(No Model.)

J. M. THAYER.

HOT WATER HEATING APPARATUS.

No. 512,847. Patented Jan. 16, 1894.

Fig. 2.

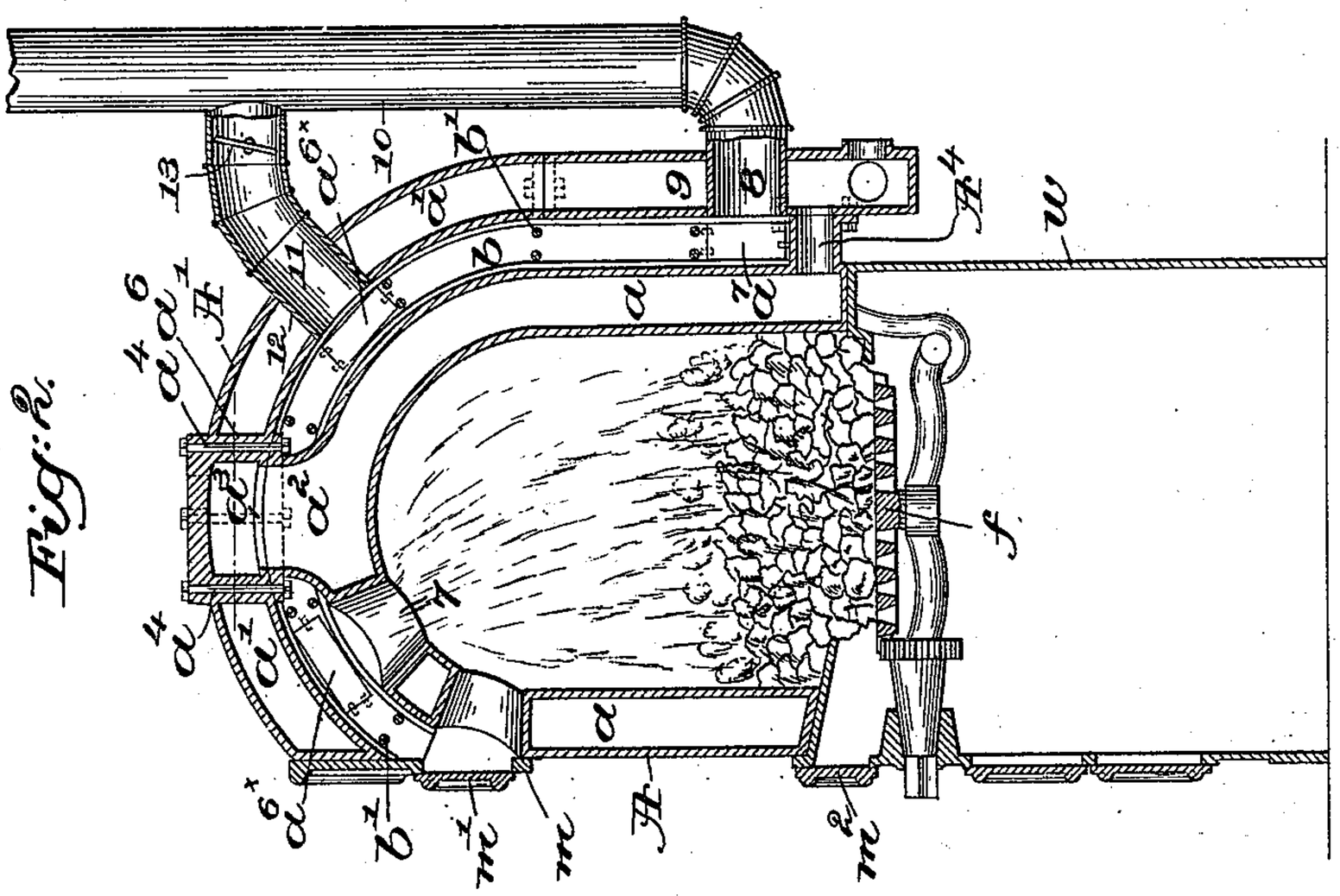

Fig. 1.

