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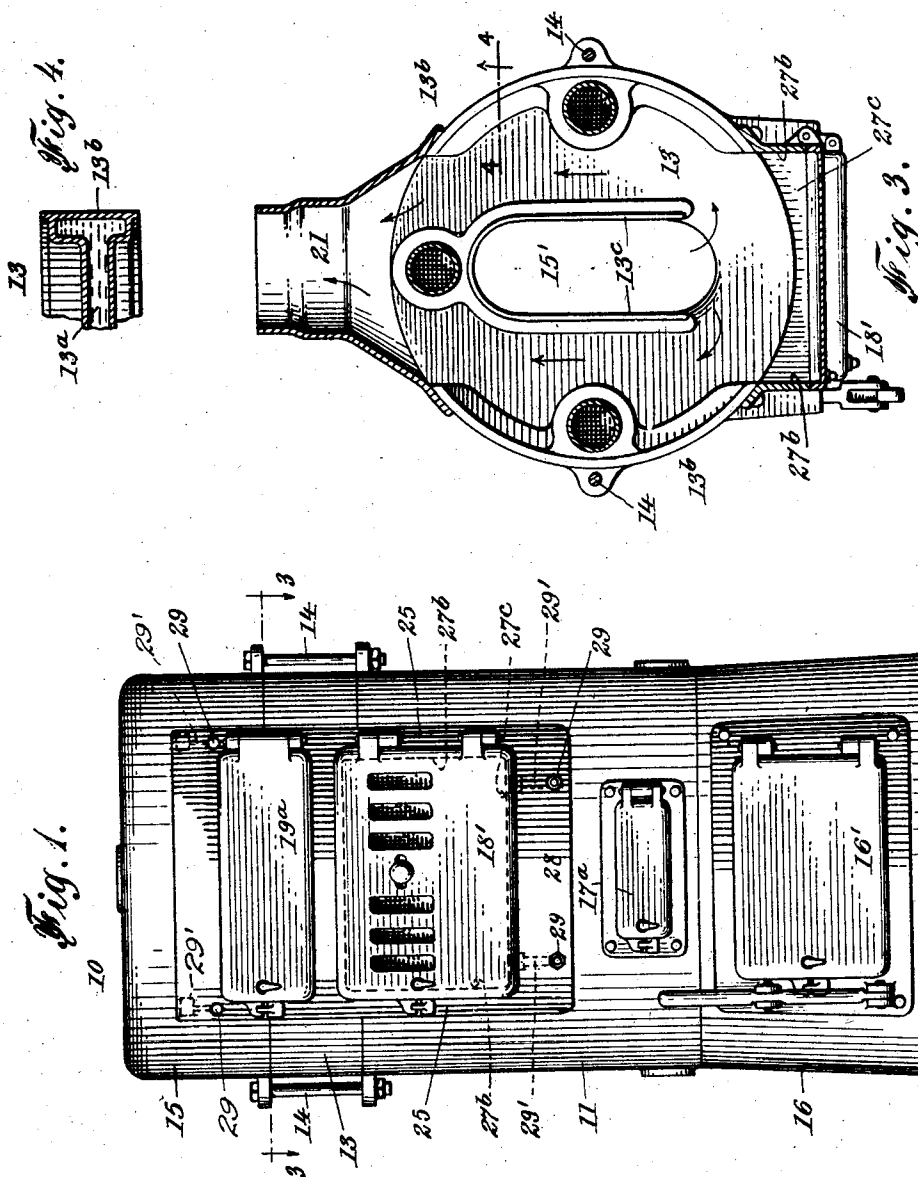
A. M. MERTZANOFF

1,687,172

BOILER

Filed May 15, 1925

3 Sheets-Sheet 1



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Oct. 9, 1928.

