

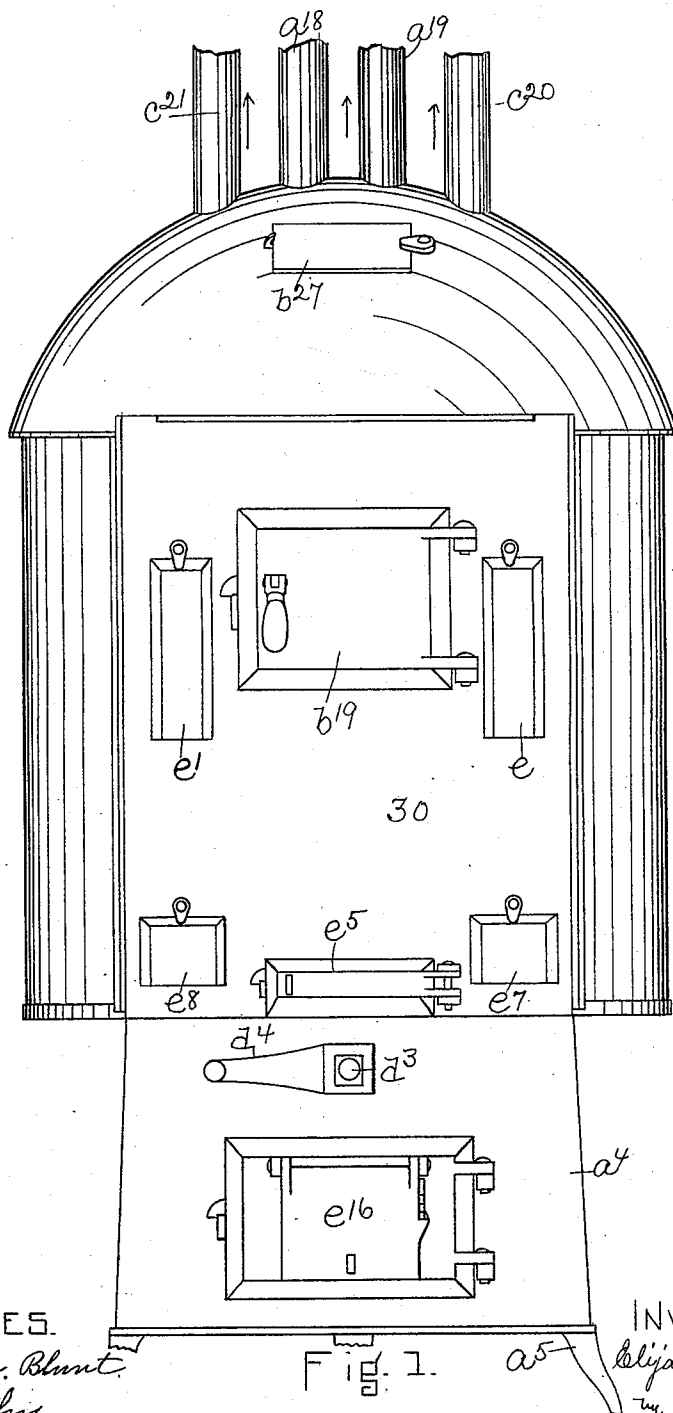
(No Model.)

4 Sheets—Sheet 1.

E. C. HALL.
HEATER.

No. 570,993.

Patented Nov. 10, 1896.



WITNESSES.

Matthew M. Blunt.
J. Murphy.

Fig. 1.