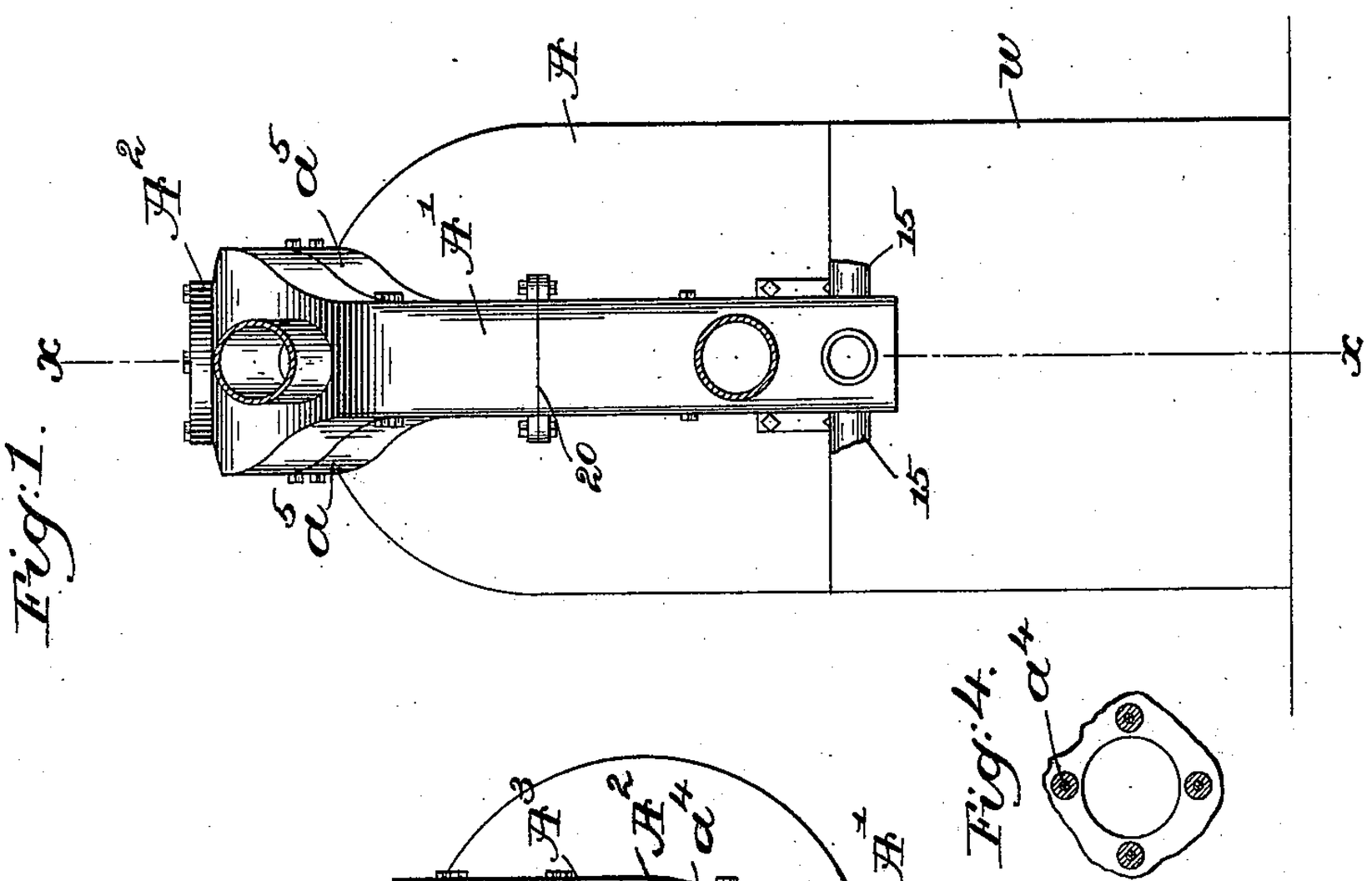

Fig. 3.

