Sept. 30, 1930. F. E. THOMES 1,777,054

HEATER

Filed Jan. 21, 1928 3 Sheets-Sheet 1

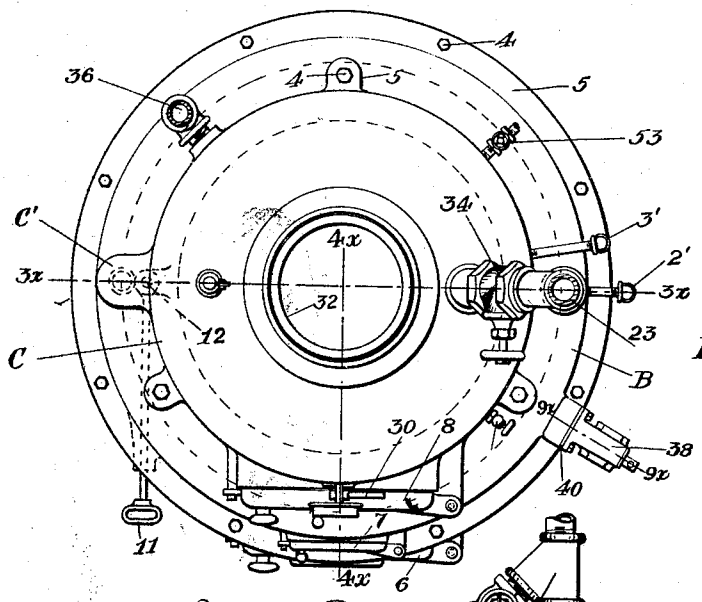

Fig. 1

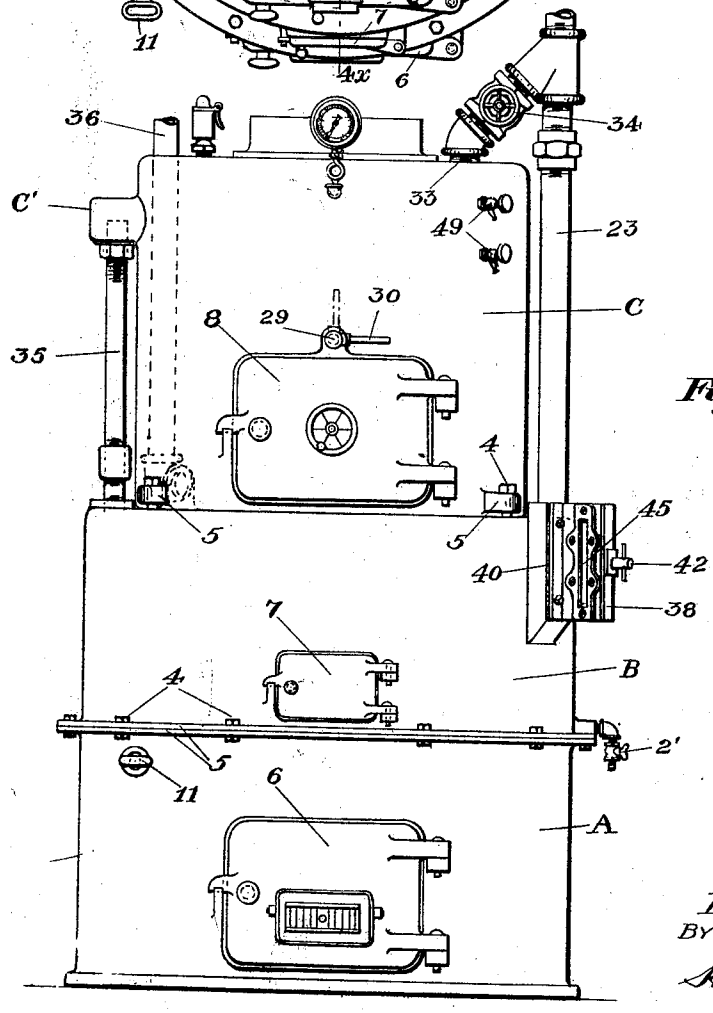