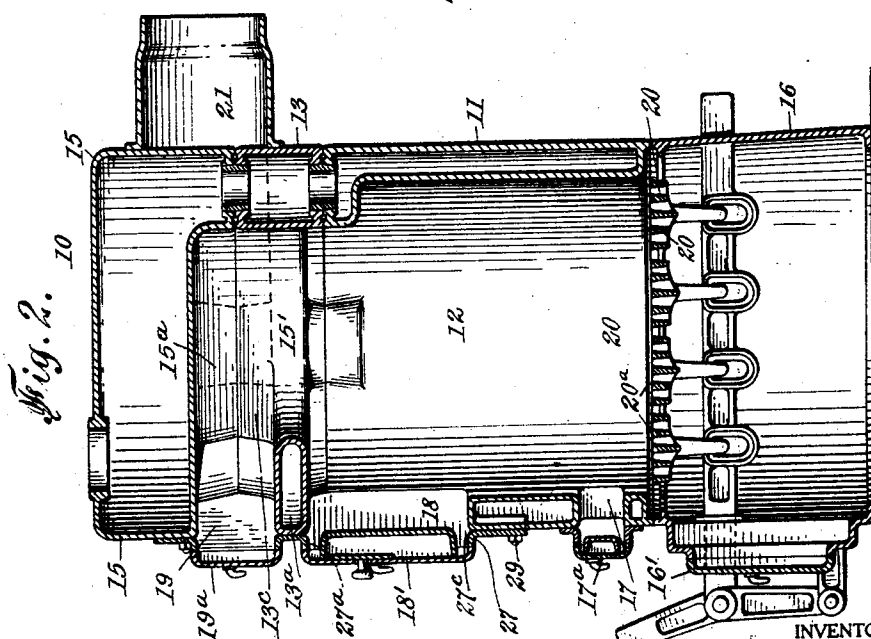
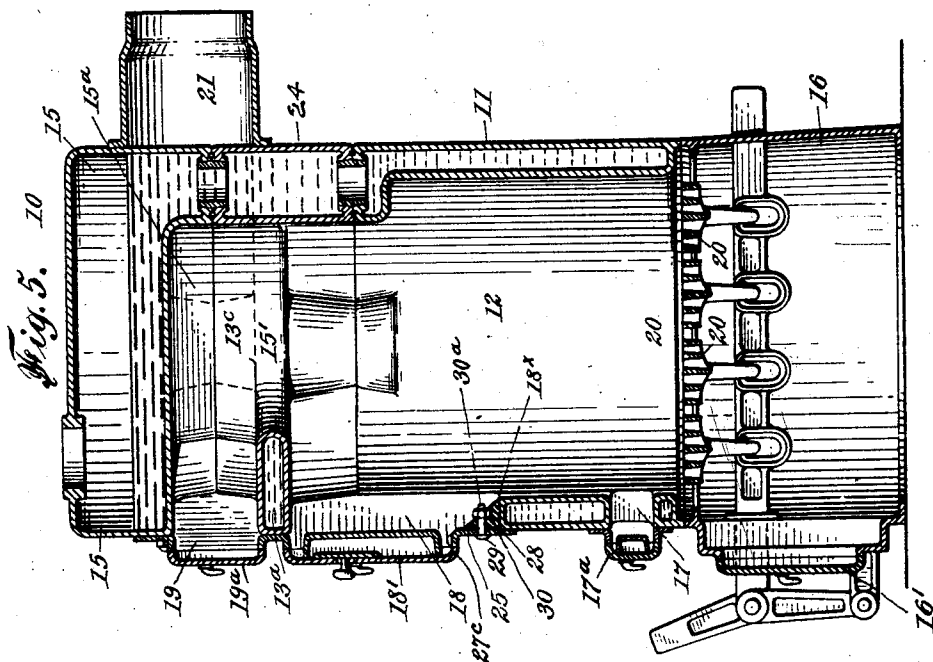
1,687,172