INVENTOR

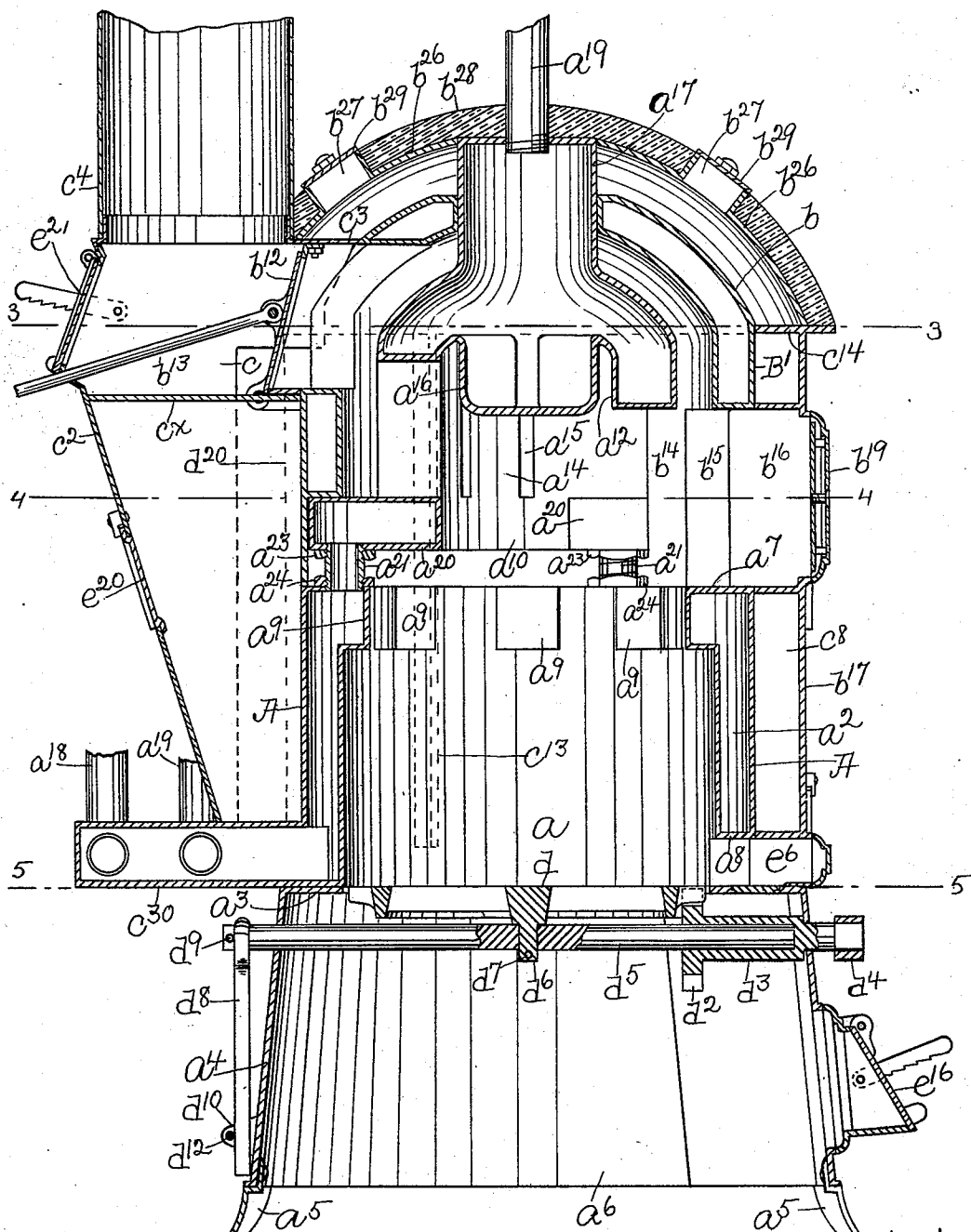
Elijah C. Hall
By Jas. F. Churchill

ATTY.

4 Sheets—Sheet 2.

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Fig. 2.

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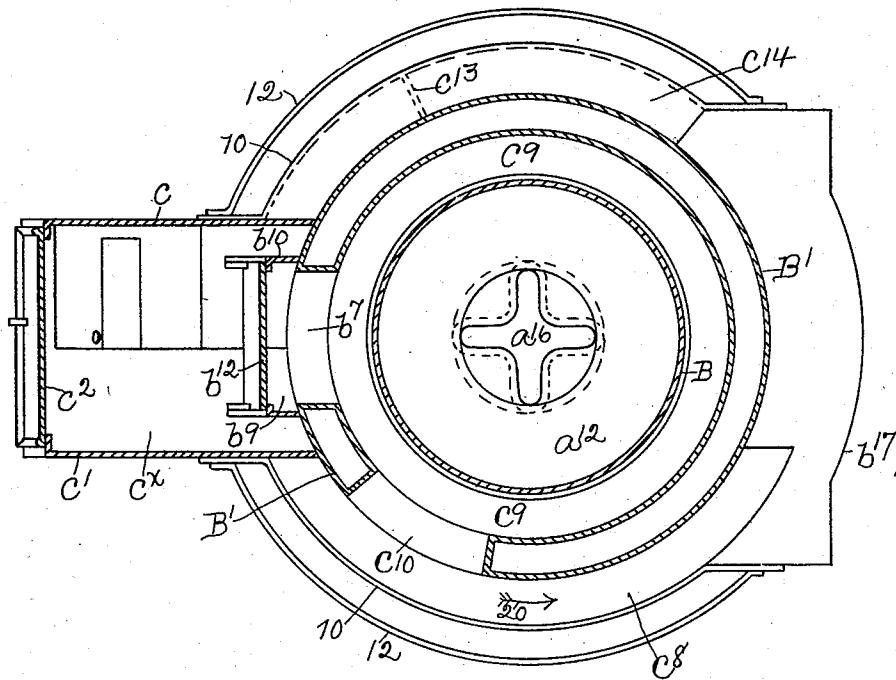