Fig. 2

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HEATER

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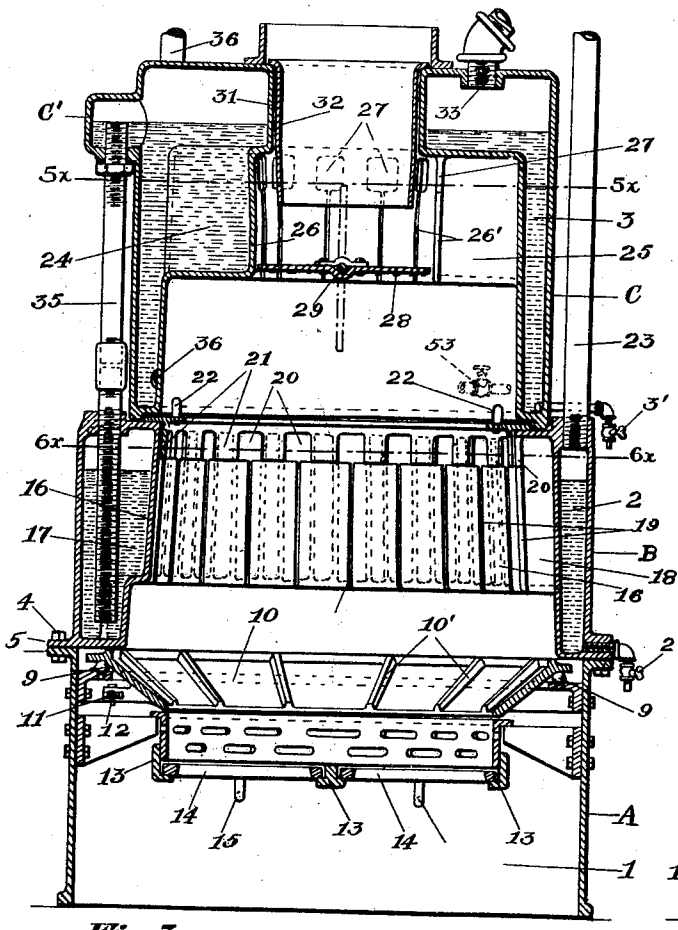