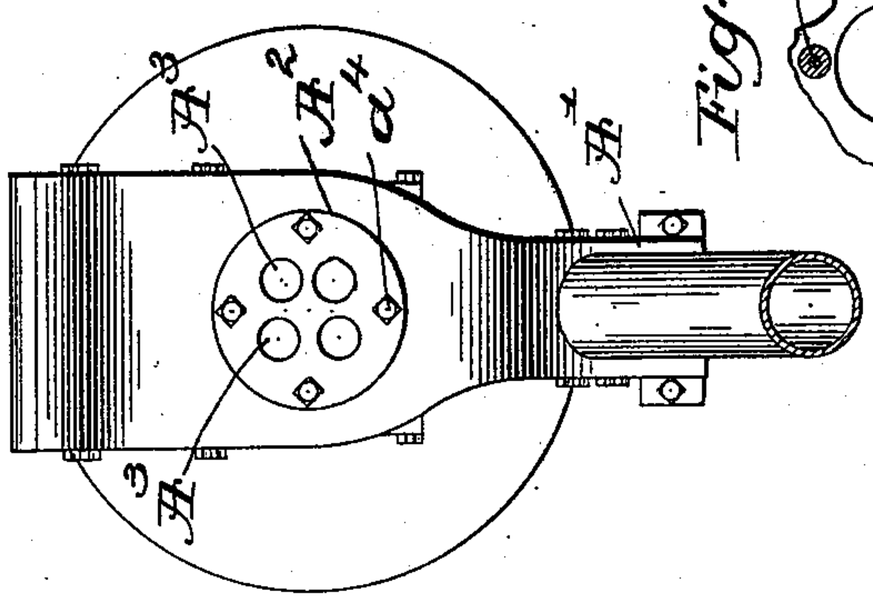

Fig. 4.

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UNITED STATES PATENT OFFICE.

JAMES M. THAYER, OF BOSTON, MASSACHUSETTS.

HOT-WATER HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 512,847, dated January 16, 1894.

Application filed December 14, 1892. Serial No. 455,163. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. THAYER, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Hot-Water Heating Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention relates to hot water heating apparatus, and the object of the invention primarily is to utilize the greatest possible number of units of heat to advantage, and to improve the heater whereby the water or circulating medium shall, in its passage through the heater, be subjected to no retrograde action whatever, but, from the moment it enters the heater, be caused to flow constantly and steadily toward the part or parts of the heater wherein the highest heat is concentrated, in order that it may be gradually and steadily raised to a high temperature before entering the circulatory system. With this end in view, I cause the products of combustion, which issue from the fire pot or chamber wherein the highest heat is concentrated, to flow through a contracted flue or chamber, and in contact with the boiler preferably toward and to the point at which the cool water first enters the boiler. By concentrating the products of combustion in this contracted flue or chamber, the heat units in the products of combustion, instead of being scattered over a large area as heretofore and thereby rendered ineffective, are collected or concentrated to thereby create in the flue a high temperature which may be utilized to assist in raising the temperature of the water in the boiler. The products of combustion preferably leave the heater at or near the point at which the cool water enters, and by this construction, the cool water entering the boiler is first subjected to the action of the out-going products of combustion, they traveling in opposite directions but following the same path, the temperature of the water being gradually raised until the water reaches the part or parts of the heater wherein the greatest heat is concentrated, whence it leaves the heater and enters the circulating system.

In carrying out this invention I prefer to employ a peculiarly constructed boiler consisting of an inner or body portion and a connected outer trunk portion.

