

No. 686,907.

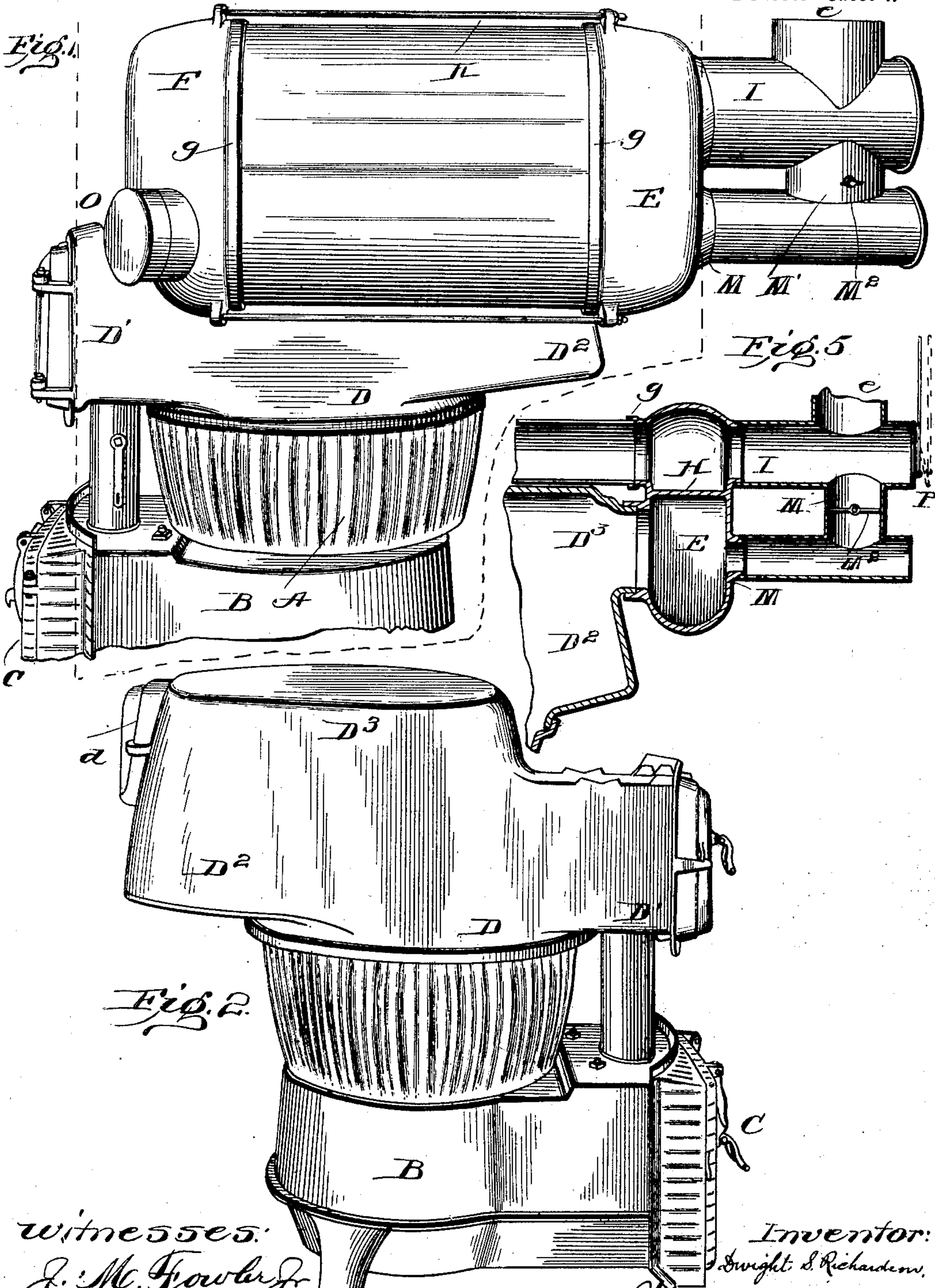
Patented Nov. 19, 1901.

D. S. RICHARDSON.  
HEATING FURNACE.

(Application filed Apr. 22, 1901.)

(No Model.)