Fig. 3

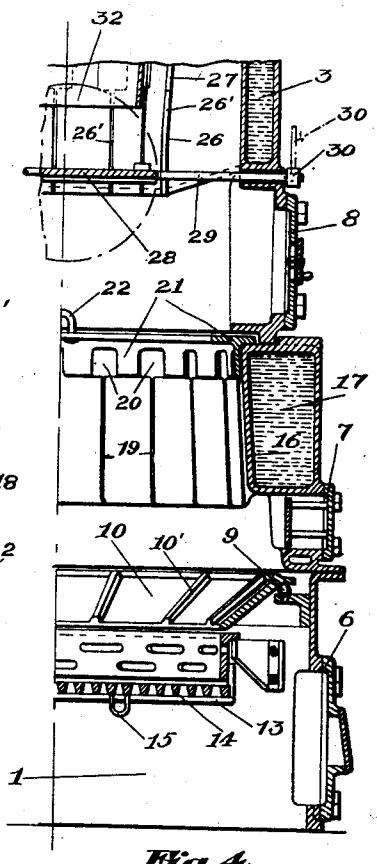

Fig. 4

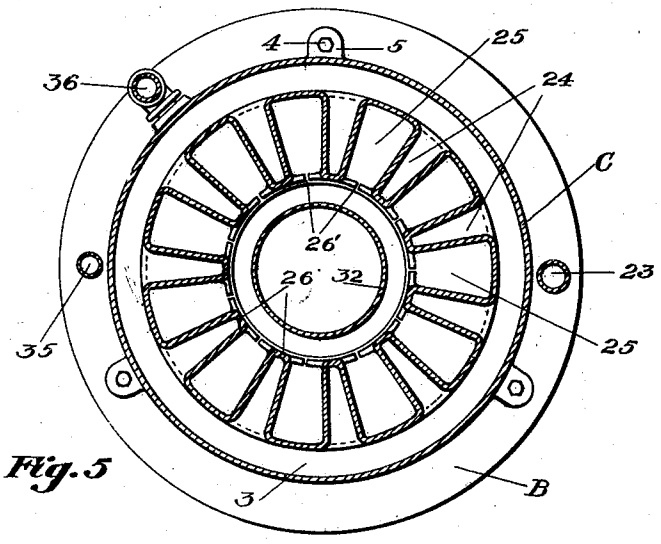

Fig. 5

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HEATER

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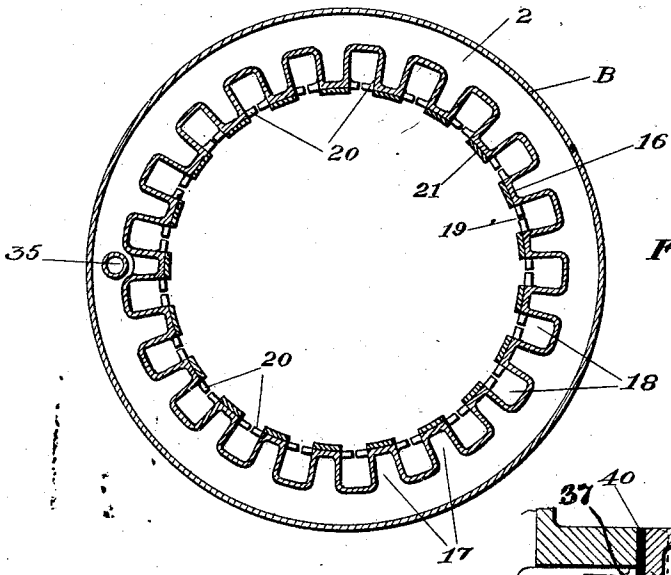