In the form in which I have herein embodied my invention the inner portion of the boiler constitutes or forms the fire-pot or chamber to inclose the fire. The outer trunk portion of the boiler is connected at or near its upper end with the inner or body portion, and is shaped to leave between it and the body portion the contracted outlet flue for the fire chamber. The return water from the heating or cirulating system enters preferably both the body and trunk portions of the boiler at or near the lower ends thereof and near the outlet end of the flue through which the products of combustion leave the heater, the course of the water thereafter following that of the flue to the top or hottest part of the boiler, from which point it enters the circulating system.

Figure 1 represents a rear side view of a heater with which to practice this invention; Fig. 2, a vertical section of the same taken on the dotted line *x—x;* Fig. 3, a top or plan view of the heater shown in Figs. 1 and 2, and Fig. 4, a detail to be referred to.

Referring to the drawings, my improved boiler consists of two portions, A representing the inner body portion, while A′ represents the outer or trunk portion. The body portion is provided with double walls having a water space *a* between them, and surrounds or constitutes the fire pot or chamber at the bottom of which is located the fire grate *f* of usual or desired construction. The outer trunk portion A′ of the boiler also has double walls to leave a water space *a′*, said upper portion extending from the front near the top of the body portion, as at 5, up and over the top of the body portion and down at one side thereof terminating at the point 6 near the bottom thereof, the two trunk and body portions of the boiler being joined or connected together at or near their highest points, the body portion in the present instance being represented as provided with an upwardly extended central neck a^2 which communicates with a corresponding opening a^3 in the under side of the trunk portion A′, the two being securely clamped together by bolts a^4 to form in effect a single boiler, the water or circulating medium in both portions combining at the junc-

tion point and passing into the circulating system as from a single boiler. The trunk A′ is separated throughout its length from the body A, the space between the two being boxed in or inclosed by walls or panels a^5 to form a narrow or contracted flue *b* extending over the top of the body portion and down the side thereof to the lower end 6 of the trunk. This flue at its upper end is connected with the interior of the fire pot or chamber by means of a flue opening 7, and the flue at its opposite or lower end is provided with an indirect flue opening 8 formed by a funnel sleeve 9 which extends directly through the trunk A′ and is connected with the usual funnel 10. The flue *b* is also provided with a direct flue opening 11 near the upper part of the boiler which is formed by a funnel sleeve 12 extending through the trunk A′ and is also connected with the funnel 10, the said direct draft or sleeve 11, being provided with the usual damper 13, as shown.

The trunk A′ is enlarged at the point where it is joined to the body A to form a manifold A^2 provided with one or more threaded openings A^3 into which the ends of the circulating pipes may be secured, the bolts a^4 which secure the trunk and body together extending through hollow posts a^6, to thus absolutely prevent leakage, the water being free to circulate in the trunk around these hollow posts. The side panels which assist in forming the flue *b* are drawn toward each other against suitable ribs or flanges on the trunk and body by means of bolts *b′*. As herein shown, and preferably, the trunk and body are also connected together at their lower ends by means of a flange connection A^4, in which case the cool or return water from the circulating system is best entered at the lower end of the trunk through pipes 15 below the said connection A^4.

The boiler is sustained upon a suitable wall *w* which forms an ash pit below the grate, suitable doors being provided by which access may be had to this ash pit.

The fuel is delivered into the fire pot upon the grate through an opening *m* in the body closed by a door *m′*, while a second door m^2 near the lower end of the boiler is provided by which clinkers may be drawn from the fire.