2 Sheets—Sheet 1.



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Fig. 3

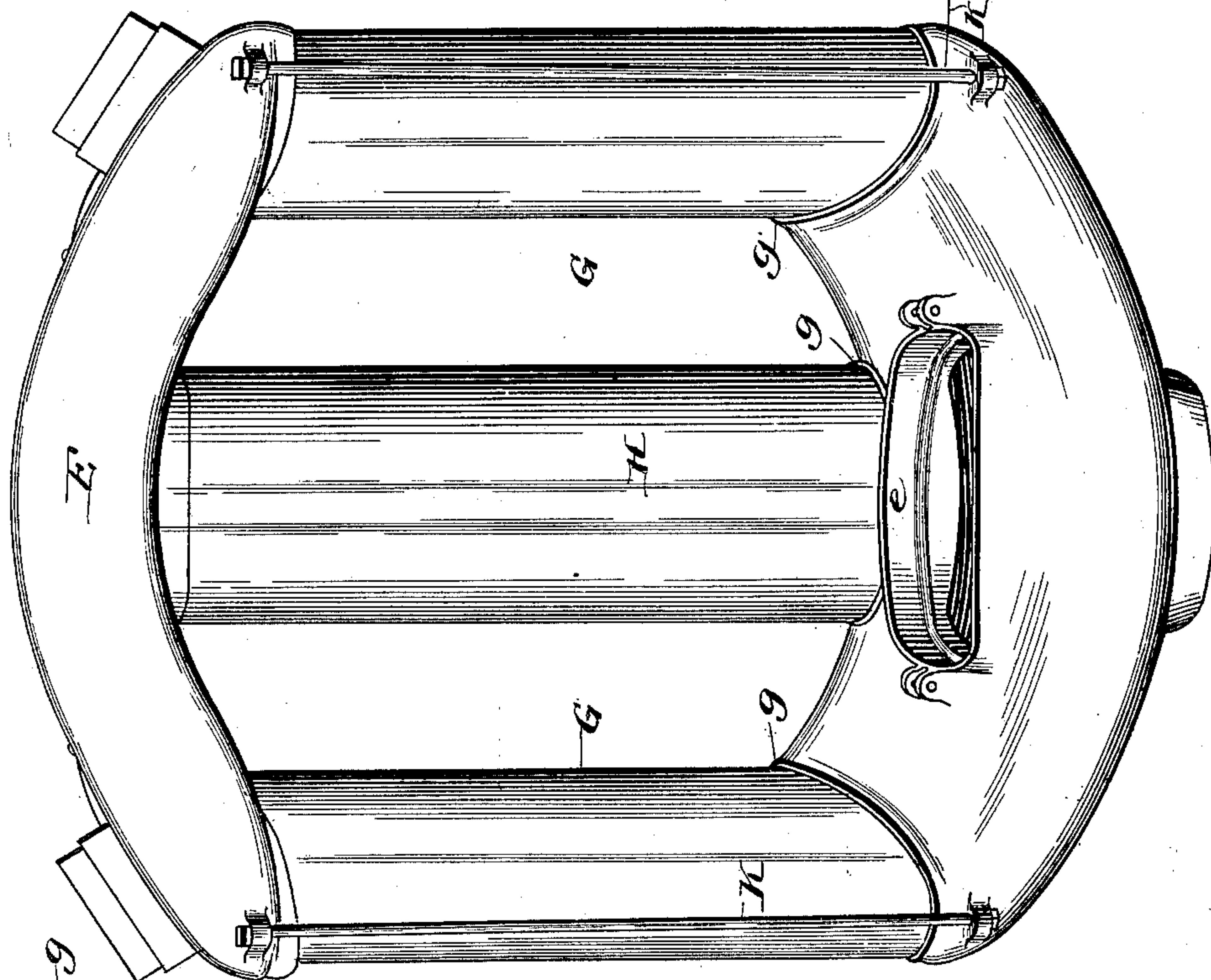
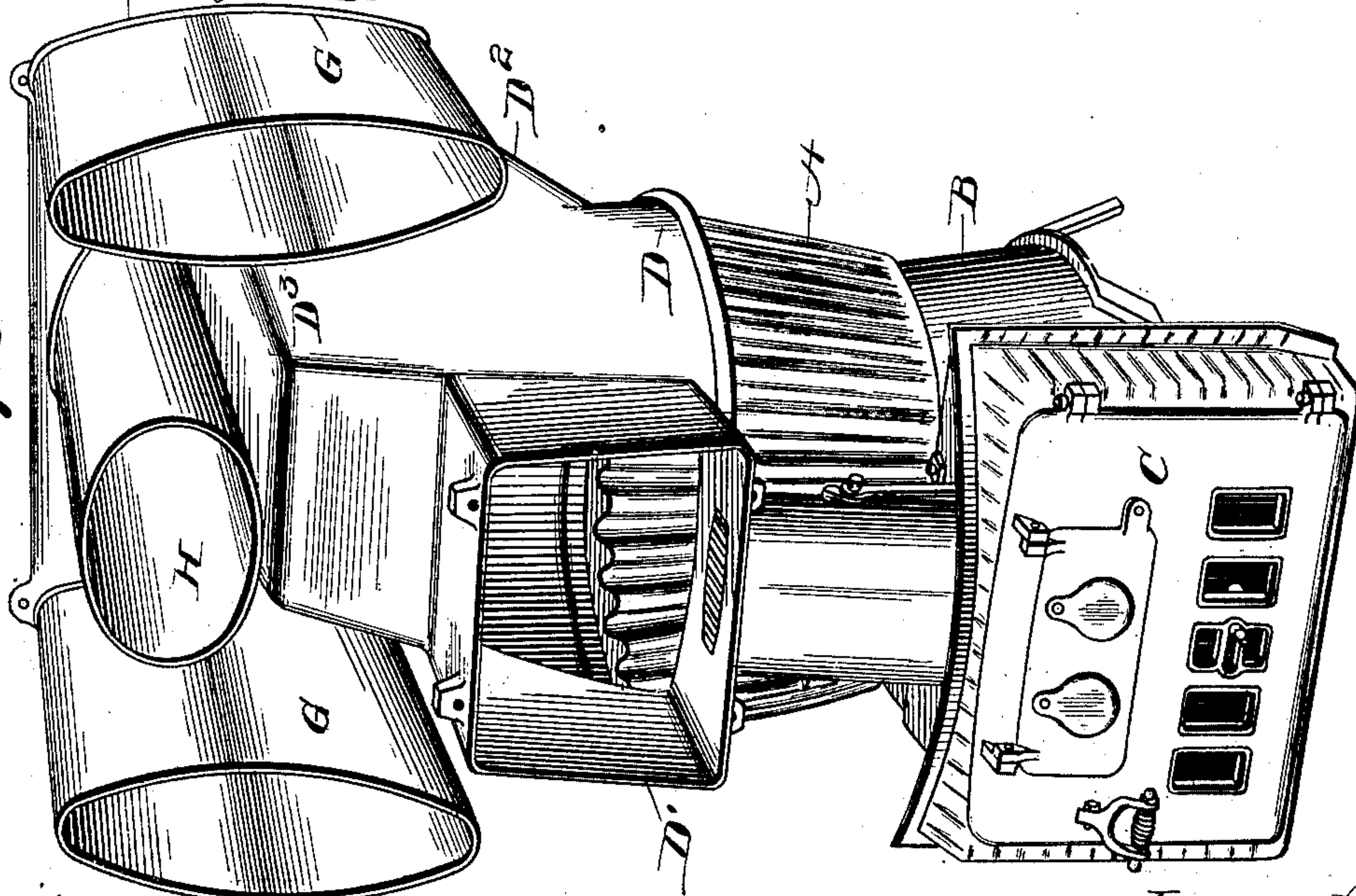


