passing from the combustion-chamber to the exit, to move in the front portion of the space N around the dome-chamber, before their passage to the said exit, the front walls of the said space will be more highly heated, and the air passing up the front of the air-space will be more powerfully acted upon, than if the hot gases passed directly to the exit at the rear.

It is also evident that by projecting the lower fingered terminating end of the fire-pot down into the ash-chamber, the air admitted to support combustion will be made to pass into the fuel in its full volume, a portion passing up through the horizontal grate and another portion laterally through the slots between the fingers of the terminating end of the fire-pot. And that in no case can any gases escape from the fire to the air-space surrounding the heater, while at the same time the heat radiated from the fire in the said projected terminating lower end will highly heat the walls of the ash-chamber, and cause it to contribute to the warming of the air in the space surrounding the same more fully than in case the lower end of the fire-pot was at the upper margin of the said ash-chamber wall, as heretofore practiced by the trade.

It is also evident that by the extended grated bottom of the fuel-chute discharging into the combustion-chamber, the fuel introduced will be caused to fall more central in the fire-pot than if no such extended bottom was used, and the fuel will be made to have a more uniform depth on the grate, and all banking of fuel in the front portion of the fire-pot will be avoided.

By placing the water-vessels in the lower portion of the heater, and at the ash-chamber walls with their back walls against the walls of the said chamber as it is heated by the radiant heat from the lower terminating end of the fire-pot projecting down in the said chamber, a sufficient evaporation of water is secured, and from a low point, to moisten the air in the air-heating space, without that excessive evaporation now had, where the water-vessels are placed opposite the fire-pot.

These several improvements are simple, and contribute to render the heater more effective than heretofore, for warming air, to be introduced into several apartments of a building.

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

1. In an air-heating furnace, the combination of the entire homogeneous outer casing Q, without mica windows or openings to permit the outward passage of heat or light, the inclosed heater provided with mica windows, and a hot-air space between said heater and said outer casing, for the purpose of increasing the radiation of heat and confining the same within the hot-air space, substantially as described.

2. In an air-heating furnace, the combination of the solid fire-pot, fitting closely upon the top of the ash-chamber, and having a fingered lower end, D, extending down into such ash-chamber, the ash chamber A, and the hot-air space between the inclosed heater and its outer casing, the several parts constructed and arranged substantially as and for the purposes set forth.

3. In an air-heating furnace, the combination of the water-vessel T, projecting outwardly from the outer casing, and extending inwardly to the ash-chamber, the ash-chamber A, and the hot-air space between the heater and the outer casing, substantially as and for the purposes set forth.

4. In combination, in a fuel-reservoir for heating stoves or furnaces, the lower section O suspended from the ring above the combustion-chamber, and half upper sections O^1 and O^2, supported from the lower ends and having flue-strips *h* cast solidly upon one of said half sections, substantially as and for the purposes set forth.

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