Fig. 6

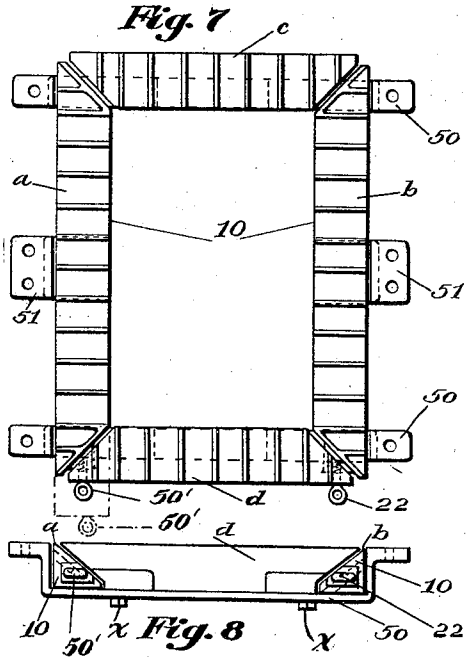

Fig. 7

Fig. 8

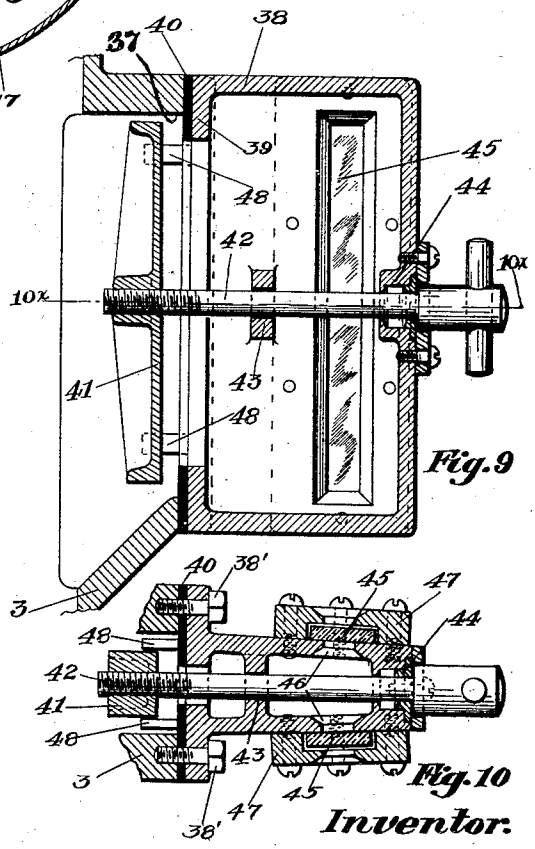

Fig. 9

Fig. 10

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Patented Sept. 30, 1930 1,777,054

UNITED STATES PATENT OFFICE

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HEATER

Application filed January 21, 1928. Serial No. 248,436.

My invention relates to improvements in steam and hot-water heating apparatus employed principally in connection with house heating but applicable also for office building or factory heating purposes.

Numerous styles and types of heating boilers are manufactured and in commercial use, each type differing in certain respects from the others but all bearing, in one particular, a close resemblance in that but a single or unitary body of water is provided, through the medium of which heat is transmitted, either directly or through conversion into steam or vapor, to the heating system, but necessitating in all cases the heating of the whole water contents of the boiler in one body or bulk.

In the conception of this invention I have sought as the primary object a division of the water space within the heater into two or more chambers, vertically separated and distinct, and to illustrate the idea in the simplest form I have shown in the drawings and described in my specification a heater having two water chambers, constituting a two-stage boiler.

I have for another object to provide a steam or hot-water delivery member starting from each water-chamber and preferably merging into one line as it passes to the heating system, the connections in any event being made in such a manner that either one chamber alone or a plurality of chambers may be drawn on for steam or hot-water,—depending on which heating medium is employed in the heating service.

Another, and a very specific object concerns the returning of all condensation in the heating lines and radiators directly to the uppermost of the water chambers.

Another object is to supply a member through which water may overflow from one chamber to the next below, serving, when the heater is operating as a steam boiler to replace the water evaporated in the bottom chamber, and when employed as a hot-water boiler to insure full chambers at all times.

A further object is to so construct the interior of the heater that substantially all heating surfaces of the furnace are vertically disposed, eliminating so far as possible all horizontal surfaces on which carbonaceous matter may collect to a considerable depth and thereby reduce the effective heating surface to that extent. This arrangement makes clean-out doors unnecessary and lends itself readily to a design or form of furnace wall of serrated outline, providing a large number of water pockets which greatly augments the total heating surface of the boiler.

And a still further object resides in the utilization, in my present invention, of certain features incorporated in the heater a patent on which was granted me on June 5th, 1928, No. 1,672,793,—the features referred to involving auxiliary flame flues which have proven very efficacious when used in conjunction with the novel arrangement of parts in the heater which is the subject of this application.

Other objects and advantages will be apparent from the description found hereinafter in the specification when taken in connection with the accompanying drawings in which the preferred embodiment of my invention is disclosed.

In the drawings, in which similar characters of reference are employed to identify like or equivalent parts throughout all the different views,—

Fig. 1 is a plan view of the heater;

Fig. 2 is a front elevation thereof;

Fig. 3 is a sectional elevation taken on line 3^x—3^x, Fig. 1;

Fig. 4 is a fragmentary sectional elevation taken on line 4^x—4^x, Fig. 1;

Fig. 5 is a sectional plan taken on line 5^x—5^x, Fig. 3;

Fig. 6 is a sectional plan taken on line 6^x—6^x, Fig. 3;

Figs. 7 and 8 are plan and end views, respectively, of the movable furnace bottom member employed when the heater is made rectangular in shape;

Fig. 9 is a sectional elevation of the built-in water-level indicating device used on the lower water chamber,—the section being taken on line 9^x—9^x, Fig. 1, and

Fig. 10 is a sectional plan of the latter member, taken on line 10^x—10^x, Fig. 9.