The operation of the apparatus is as follows:—The products of combustion from a fire upon the grate *f*, pass out through the flue opening 7 into the flue *b*, passing along said flue and down the back side of the body between it and the trunk to the indirect draft *h*, and thence into the funnel and chimney, the direct draft being closed by the damper 13. It will be seen that the most intense heat is concentrated at the crown of the boiler or at or near the junction of the body and trunk. It will also be seen that the products of combustion issuing from the fire chamber with the heat units contained therein are not diffused or spread out over a large area, and the effects of the heat units thereby lost, as in heaters as now commonly constructed, but that in my heater the said products of combustion with these heat units are collected or compacted in the contracted flue *b* which brings such a number of the heat units into a comparatively small compass as to create a sufficiently high temperature to produce further and almost complete combustion of the unconsumed products in the flue, which products, in heaters of usual construction, escape unconsumed, this further combustion materially reducing the amount of deposit and aiding greatly in heating the adjacent water in the boiler. The return or cooled water from the system is entered through the pipes 15 and immediately divides, a part thereof flowing directly upward through the outer trunk portion of the boiler, while another and larger part enters the inner body portion of the boiler through the connection A^4, but in either case the coldest water enters at the point of least heat, viz:—the outlet of the flue *b*. From this point it will be noticed that the inflowing water follows the path of the products of combustion toward the crown of the boiler where the greatest heat is concentrated, and as the products of combustion passing down the flue become gradually cooler and cooler, giving off their heat to the water in the boiler, it will be evident that the water, entering at the point where the products of combustion leave the boiler and flowing upwardly following the path pursued by the products of combustion, yet in a direction opposite thereto, will constantly flow toward hotter products of combustion, and will thereby be constantly and steadily raised in temperature until it reaches the crown of the boiler at the junction point of the two portions, as described, at which point the greatest heat is concentrated, and from which point the water enters the circulatory system. By this construction, all the heat units are utilized to the best advantage, that is, the cooler products of combustion are first employed to raise the cold water slightly in temperature, and thereafter, the hotter products of combustion are employed to raise the temperature still more, so that the products of combustion, which must necessarily become gradually cooler from the time they leave the fire pot or chamber until they leave the heater, are employed in reverse ratio to gradually raise the temperature of the inflowing water. The cool water is not brought in contact with the highest heat when it first enters the heater, as is now commonly the case, but is first heated only slightly, and is thereafter gradually and steadily raised to its highest temperature before entering the circulatory system. Neither are the products of combustion so cooled by diffusion or by being conducted through long and circuitous flues as to extract heat from the water rather than to impart heat thereto, but in my improved heater the products of combustion travel constantly from the hottest parts of the boiler toward the coolest parts

thereof, so that no matter how cool the products of combustion may become they are always in contact with and in position to impart some heat to the cooler water next to it. This prevents any retrograde action or tendency on the part of the water, and insures a positive circulation of water and speedy heating of the circulatory system.

As herein shown, and preferably, the trunk portion A′ of the boiler is formed in independent sections joined at the point 20, Fig. 1, the said trunk being enlarged at the point of juncture of the two portions of the boiler to provide always sufficient area for the inflowing water.

The panels a^5 which constitute the sides of the flue b are provided preferably with doors or openings a^{6x} by which the flue may be cleaned out when necessary. A door a^7 is also provided at the lower end of the flue, which not only serves to permit cleaning of the lower end of the flue, but also when opened acts as a cold air damper to check the heater.

If desired the heater may be inclosed in asbestus or other non-conducting material to prevent excessive radiation of heat.

While I have herein shown and prefer to form the sides of the flue b by side plates or panels for the sake of economy in construction, yet it is evident the two portions of the boiler may be joined by side water legs or spaces entirely inclosing the flue.

The invention is not restricted to the particular shape or construction of the boiler herein shown, though I prefer substantially the form shown.

By the term "contracted" as herein used and as employed in the claims as descriptive of and limiting the outlet flue for the products of combustion, I mean a flue which shall collect or compact the products of combustion into a substantially small compass, as distinguished from a flue it may be of the same cross sectional area, but made thin or spread out. For by the former compact form I effect a thorough intermingling and combination of the unconsumed products of combustion issuing from the fire chamber with the resultant additional heat, whereas by the latter form, that is, where the flue is thin or spread out, the products of combustion are so scattered and separated that they cannot combine for further combustion after issuing from the fire chamber.

The construction shown in United States Patent No. 486,467, dated November 22, 1892, is hereby disclaimed.