Fig. 4



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# UNITED STATES PATENT OFFICE.

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## HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 686,907, dated November 19, 1901.

Application filed April 22, 1901. Serial No. 56,950. (No model.)

*To all whom it may concern:*

Be it known that I, DWIGHT S. RICHARDSON, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Heating-Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to that type of heating-furnaces designed particularly for use in dwellings or buildings of moderate size, and has for its objects to provide a structure having the largest possible radiating-surface and composed of the smallest possible number of separate parts, whereby the liability of the formation of cracks for the escape of gas is avoided, the parts, however, being of such shape and so assembled that they may be readily passed through doors of ordinary dimensions and set up for use in a cellar or compartment having a relatively low ceiling.

A further object of the invention is to attain these desirable results without affecting the draft or requiring a stronger draft to maintain the fire in the furnace than is required for a stove or furnace of ordinary construction.

Further objects of the invention are to provide a structure which can be easily cleaned and the major parts of which may be conveniently and cheaply formed by casting in integral sections.

Referring to the accompanying drawings, Figure 1 is a perspective view of a furnace embodying my present improvements, the view being taken from the right-hand side and the casing indicated by dotted lines only.

Fig. 2 is a view looking at the left-hand side of the body of the furnace, the fire-pot, and the ash-pit. Fig. 3 is a view looking at the under side of the radiator removed from the body. Fig. 4 is a view of the body and radiator in their proper relative positions, but with the front smoke-box of the radiator removed to show the relationship existing between the several parts. Fig. 5 is a vertical section taken through the rear smoke-box and discharge-ducts to show the diaphragm and

the preferred arrangement of rear by-pass or direct-draft connection.

Like letters of reference in the several figures indicate the same parts.

The letter A indicates a fire-pot of any ordinary or preferred type, preferably, however, of relatively large diameter and mounted upon an ash-pit casting B. The latter may also be of any preferred type and is provided at its forward side with the usual draft, grate, and ash openings and doors C, all as indicated clearly in Figs. 1, 2, and 4. Above the fire-pot A is the body or combustion-chamber of the furnace, being in the present instance preferably an integral casting having its lower portion circular at D to fit the upper edge of the fire-pot, while at the front there is a forward extension D', constituting the feed-opening, and at the rear there is a rearward extension D<sup>2</sup>, constituting an enlarged combustion-chamber and radiating-surface. This rearward extension D<sup>2</sup> extends upwardly and is arched from side to side, forming an elongated dome D<sup>3</sup>. The smoke-exit is located at the rear end of this dome D<sup>3</sup> and is preferably in the form of a collar or projection *d*, adapted to fit into and form a tight joint with a corresponding collar or projection *e* on the rear smoke-box E. Smoke-box E constitutes the rear portion of what I shall herein term the "radiator," said radiator being preferably of the shape indicated in Fig. 3—that is to say, of a general oval shape—so as to adapt the furnace for use in connection with an oval casing. The said radiator in itself is composed of two smoke-box castings E and F, respectively, located at the rear and front of the dome D<sup>3</sup> and connected by side smoke-boxes G and a central smoke-box H, said side and central smoke-boxes being, if so desired, formed of sheet metal and held in place by being clamped between the front and rear smoke-boxes, as by tie-bolts K or other equivalent fastenings. In order to avoid as far as possible the formation of cracks or openings through which gas might escape, the sheet-metal portions or flues of the radiator have their ends located inside the flanges or collars *g* of the cast-metal portions, and thus the tendency of the joints to open is largely ob-



viated, because of the fact that when the sheet metal expands (which it will do before the cast metal expands, owing to its thinness) such expansion tends only to tighten and not to open the joints.

As before stated, the flange around smoke-exit from the dome  $D^3$  fits into the opening formed by the flange  $e$  of the rear smoke-box, and when the radiator is in its position on the body of the furnace the front smoke-box extends across said body above the projection  $D'$  and in front of the dome  $D^3$ , the upper portion of said dome being therefore inclosed by the radiator, but not tightly inclosed, for relatively large passages for the air are left around and between the parts of the body and radiator, as will be readily understood from an inspection of Fig. 4. The central smoke-duct  $H$  overlies the dome  $D^3$  and is preferably located in close proximity thereto or, if so desired, rests thereupon, although the weight of the radiator at the forward end is usually supported by resting the front smoke-box  $F$  on the top of the projection  $D^3$ . No connection is formed between the parts at this point, however, inasmuch as it is desirable to allow for expansion and contraction as the temperature varies.

The central smoke-duct  $H$ , it will be observed, connects the upper central portions of the front and rear smoke-boxes and is adapted to carry the products of combustion from the front to the rear box, such smoke and products of combustion passing thence off through a smoke-pipe  $I$  to the chimney or draft-creating device. To prevent the passage of the products of combustion and smoke directly from the body into the ducts  $H$   $I$ , a diaphragm  $H'$  is arranged in the rear smoke-box so as to extend around the openings for ducts  $H$   $I$ , thereby, in effect, forming a transverse passage across at the center of the upper part of the rear smoke-box. With this construction the products of combustion passing off from the fire in the fire-pot after circulating about the combustion-chamber pass out at the rear and into the curved rear smoke-box immediately below the diaphragm  $H'$ . From this point the products of combustion pass forwardly on each side through the flues  $G$  and into the forward or front smoke-box, where they unite at the center and pass rearwardly through the flue  $H$  and thence off to the stack. In circulating through the smoke-box and flues, as aforesaid, they heat an exceedingly large radiating-surface, and while under ordinary circumstances, by being caused to circulate to the extent mentioned, they would check or retard the draft through the fire or require a much higher stack, so as to create a stronger draft, this difficulty is overcome in the present instance by bringing the most highly heated products of combustion in proximity to the diaphragm  $H'$ , thereby imparting to the outgoing products sufficient heat to effectually maintain the draft in