Referring to the drawings, A represents the base member of my heater within which is the ash-pit 1. Secured to and positioned above the base member is the boiler section B which is provided with a water chamber 2. Surmounting the member B is another somewhat similar shaped boiler section C within which is also a water chamber 3. These foregoing members are secured together by bolts 4 which pass through flanges and lugs 5. The ash-door 6, clinker-door 7 and feed-door 8 are located on the three sections, A, B and C, respectively,—the latter members, for the purpose of illustration only, being shown round, although it is obvious that other shapes, as rectangular or oblong might be adopted and would serve as satisfactorily in practical operation.

Within the base A and supported on rolls or balls 9 is a frusto-conical shaped member 10 having radially disposed ribs 10′ on its upper, inclined surface. This member carries a portion of the fuel-bed adjacent the wall of the furnace and its function is to stir up and clear the outlying portions of the fuel-bed, directly beneath the flame flues, so that an active fire can be maintained at this point. Its actuation is accomplished by the use of the shaker rod 11 which is pivotally connected therewith at 12,—the rod extending through the base A and having on its outer end a handle with which to manipulate it. The member 10 can be oscillated a short way in either direction.

Beneath the member 10 and located in a frame 13 is a grate 14 which is provided with staples 15, by the engagement with which of any suitable utensil, as a bent-end bar, the grates may be reciprocated in the frame,—the operation being performed through the ash-door opening, or if preferred by a rod extending through the base casting in a similar manner as does the rod 11.

If reference be had to Figs. 3 and 6 it will be observed that the boiler section B has a vertically disposed, irregular shaped inner wall 16 extending into the furnace space for the greater portion of the height of the section and that the corrugated formation provides alternate water spaces or pockets 17 and flame flues 18, the latter being provided on their inner sides with narrow slots 19, cutting the wall 16 and extending from the bottoms of the flues to the flue-ports 20. These slots are for the purpose of relieving the strain on the wall due to the expansion and contraction of the metal when alternately heated and cooled.

This auxiliary flame flue construction is substantially like that disclosed in my former patent on heaters, hereinbefore referred to.

A damper 21, also an element in the previously mentioned case, opens or closes the ports 20 according as it is desired to either increase or decrease, respectively, the activity of the fire.

The damper has depending portions alternating with spaces to match the circumferential spacing of the ports 20, so that the latter can be fully closed or fully opened. A bent-end bar with which to engage the staple 22 is employed in rotating the damper.

From an opening through the top of the water chamber 2 a pipe 23 extends upwardly and carries either steam or hot-water to the heating system,—depending on whether the boiler is being used as a steam or hot-water producer.

The member C which is shown in sectional elevation in Fig. 3 and in sectional plan in Fig. 5 has a water capacity preferably somewhat greater than has section B. As is the case with section B, the section C has water pockets 24 which alternate around its inner wall with smoke flues 25.

An inner wall 26, which is the counterpart of wall 16 in member B, depends from the top of member C into the furnace space for somewhat more than half its height. The inner walls of the smoke flues 25 are slit, as are the smoke flues in section B, the slots 26′ cutting the wall 26 for the reason hereinbefore mentioned in the case of wall 16. The flues 25 have at their upper ends flue ports 27 which normally serve to provide smoke exit to the chimney.

At the lower end of wall 26 is an auxiliary damper 28, revolubly mounted on the rod 29 which extends through the walls of the heater and is provided with a handle 30 on the outside.

Within the upper, central opening 31 in section C I insert the sleeve 32 the lower end of which preferably depends below the bottoms of the ports 27. This provides a slight downward draft and retards somewhat the outflow of burning gas and aids in more completely consuming it within the furnace. The length of this sleeve, however, may be varied to suit each installation. The shorter the sleeve the more direct is the passage of smoke from the furnace and where draft conditions are poor a shorter sleeve may be employed.