Fig. 3.

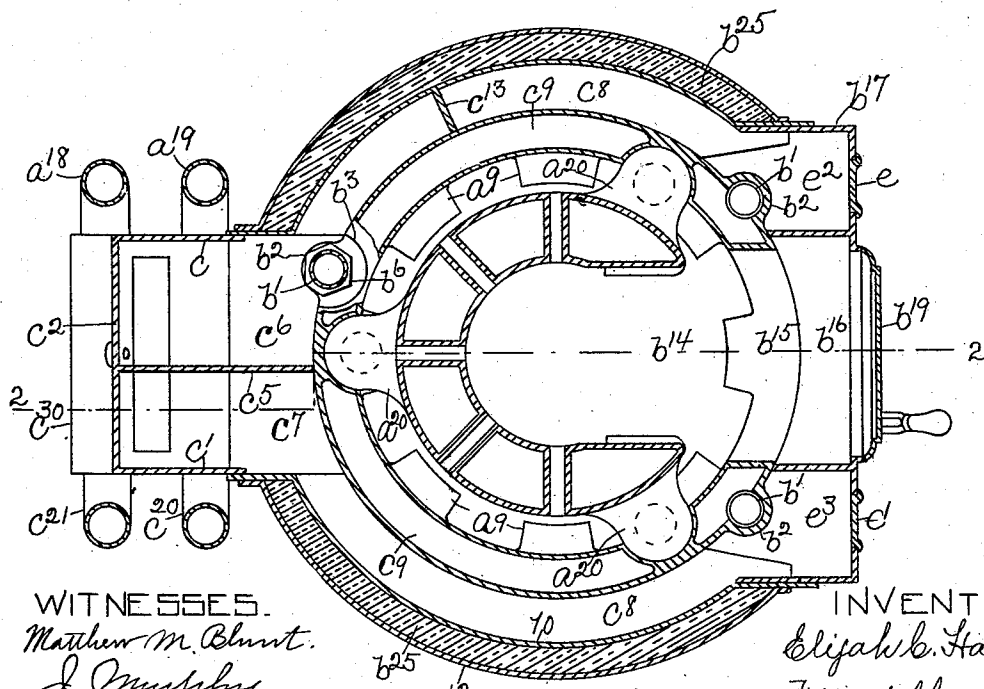


Fig. 4.

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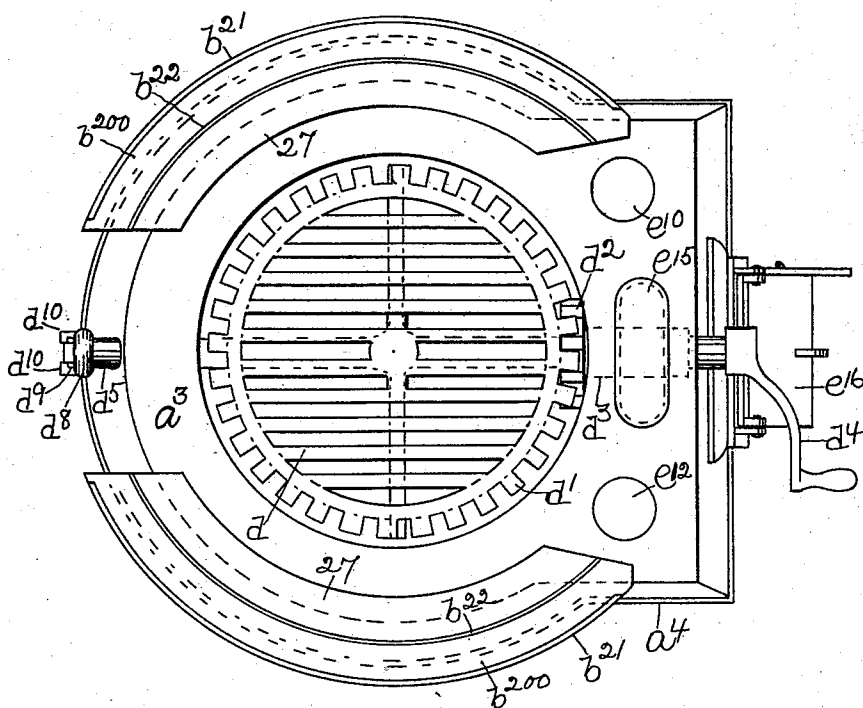