I claim—

1. In a hot water heating apparatus, a boiler comprising a body portion inclosing the fire-chamber, and having at or near the top of said chamber an outlet for the products of combustion, a water inlet for and near the bottom of said body portion, a water outlet at or near the top thereof, and a contracted flue leading from said outlet down one side of said fire chamber to or near the level of the water inlet whereby the water first enters in contact with the coolest outgoing products of combustion and leaves at a point where the products of combustion are the hottest, substantially as described.

2. In a hot water heating apparatus, a boiler comprising an inverted cup-shaped body portion inclosing the fire chamber, an outlet opening at the top thereof whereby the products of combustion are concentrated in the top of said chamber and permitted to escape through said opening, a trunk-like outer portion separated from the body portion to leave a contracted flue leading from the said outlet opening to a point at or near the bottom of said body portion, water inlets for and at the bottoms of said body and trunk portions, connections between said portions at or near their highest points adjacent said outlet opening, and a water outlet in proximity to said connection whereby the cool water enters the boiler at the bottom and gradually rises toward the point of connection of the two portions at which the highest heat is concentrated and maintained, and from which point it escapes through the water outlet, substantially as described.

3. In a hot water heating apparatus, a boiler comprising an inverted cup-shaped portion formed to present a single continuous space surrounding and inclosing at the top the fire chamber, a water inlet at or near the bottom of said portion, a water outlet at or near the top thereof, an outlet in and near the top of said body portion for the escape of products of combustion from the fire-chamber, and a contracted outlet flue leading from said outlet down the outside of and in contact with said body portion whereby the cool water enters the boiler at or near the level at which the products of combustion escape, said water continually rising toward the crown of the boiler at which the highest temperature is maintained, substantially as described.

4. In a hot water heating apparatus, a boiler comprising a body portion inclosing the fire chamber, and a narrow trunk-like portion extending over the top of the body portion and down to the bottom thereof at one side and connected with the body portion at both ends but separated from the body portion to leave a flue space through which the products of combustion from the fire chamber are caused to pass, substantially as described.

5. In a hot water heating apparatus, a boiler composed of body and trunk portions joined together at their upper and lower ends and separated to leave a flue space through which the products of combustion from the fire are caused to pass from the upper toward the lower end of the flue, combined with a water inlet for the said boiler at or near the lower outlet end of the said flue, and a water outlet for the said boiler at or near the upper inlet end of said flue whereby the water enters in contact with the coolest outgoing products of combustion and leaves at a point where the

products of combustion are the hottest, said water from the time it enters the boiler thereby having a continuous uninterrupted flow toward hotter products of combustion, substantially as described.

6. In a hot water heating apparatus, a boiler consisting of an inverted cup-shaped body portion, and a trunk-like outer portion separated to leave a flue *b*, combined with direct and indirect flue openings and dampers to control the same, substantially as described.

7. In a hot water heating apparatus, a boiler consisting of an inverted cup-shaped body portion A, and a trunk-like outer portion A′ separated to leave a flue *b*, the side walls of which are formed by plates a^5, the said body and trunk being connected at a^2, combined with the flue openings 7 and 8 arranged to operate, substantially as described.

8. In a hot water heating apparatus, a boiler consisting of an inverted cup-shaped body portion A, and a trunk-like outer portion A′ separated to leave a flue *b*, the side walls of which are formed by plates a^5, the said portions being connected at a^2, combined with the flue openings 7 and 8, and a door in the said flue adjacent the said flue opening 8, to operate, substantially as described.

9. In a hot water heating apparatus, a boiler consisting of an inverted cup-shaped body portion A provided with a neck a^2, and a trunk-like outer portion A′ separated from the inner portion to leave a flue *b*, and hollow posts a^6 in the upper portion, through which bolts may be passed to secure the two portions together, substantially as described.

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

JAMES M. THAYER.

Witnesses:
FREDERICK L. EMERY,
EDWARD F. ALLEN.