Communicating with the interior of member C, at its top end, is the pipe 33 which, with the proper fittings including the valve 34, unites with the pipe 23 rising from section B.

A pipe 35 extends from an outwardly projecting portion, C′, of the section C, downwardly into and substantially to the bottom of section B and serves to conduct the overflow of surplus water of condensation returning by the way of pipe 36 from the heating lines, into member B.

It is sometimes desirable, as for instance in extremely cold weather, to lower the water level in section C, below its normal location, so as to provide more steam space in chamber

3. This naturally raises the level of the water in chamber 2, but in this case, where the two sections are called upon to supply their maximum steam output, the combination operates more like an ordinary steam boiler,—the upper section, as a matter of fact, supplying even more of the steam than the lower one.

Releasing the check-nut shown on pipe 35 permits of the latter being adjusted vertically in the chamber 3, with a consequent relocation of the water level therein.

Cocks 2′ and 3′ provide means to drain the water chambers 2 and 3, respectively, of their contents when required.

It will be observed that under normal working conditions the top end of pipe 35 is flush with the water level in member C, there being always, in the steam boiler, a space above the water in chamber 2. In the hot-water boiler both chambers, 2 and 3, as well as the heating lines are always full of water.

When operating with a strong and active fire, ebullition in chamber 2 often becomes violent. This condition makes it difficult to accurately gauge the water level in this chamber when reliance is placed on the ordinary gauge glass columns quite generally used for this purpose.

I have therefore devised for and use in connection with the lower section B an improved method of indicating the water level, this element being illustrated in detail in Figs. 9 and 10.

An opening 37 in the side of member B provides open communication for substantially its full length between the chamber 2 and the interior of the gauge body 38, which latter member is secured to the member B by the bolts 38′. A flange 39, projecting inwardly, extends completely around the periphery of the body and serves as a seat for the interposed packing 40 against which the rectangular shaped flat valve 41 abuts when it is desired to close communication between the water chamber 2 and the interior of the gauge body 38.

A screw threaded rod 42, supported in the bearing 43 and the stuffing-box 44, operates to open or close the valve 41. Glass strips 45 placed on each side of and adjacent the openings 46 in the gauge body permits of the water level being visible. These glass pieces are cemented into the pads 47 which are bolted to the sides of the member 38. Guides 48 hold the valve 41 against rotation when actuating the rod 42.

As is obvious, an accurate tab may be kept on the water level in chamber 2 by this construction, as the interior of the indicator is, to all intents and purposes, an integral part of chamber 2 and there is no possibility of the water lifting or siphoning to cause the operator to be deceived as to the amount of water in the chamber, as is the case with many present day water-column devices.

I discard the visible method of ascertaining the water level in chamber C, employing as a substitute the ordinary gauge cocks 49, one above and the other below the normal water level in this chamber.

As I have before stated, the characteristic features of my invention may be incorporated in a heater of rectangular shape. It can easily be visualized how the members A, B, and C can be changed to this form.

In Figs. 7 and 8 I have illustrated the elements in rectangular form which function to produce practically the same results as does the circular member 10 in the round heater.

In this construction the sides *a* and *b* are movable and the end pieces *c* and *d* are fixed,—although these latter may be constructed so as to move also if desired.

The main supports for the structure are the bearer bars 50 which are attached to the heater base casting in any approved manner.

The end pieces *c* and *d* are secured to these bearer bars by means of the bolts *x*, and the side pieces *a* and *b* may be reciprocated on these bars and the central supporting brackets 51 when it is required to stir the fuel bed.

The screw eyes 50′ offer means by which, with a bent end bar or poker, the members *a* and *b* may be actuated.

The ends of the elements *c* and *d* are undercut, as seen in Fig. 8, so that the side members *a* and *b* may slide by and under them when the former are reciprocated.