FIG. 5.

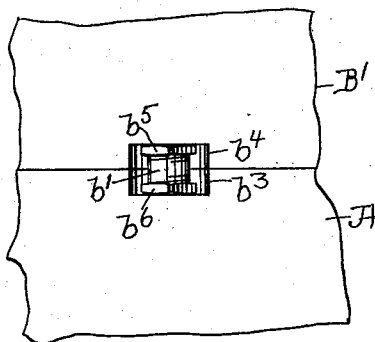


FIG. 6.

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UNITED STATES PATENT OFFICE.

ELIJAH C. HALL, OF BRAINTREE, MASSACHUSETTS.

HEATER.

SPECIFICATION forming part of Letters Patent No. 570,993, dated November 10, 1896.

Application filed August 28, 1896. Serial No. 604,209. (No model.)

To all whom it may concern:

Be it known that I, ELIJAH C. HALL, residing in Braintree, in the county of Norfolk and State of Massachusetts, have invented an Improvement in Heaters, of which the following description, in connection with the accompanying drawings, is a specification, like letters and numerals on the drawings representing like parts.

10 This invention relates to a heating apparatus and is herein shown as embodied in a water-heater, and is an improvement upon that shown and described in United States Patent No. 524,897, granted to me August 21, 1894.

15 My present invention has for its object to provide a simple, more efficient, and economic heater, as will be described.

In accordance with this invention the heater is provided with a hollow water-containing casing forming the walls of the fire-pot or combustion-chamber and with two independent water-containing chambers or castings of different diameters which are supported by and communicate with the said hollow casing, the casting or water-chamber of smaller diameter being supported above but within the walls of the said hollow casing, so as to be surrounded by the heat and products of combustion on its passage to the smoke-outlet for the heater, and the outer or larger water-containing chamber is also exposed to the heat on its inner side and outer side, as will be described, so that the water flowing through the heater is exposed to a substantially large heated surface, which results in a maximum heating effect with a minimum consumption of fuel. These and other features of this invention will be pointed out in the claims at the end of this specification.

40 Figure 1 is a front elevation of a heater embodying this invention; Fig. 2, a vertically-longitudinal section of the heater shown in Fig. 1 with a portion of the smoke stack or pipe added; Fig. 3, a horizontal section on the line 3 3, Fig. 2; Fig. 4, a horizontal section on the line 4 4, Fig. 2; Fig. 5, a horizontal section on the line 5 5, Fig. 2; and Fig. 6, a detail to be referred to.

50 The heater herein shown as embodying this invention is provided with a fire-pot or combustion-chamber *a*, preferably of circular

shape, and having its circumferential walls composed of a hollow casing A, preferably cast in one piece and forming a water-containing chamber *a*², the said casing resting upon and being supported by an inwardly-projecting circular flange *a*³ of a hollow base or supporting-frame *a*⁴, herein represented as provided with legs or feet *a*⁵, the said hollow frame or base forming the ash-pit *a*⁶ for the heater. 60

The hollow casing A is provided with a substantially flat top wall *a*⁷ and bottom wall *a*⁸, and at or near its upper end the said casing is provided with inwardly-projecting hollow lugs or arms *a*⁹ to obtain increased heating surface, and some of the said lugs or arms are employed to support a hollow chamber or casting B, (see Figs. 2 and 4,) preferably of smaller diameter than the inner diameter of the casing A, and composed, as herein shown, of a hollow substantially semicircular bottom portion *a*¹⁰, a dome-shaped top portion *a*¹², and intermediate hollow columns *a*¹⁴, separated by slots or openings *a*¹⁵ for the passage through them of heat and products of combustion. 75