the furnace. The return-flue  $H$  passes immediately over or in contact with the dome  $D^3$ , so in a large measure aiding the draft.

It will be observed that the smoke-boxes  $F$  and forwardly-extending flues  $G$  are formed with their greatest diameters vertical, or substantially vertical, adapting them to surround the dome  $D^3$  and to afford an extended vertical radiating-surface, while the rearwardly-extending flue  $H$  is formed with its greatest diameter horizontal. Thus while its capacity is maintained it is brought down to substantially the level of the upper portion of the side flues, and the whole structure may be conveniently mounted in a low-down oval casing.

To provide a direct-draft connection for starting the fire or for other purposes, the rear smoke-box  $E$  may be provided with a lower smoke-exit  $M$ , to which a pipe  $M'$ , communicating with the pipe  $I$ , may be attached, said pipe  $M'$  being provided with a damper  $M^2$ , by which the direct connection may be cut off and the smoke and heated products of combustion forced to circulate, as heretofore described.

The front and rear smoke-boxes  $E$  and  $F$  are solid castings, and in order to provide a means whereby all of the flues of the radiator, including said boxes, may be effectually cleaned the front smoke-box  $F$  is provided with clean-out openings and collars  $O$ , located at each side in such position that the side flues  $G$ , as well as the flue through the smoke-box  $F$ , may be conveniently reached therefrom with the usual cleaning implements. The bottom of the rear smoke-box  $E$  may be cleaned with a long scraper through the feed-opening  $D'$ , and the central flue  $H$  may be conveniently cleaned through the exit-pipe  $I$ , which is preferably provided with a cap, lift-damper  $P$ , or equivalent device for permitting of its rear end being opened for the purpose stated or for the purpose of checking the draft through the furnace.

It will be observed that the structure of the body and radiator is exceedingly simple, easily assembled, and thoroughly well supported and tied together when assembled. For a moderate-sized furnace it will be observed that a very much larger radiating-surface is secured than in prior constructions, for not only is a combustion-chamber provided which has an exceedingly large radiating-surface in itself, but the large radiator-flues passing around said combustion-chamber and partially inclosing the same provide even a greater radiating-surface, and the products of combustion are forced to travel through these radiator-flues, and all without requiring a stronger draft than an ordinary plain dome-furnace would require, thus adapting the present structure for use in any dwelling designed for any type of furnace or heater.

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



1. In a heating-furnace, the combination with a fire-pot, a furnace-body surmounting said fire-pot and having a forwardly-extending projection constituting a filling-opening, a projection extending rearwardly above the level of the filling-opening in the form of an arch-shaped dome and having a smoke-exit at its rear end, of a radiator having a rear smoke-box located in rear of and communicating with said exit-opening, a front smoke-box overlying the filling-opening and in front of the dome-shaped projection, flues connecting said smoke-boxes at each side of the dome and with their upper sides above the level of the dome and an exit-flue for the front smoke-box extending over and lying in proximity to the arch-shaped dome between the side flues; substantially as described.

2. In an air-heating furnace, the combination with the fire-pot, the furnace-body surmounting said fire-pot and formed in an integral casting with the arch-shaped dome extending rearwardly of said fire-pot and the projection extending forwardly of said fire-pot with its top below the level of the top of the dome and constituting the feed-opening, said arch-shaped dome having a smoke-exit at the rear side, of a radiator embodying a rear smoke-box located in rear of the dome and communicating with said smoke-exit from the dome, forwardly-extending flues communicating with the ends of said smoke-box and lying on each side of said arch-shaped dome and having their upper sides extending above the level of the dome and a front smoke-box communicating at its ends with said flues and resting centrally on the forwardly-extending projection of the body in front of the dome and a smoke-exit for said front smoke-box extending rearwardly in proximity to the top of the arch-shaped dome between and below the level of the top of the side flues; substantially as described.