I will now describe the method of operating my heater when used as a steam boiler.

Assume, first, that the fuel-bed has burned low and needs replenishing. The auxiliary damper 28 is temporarily opened so that a more direct draft to the chimney is provided to prevent gas or smoke blasting back through the feed-door opening when the fresh fuel is added. After re-fueling and the furnace door is closed, the damper 28 is returned to "closed" position also,—as seen in Fig. 3. The fuel added should not bring the fuel level much higher than the tops of the ports 20 which will allow the hot flame passing upwardly through the flues 18 from the hottest portion of the fuel-bed to ignite the gas liberated from the coal before it escapes up the chimney.

If an active fire is required, the valve 34 is opened and the heater, now operating at full capacity, is furnishing steam to the heating lines from both of the sections, B and C, through the pipes 23 and 33, respectively.

During the night time, however, or through periods in the day time when a low fire is sufficient, the valve 34 is closed. Steam to the heating lines can now be delivered

directly from the pipe 23 only, and as this is in communication with the section B in which is the smaller portion of the boiler water, which accordingly will evaporate more readily, and furthermore as this section is adjacent the hottest portion of the banked fuel-bed there will result the making of a certain amount of steam, which, passing to the heating lines will provide an amount of heat sufficient for the low duty which the heater is now called upon to perform.

It might be well, at this point, to contrast this condition with that which would have obtained had the same furnace heat been distributed to two or more times the amount of water,—or the amount which would be required to be heated in the ordinary type of boiler.

The returns from condensation of steam in the heating lines passes to the section C and any surplus or amount of water which would raise the level above the top of pipe 35 in this section passes or overflows to section B. Thus a very constant level of water is maintained in the chamber 2 once the system has become filled with steam,—provided, of course, that there are no leaks in the pipe lines. As a matter of fact, however, there will be a slow loss of water, due to radiator air valve and other ways of escape from the system, but this is easily replaced by the admission of more water through the feed valve 53, the entrance being into chamber 3.

When operating the heater under the conditions as last recited it is obvious that what amounts to a small, independent but very efficient heater is provided, necessitating the raising of but a small body of water to the steam generating temperature; that by returning all condensation to the upper chamber 3 it receives a pre-heating before passing to chamber 2, due to the fact that a certain amount of heat is bound to rise from the borders of the banked fuel-bed and cause a moderate temperature of the water in chamber 3 to be maintained,—a combination, in effect and result, closely resembling a feed-water heater; that by utilizing the heat in the banked fuel-bed in this manner, made possible by the novel arrangement of flame flues, the rooms of the house or other building are kept at a comfortable temperature through the night, making it unnecessary to force the furnace fire in the morning to an extent which would otherwise be required; and furthermore, due to the several characteristic features embodied in the structure of the heater, a very cheap or low grade of fuel may be used, materially reducing heating costs.

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

1. A heater, adapted for use in steam and hot water heating systems, comprising two separate and distinct annular water-holding members, one superimposed upon the other, the lower one devoid of a crown sheet and the upper one adapted to receive the direct and unobstructed radiation of heat from the entire surface of the fuel-bed of said heater, means whereby the heating agent, either steam or hot water, may be drawn directly and solely from the lower of the two said members and passed to the heating system, and means operable to draw from both members, collectively, for heating purposes only, the heating agent for said heating system.

2. In a heater, adapted for use in heating systems, the combination with a grate therefor, of two annular water holding members—one superimposed upon the other, a combustion chamber comprising the combined and unobstructed space included between the inner walls of both of said annular members, a central opening through the upper of the two said members adapted to serve as means to conduct smoke from said heater, a plurality of vertically disposed, circumferentially spaced flues in said upper member, said flues being formed by the wall of said central opening, the interior wall of said upper member and two radial walls interconnecting the two said first named walls, a port through the inner wall of each of said flues, near the top thereof, adapted to provide communication between said flue and said central opening, a damper adapted to normally close the bottom of said smoke pipe, below said ports, a pipe leading from the upper interior of the lower one of the two said members to the heating system, a pipe leading from the upper interior of the upper one of the two said members to said heating system, both of said pipes being adapted to serve as main steam carriers to convey steam from said heater to said heating system, a valve on said last mentioned pipe, a pipe extending from near the bottom of the interior of said lower member into the interior of the said upper member, near the top thereof, and means to vary the position of said last mentioned pipe with respect to its location, vertically, within said upper member.