The dome-shaped upper portion *a*¹² of the chamber or casting B is preferably provided with a substantially central depending cross-shaped portion *a*¹⁶, practically forming a pot or kettle which is located centrally over the hottest part of the fire in the combustion-chamber or fire-pot *a*. The dome-shaped upper portion of the casting B is provided, as herein shown, with an extended neck *a*¹⁷, to which the outlet-pipes *a*¹⁸ *a*¹⁹ (shown in Fig. 1) are connected to communicate therewith. 85

The chamber or casting B is supported by some of the inwardly-projecting arms *a*⁹, and in the present instance the lower portion *a*¹⁰ of the chamber or casting B is provided with three outwardly-projecting hollow arms *a*²⁰, (see Figs. 2 and 4,) which extend over the hollow casing A and communicate therewith through nipples or short coupling-pipes *a*²¹. Represented in Fig. 2 as screwed into suitable threaded openings in the arms *a*²⁰ and in the arms *a*⁹ of the hollow casing A and secured by lock-nuts *a*²³ *a*²⁴.) The hollow casing A also supports a second hollow chamber or casting B', substantially dome-shaped and of a diameter substantially equal to the diameter of 100

the supporting-casing A, the dome-shaped casting B' having its rounded top *b* (see Fig. 2) provided with a central opening, through which the neck portion *a*¹⁷ of the dome-shaped casting B is extended. The hollow casting B' is secured to the supporting-casing A and communicates therewith by means of nipples or pipe-sections *b*¹, (shown in Figs. 4 and 6,) the casing A being provided with outwardly-projecting arms *b*² and also provided with a substantially semicircular recess *b*³, which corresponds with a like recess *b*⁴ (see Fig. 6) in the casting B'. The casting B' in the present instance rests directly upon the top wall *a*⁷ of the casing A, and the pipe sections or couplings *b*¹ are located within the hollow recesses *b*³ *b*⁴ after the manner represented in Fig. 6.

The pipe sections or couplings *b*¹ are firmly secured by means of lock-nuts *b*⁵ *b*⁶. The outer dome-shaped casting B' is provided at its rear portion with an opening *b*⁷, with which communicates a smoke-outlet passage *b*⁸, formed by a suitable frame or box *b*¹⁰, provided with an opening adapted to be closed by a damper *b*¹², which may be operated, as herein shown, by means of a rod *b*¹³. The inner and outer dome-shaped castings B B' are provided at their front end with inlet-openings *b*¹⁴ *b*¹⁵, which communicate with and practically form part of an opening *b*¹⁶ in an outside or inclosing shell or casing *b*¹⁷, which opening *b*¹⁶ is normally closed by a door *b*¹⁹, and through which opening fuel is supplied to the fire-pot *a*. The outside shell or casing *b*¹⁷ is adapted to rest upon suitable side flanges *b*²⁰, secured to or forming part of the supporting-base *a*⁴, the said flanges being provided with upturned lips *b*²¹ *b*²², forming a channel *b*²⁰⁰, into which is fitted the outside shell *b*¹⁷. The portion of the flange *b*²⁰ within the lip *b*²² forms the bottom of the indirect-draft space, as will be described. The outside shell *b*¹⁷ at its sides is preferably composed, as herein shown, of two parts 10 12, (see Fig. 4,) which in practice rest upon the flanges *b*²⁰ between the upturned lips *b*²¹ *b*²².

The side pieces 10 12 of the outside inclosing shell or casing form hollow chambers, which are designed in practice to be filled with a non-heat-conducting material *b*²⁵, such as asbestos, mineral wool, or other suitable material, and the outside shell is provided with a dome or cap *b*²⁶, (see Fig. 2,) having suitable hand-holes *b*²⁷ and provided with a covering *b*²⁸ of suitable non-heat-conducting material. The hand-holes *b*²⁷ are normally closed by removable covers *b*²⁹, which may be easily opened to gain access to the interior of the upper portion of the outside shell or casing when it is desired to clean or brush off the top portion *b* of the outer dome-shaped casting B'. The side portions 10 12 of the outside casing or shell *b*¹⁷ are separated at the rear side of the heater by a sufficient space to permit of attachment of a frame or casting composed of the side pieces *c* *c*¹ and the inclined back piece *c*², (see Fig. 3,) which