3. In an air-heating furnace the combination with the fire-pot and the furnace-body surmounting said fire-pot and having the rearwardly-extending arch-shaped dome and the forwardly-extending projection constituting the feed-opening, of a radiator extending horizontally entirely around the upper portion of said dome but leaving air-space between the same and the sides of the dome the rear smoke-box of said radiator being connected centrally with the arch-shaped dome and the front smoke-box of said radiator resting on the forwardly-extending projection of the body and a smoke-exit leading from said front smoke-box rearwardly between the sides of the radiator and in close proximity to the arch-shaped dome so as to be heated thereby; substantially as described.

4. In an air-heating furnace the combination with the fire-pot and the furnace-body surmounting said fire-pot and having the rearwardly-extending arch-shaped dome provided at its rear end near the top with a smoke-exit and at its front end near the bot-

tom with a forwardly-extending projection constituting a feed-opening, of a radiator embodying a rear smoke-box having a central diaphragm in proximity to the smoke-exit from the arch-shaped dome, a front smoke-box overlying the forwardly-extending projection, side flues connecting the ends of said smoke-boxes and a central flue extending from the front smoke-box through the rear smoke-box above said diaphragm; substantially as described.

5. A radiator for heating-furnaces embodying a rear smoke-box having its ends curved forwardly and a smoke-entrance opening on its inner side near the bottom with a diaphragm above said opening to form a transverse flue through said box, a front smoke-box having its ends curved rearwardly and a central smoke-exit, a central duct connecting the smoke-exit of the front smoke-box with the transverse flue in the rear smoke-box, side flues connecting the ends of said smoke-boxes and tie-bolts uniting said smoke-boxes to clamp the flues between them; substantially as described.

6. In an air-heating furnace, the combination with a fire-pot and the furnace-body having the relatively long arch-shaped dome with the smoke-exit at its rear end, of the radiator having front and rear smoke-boxes with side flues connecting said boxes for bringing the products of combustion from the rear to the front side of the dome, the said flues and boxes having their greatest diameters extending vertically with their lower edges below and their upper edges above the top of said dome, and a flue overlying the arch-shaped dome and centrally connecting the front and rear smoke-boxes for conveying the smoke and products of combustion from the front to the rear of said dome, said last-mentioned flue having its greatest diameter extending horizontally whereby the tops of said flues are at substantially the same level and the furnace is adapted for use with a low-down casing; substantially as described.

7. A radiator for heating-furnaces embodying a rear smoke-box formed in an integral casting and having a smoke-entrance opening at the center near the bottom with a diaphragm above said opening, transverse flue-openings above said diaphragm and flue-openings at each end on the forward side, and extending vertically to the level of the top and bottom of the transverse flue and smoke-entrance openings, a front smoke-box, flues connecting the ends of the front and rear smoke-boxes and a central flue the top of which is at substantially the level of the tops of the side flues and connecting the front smoke-box and transverse flue in the rear smoke-box; substantially as described.

8. A radiator for heating-furnaces embodying a rear smoke-box having a smoke-entrance opening and smoke-exit openings at the ends, the latter openings extending down to the level of the bottom of the entrance-opening,



a front smoke-box formed in an integral casting with smoke-entrance openings at the ends, and a smoke-exit opening at the center, the top of which is at substantially the level of  
5 the tops of the smoke-entrance openings, flues connecting the end openings of the front and rear smoke-boxes and a smoke-flue leading from the central exit-opening of the front smoke-box and the top of which is at sub-  
10 stantially the level of the tops of the side flues; substantially as described.

9. In a radiator for air-heating furnaces, the combination with the rear smoke-box having its ends curved forwardly, a central entrance-opening near the bottom and a trans-  
15 verse flue near the top, a front smoke-box hav-

ing its ends curved rearwardly with a central exit near the top, flues connecting the ends of said smoke-boxes, and having a vertical width equal to the distance from the bottom 20 of the entrance to the top of the exit openings, a flue connecting the exit-opening of the front smoke-box with the transverse flue of the rear smoke-box and clean-out openings located at the ends of the front smoke-box, whereby both 25 said smoke-boxes and the side flues may be cleaned; substantially as described.

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