3. A heater, adapted for use in steam and hot-water heating systems, comprising in combination with a grate, an annular water-holding section superjacent said grate and a plurality of vertically disposed smoke and flame flues circumferentially spaced on the inner side of the interior wall of said section, a second annular water-holding section disposed above but apart from said first mentioned section and having a centrally disposed, unobstructed combustion chamber, for the burning of gas, of substantially the

same dimensions as that of the space enclosed by the flues in the said first section—the two said spaces merging, a centrally disposed opening in the upper portion of said second section of lesser diameter than that of the said combustion chamber, said opening serving as a smoke pipe through which to conduct smoke and gas from said heater, a plurality of smoke flues in said second section disposed above said combustion chamber and circumferentially spaced around the wall of said smoke pipe, said flues being bounded by the interior wall of said second section, the wall of said smoke pipe and two radial walls interconnecting the two first mentioned walls, a plurality of flue ports each cutting the wall of said smoke pipe and providing means of communication between the space in the respective flues and the interior of said smoke pipe, means for conveying service steam for the heating system from one or both of said sections, and means to convey water from the said second section to the said first section.

4. A heater adapted for use in steam and hot-water heating systems, comprising in combination with a lower, water-holding section having a relatively large, unobstructed central opening therethrough and a plurality of vertically disposed smoke and flame flues circumferentially spaced around and inside of its inner wall, an upper water-holding section disposed in separate relation to said lower section, a combustion space in said upper section of substantially the same transverse dimension as that of the clear opening in said lower section, the two spaces merging into one large fuel consuming chamber divided as between the two sections in substantially equal portions, a central opening through the upper portion of said upper section, a plurality of smoke flues alternating with water spaces arranged in an annular space immediately surrounding the wall of said central opening, said flues being formed by the interior wall of said upper section, the wall of said central opening and two radial walls joining the two first mentioned walls, a flue port cut in the wall of said central opening abreast of each of said flues, means operable to either open or close the bottom end of said central opening, means intercommunicating with the interiors of both of said sections whereby a steam space may be maintained in each, and means to vary the elevation of the water level in the upper of the two said sections.

5. A heater comprising in combination with an annular water-holding submember having a plurality of circumferentially spaced, vertically disposed smoke and flame flues lying adjacent its inner wall and so positioned, vertically, that when said member is filled with fuel, smoke and flame may enter said flues from one portion and exit into another portion of the fuel-bed, a super member disposed in separate relation to said submember and provided with an annular water leg for a portion of its height, said water leg enclosing two sides of a relatively large, unobstructed combustion chamber, a central opening through the upper portion of said super member, a plurality of smoke flues arranged in circumferentially spaced order around the outside of the wall of said central opening, said last mentioned flues alternating with water spaces and extending upwardly from said combustion chamber for a portion of the remaining height of said super member, each of said flues, further, being formed by the wall of said central opening, the inner wall of said super member and two radial walls connecting the two first mentioned walls, a port in each of said flues last mentioned, a damper adapted, normally, to close the lower end of said central opening whereby smoke passing from said combustion chamber must exit exclusively through said flues and said ports, means whereby a steam space may be maintained in said sub and said super members, an overflow pipe connecting said sub with said super member, means to vary the position, vertically, of said pipe whereby various elevations of water level may be procured in said super member, and means whereby full capacity service line steam may be drawn from one or from both of said members.

In testimony whereof I affix my signature.

FRANK E. THOMES.