side pieces are extended into the furnace and abut against the outside of the casing A and casting B'. The frame composed of the side pieces *c* *c*¹ and inclined back wall *c*² is provided with a top plate *c*³, which also extends into the furnace and abuts against the outer wall of the hollow casting B', the said top plate being provided with a suitable opening, over which is fitted the smoke-outlet pipe *c*⁴. (Shown in Fig. 2.) The frame referred to is provided with a preferably central partition-wall *c*⁵, which divides the smoke-outlet portion of the shell or casing into two chambers *c*⁶ *c*⁷, the chamber *c*⁶ communicating with the passage or space *c*⁸, surrounding the heater proper between the casing A and casting B' and the outside casing or shell *b*¹⁷, and this passage *c*⁸ also communicates with an annular space or passage *c*⁹, surrounding the inner dome-shaped casting B between the same and the inner walls of the dome-shaped casting B'. (See Figs. 3 and 4.) This communication is effected, as herein shown, by providing the outer dome-shaped casting B' with an opening *c*¹⁰. (See Fig. 3.) The partition-wall *c*⁵ is connected by a top plate or wall *c*¹¹, (see Figs. 2 and 3,) so as to cut off the chamber *c*⁷ from the outlet-pipe *c*⁴ except through the indirect-draft passage *c*⁸. The passage *c*⁸ on one side of the heater is provided with a vertical partition *c*¹³, (see Figs. 3 and 4,) which extends from an inwardly-projecting flange *c*¹⁴ of the outside casing or shell *b*¹⁷ down toward the bottom of the casing or shell, but not entirely to the bottom, (see dotted lines, Fig. 2,) so that an opening will be left below the bottom of the partition-wall *c*¹³, by which the continuity of the indirect passage *c*⁸ may be maintained for a purpose, as will be described.

The top portion *b* of the outer casting B' has communicating with it, as herein shown, two outlet-pipes *c*²⁰ *c*²¹, (see Fig. 1,) and the outlet-pipes *a*¹⁸ *a*¹⁹ *c*²⁰ *c*²¹ form two distinct sets of outlet-pipes, which may be led throughout the building and returned to the inlet end of the heater, preferably being connected, as represented in Figs. 2 and 4, to a hollow extension or outwardly-projecting hollow arm or box *c*³⁰, secured to or forming part of the casing A.

The heater may be provided with any suitable form of grate-surface *d*, represented in the present instance as a revolving grate, and provided with gear-teeth *d*¹, (see Fig. 5,) with which mesh a pinion *d*² on a sleeve *d*³, extended through the front wall of the supporting-base *a*⁴ and adapted to be turned by a crank or key *d*⁴, the said sleeve having fitted into it a rod or shaft *d*⁵, upon which the sleeve turns when it is desired to revolve the grate. The shaft *d*⁵ is connected to the revolving grate *d*, so as to turn the same when it is desired to dump the fire, and this connection may be effected, as herein shown, by means of a round stud *d*⁶, extended from the under side of the central portion of the grate through a hole in the shaft or rod *d*⁵, and the said stud

may be locked to the shaft or rod d^3 by a suitable pin d^7 . (See Fig. 2.) The shaft or rod d^3 has its rear end extended through the rear side of the base a^4 , and is provided at its end with an angular extension, over which loosely fits a crank or arm d^8 , adapted to be retained on the angular portion of the shaft or rod d^3 by a pin d^9 , the lower end of the crank or arm d^8 being adapted to be locked between lugs or ears d^{10} on the base a^4 by a pin d^{12} . (See Figs. 2 and 5.) By reference to Fig. 2 it will be seen that as long as the crank or arm b^8 is locked between the ears d^{10} the shaft d^3 cannot be turned so as to dump the grate, while at the same time the grate is free to be revolved on the stud d^6 as a pivot by turning the sleeve d^3 by means of the crank or handle d^4 .

By reference to Fig. 2 it will be seen that the damper b^{12} controls what is termed the "direct draft," and when closed, as shown in Fig. 2, the fire-pot or combustion-chamber a communicates with the smoke-outlet pipe c^4 by way of the indirect draft, which is afforded an outlet from the passage c^8 through an opening d^{20} in the side wall c .

The operation of the heater may be briefly described as follows: Assuming that a fire has been built upon the grate d and that the damper b^{12} has been opened, which is effected by drawing out the rod b^{13} so as to turn the damper b^{12} back upon its pivot or hinge d^{21} , the products of combustion generated in the fire-pot a directly impinge upon the inner circumferential walls of the casting B and upon the depending section a^{16} and pass from within the dome-shaped casting B out through the passages a^{15} into the space c^9 , and a portion of the products of combustion pass from the fire-pot a directly up into the passage or space c^9 , and from this space an outlet is afforded through the opening or passage b^7 , chamber b^9 , and thence directly into the smoke-stack c^4 . On the passage of the products of combustion to the smoke-outlet c^4 it will be observed that the inner dome-shaped casting B is subjected to the heat of the products of combustion on both its inner and outer sides, while at the same time the inner wall of the outer dome-shaped casting B' is also subjected to the heat of the products of combustion. After the fire has been sufficiently burned up the damper b^{12} is brought into the position represented by full lines in Fig. 2, so as to close the direct draft and to establish the indirect draft of the heater, which may be traced as follows, namely: up from the fire box or chamber a into the dome-shaped casting B and into the passage c^9 surrounding the same, and thence through the passage or opening c^{10} to the passage or space c^8 on one side of the heater, the said heat being directed from the opening c^{10} around the front of the heater, as indicated by the arrow 20, Fig. 3, until it strikes the vertical partition-wall c^{13} , whence its course is deflected downward to the bottom of the heater,

so as to pass by the partition-wall c^{13} into the passage c^8 on the other side thereof, and from which latter the heat escapes through the opening d^{20} in the wall c into the chamber c^6 , and from thence to the outlet-pipe c^4 . By means of the partition-walls c^5 direct communication from the opening c^{10} to the outlet-pipe c^4 is cut off, and consequently the heat has to take the course entirely around the outside of the outer dome-shaped casting B' and around the hollow casing A; the partition-wall c^{13} causing the heat to pass downward to the bottom of the heater before it can escape to the smoke-outlet pipe.

It will thus be seen that the water contained in the hollow base or casing A is exposed to heat on its inner and outer sides and that the two upper water-containing castings or chambers B B' are also exposed to heat on their inner and outer sides, and, furthermore, the vertical slots or openings a^{15} in the inner casting B subdivide the same into columns to still further increase the heating effect upon the water contained in the casting B. It will thus be seen that in the heater herein shown I have what may be termed a "common" supply-chamber A, into which cold or cooler water is admitted, and in which it is subjected to a preliminary heating by the fire in the fire-pot and by the heat passing through the passage c^8 . The water preliminarily heated in the walls of the fire-pot pass up by the separate outlets, namely, the nipples or couplings a^{21} and b^7 , into the dome-shaped castings or chambers B B', wherein the water is subjected to its highest heat, and from which two independent outlets are provided, namely, one being through the pipes a^{18} a^{19} and the other through the pipes c^{20} c^{21} . The water in the outer casting or chamber B' is subjected to substantially as great a heat as the water in the inner chamber or casting B, by reason of the fact that it is made shallower so as to expose a less quantity of water to heat on both sides of the casting or chamber. The heater herein shown has the front wall 30 of the inclosing case b^{17} provided on opposite sides of the fire-door b^{19} with removable doors or covers e e' , normally closing openings or passages e^2 e^3 , which communicate with and form part of the passage c^8 , so that access may be had to the passage c^8 for cleaning the outside of the outer casting B' and also the outside of the base or casing A by means of a suitable brush. The front wall 30 of the inclosing casting b^{17} is further provided at or near its bottom with a door e^5 , normally closing an opening e^6 , (see Fig. 2,) which communicates with the fire-pot a , whereby clinkers which may accumulate on the grate d may be readily removed, and on opposite sides of the clinker-door e^5 the front wall 30 of the inclosing case is provided with covers or doors e^7 e^8 , normally closing suitable openings which communicate with the indirect-draft passage c^8 at or near its bottom and above the

portion 27 of the inwardly-projecting flange b^{20} of the supporting-base a^4 , the flange a^3 at the front portion of the heater being provided with removable covers e^{10} e^{12} at opposite sides of the front portion, (see Fig. 5,) which covers normally-closed openings leading into the ash-pit, and through which openings the dust removed from the outside of the casings A and B may be brushed into the ash-pit a^6 .

The flange a^3 of the supporting-base a^4 may also be provided at its front portion with a hand-hole normally closed by the cover e^{15} , by removing which access may be had to the sleeve d^3 . The ash-pit a^6 may be provided with the usual ash-door e^{16} , and the inclined wall c^2 may also be provided with an opening normally closed by a removable cover e^{20} , by which access may be had to the rear of the furnace. The wall c^2 may also be provided at its upper portion with a removable cover e^{21} , constituting a cold-air damper.

I claim—

1. In a heater, the combination with a hollow casing forming the walls of a fire-pot, of a hollow chamber supported above the said hollow casing and communicating therewith and provided with an outlet for the products of combustion, and a second hollow chamber surrounding the first hollow chamber and supported by and communicating with the hollow walls of the fire-pot and provided with a direct-outlet opening and with a separate indirect-outlet opening for the products of combustion, and an inclosing shell forming with the second hollow chamber a heat-circulating passage with which the indirect-outlet opening communicates, substantially as described.

2. In a heater, the combination with a hollow casing forming the walls of the fire-pot, of a hollow dome-shaped chamber supported by and communicating with said hollow casing, means to detachably secure said chamber to the said hollow casing, and a second dome-shaped chamber surrounding the first dome-shaped chamber and separated therefrom to leave a passage for the heat about the said first chamber, and means to detachably secure said second dome-shaped chamber to the hollow casing to communicate therewith, and outlet-pipes for each of said chambers, substantially as described.

3. In a heater, the combination with a hollow casing forming the walls of a fire-pot, of a hollow chamber of less diameter than the said hollow casing supported above the same and communicating therewith, and a second hollow chamber of larger diameter than the first chamber and surrounding the same to leave a passage for the circulation of heat around the outside of the first chamber, and means to connect the said second chamber with the hollow casing, substantially as described.

4. In a heater, the combination of the hollow casing A provided with inwardly-project-

ing arms, and forming the walls of a fire-pot, of a hollow dome-shaped casting B of smaller diameter than the casing A and supported upon the said inwardly-projecting arms, and a hollow dome-shaped casting B' of larger diameter than the casting B to form a passage for the circulation of heat about the outside of the casting B, and means to connect the hollow casting B' with the hollow casing A, substantially as described.

5. In a heater, the combination of the hollow casing A provided with inwardly-projecting arms and forming the walls of a fire-pot, of a hollow dome-shaped casting B of smaller diameter than the casing A and supported upon the said inwardly-projecting arms, and provided with the substantially central depending portion a^{16} and with an upwardly-extended neck portion a^{17} , and a hollow dome-shaped casting B' surrounding the casting B and separated therefrom by a heat-circulating passage and provided with an opening in its top through which the neck portion of the casting B extends, substantially as described.

6. In a heater, the combination of the following instrumentalities, an inclosing shell, a hollow casing located therein and forming the walls of a fire-pot, a hollow chamber supported by said hollow casing and consisting of a hollow bottom portion a^{10} , a hollow top or dome a^{12} and intermediate separated hollow columns a^{14} , means to connect the hollow bottom portion with the hollow casing, and a second hollow chamber surrounding the first hollow chamber and separated therefrom to leave a heat-circulating passage, and also separated from the inclosing shell to form a heat-circulating passage on the outer side of the said second hollow chamber, and means to connect the second hollow chamber with the hollow walls of the fire-pot, substantially as described.

7. In a heater, the combination of the following instrumentalities, an inclosing shell provided with a fire-door, a hollow casing located therein and forming the walls of a fire-pot, a hollow chamber provided with a top, sides and bottom supported upon the hollow casing and communicating therewith, and having an opening b^{14} in line with said fire-door, and a second hollow chamber supported upon the said hollow casing and surrounding the first hollow chamber and provided with an inlet-opening b^{15} in line with the opening b^{14} and with the fire-door, and having an outlet-opening c^{10} , substantially as described.

8. In a heater, the combination with an inclosing shell, of a hollow casting located therein and forming therewith a heat-circulating passage outside of the said casting and provided with a direct-outlet opening b^7 and with an indirect-outlet opening c^{10} for the products of combustion, a partition-wall c^{18} extended from the top to near the bottom of the said circulating-passage, and a second

hollow casting of smaller diameter than the first casting and located therein to form there-with a heat-circulating passage between the said castings and provided with an opening
5 to form a passage for the products of combustion from one to the other side of the said smaller casting, substantially as described.

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

ELIJAH C. HALL.

Witnesses:

JAS. H. CHURCHILL,
J. MURPHY.