A. M. MERTZANOFF

BOILER

Filed May 15, 1925

3 Sheets-Sheet 2



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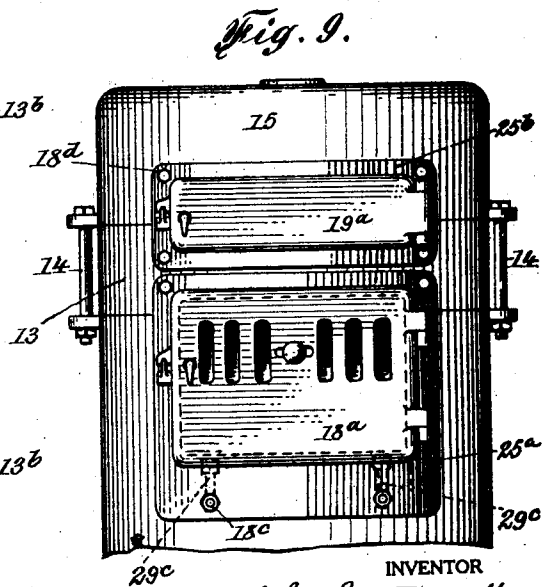
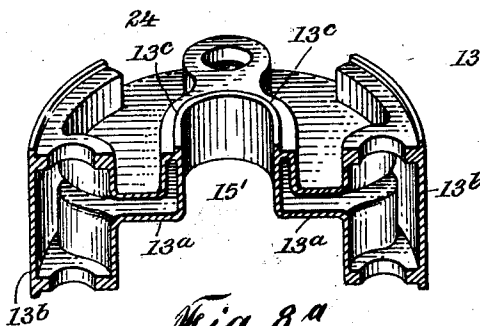
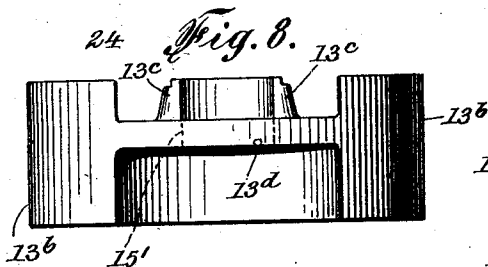
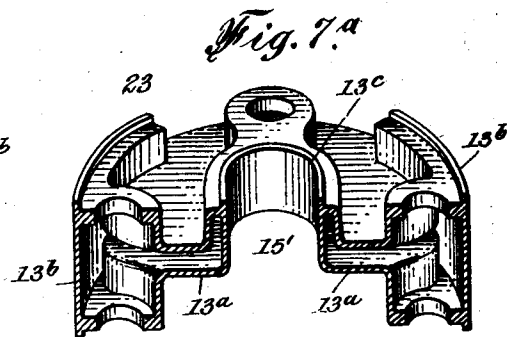
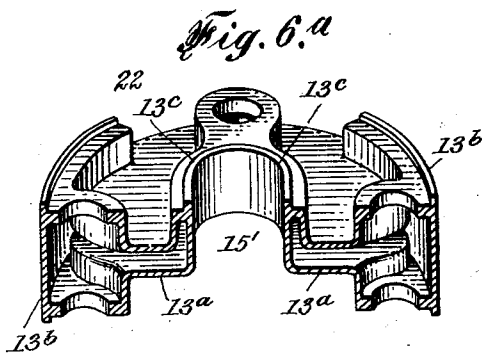
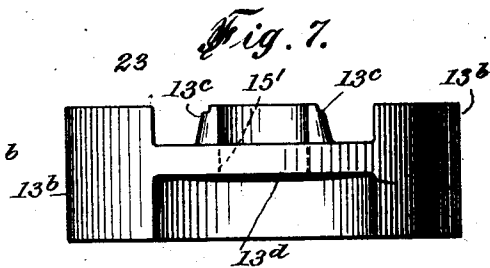
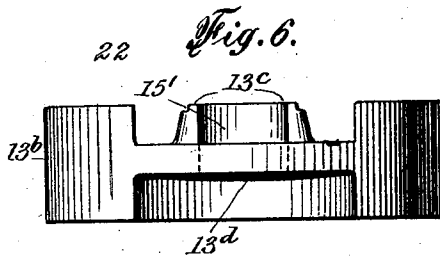
1,687,172

A. M. MERTZANOFF

BOILER

Filed May 15, 1925

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

ANDRÉ MANUEL MERTZANOFF, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN RADIATOR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

BOILER.

Application filed May 15, 1925. Serial No. 30,410.

My invention relates to improvements in heating apparatus and the same has for its object to provide a boiler for house heating purposes which may be readily enlarged or decreased in accordance with the predetermined load to be imposed upon the boiler.

Further, said invention has for its object to provide a boiler which may be readily enlarged or decreased between certain prescribed high and low limits, and still maintain the proper relation or balance between heat absorbing surface, grate area and fuel capacity to yield the maximum operating efficiency of the boiler for different predetermined loads within said limits.

Further, said invention has for its object to provide a horizontal sectional boiler which for all sizes between given high and low limits is composed of three operating parts enclosing the circulating heating fluid, and of which two interdependent sections jointly constitute the firepot and combustion chamber having inner or heat absorbing surfaces, whose aggregate areas bear definite ratios to the grate area for all sizes of boilers between said limits.

Further, said invention has for its object to provide a boiler which may be readily enlarged or decreased, between certain specified limits, by merely removing the intermediate water containing section, which constitutes the top and upper side wall portions of the combustion chamber and firepot, and inserting in place thereof another intermediate section of different size which will accommodate the additional fluid to be heated, and at the same time proportionately increase capacity of the firepot and combustion chamber, and the inner or heat absorbing surfaces thereof to meet the increased load, and still maintain the proper ratios which said heat absorbing surfaces must bear to the grate area necessary to yield the maximum operating efficiency of the boiler.

Further, said invention has for its object to provide a boiler in which the height or depth of the firepot may be increased in order to accommodate a deeper bed of fuel to maintain the proper balance or relation between fuel capacity, grate area and heat absorbing surface of the firepot and combustion chamber, when the capacity of the boiler is to be varied.

Further, said invention has for its object to provide a boiler in which the fuel supply opening is adjustable whereby to increase or diminish the height of the fuel mass within the firepot in order that the boiler may be readily adapted to suit different predetermined loads to be imposed upon the boiler.

Further, said invention has for its object to provide a boiler in which the fuel supply opening is arranged in a movable member or frame so that the height of said fuel opening with respect to the grate may be varied to increase or diminish the fuel capacity of the firepot in accordance with different predetermined loads to be imposed upon the boiler.

Further said invention has for its object to provide a boiler in which the fuel supply opening is arranged in a member or frame which is adjustable with regard to the top and bottom sections of the boiler so as to permit of the insertion and substitution, between said bottom and top sections, of an intermediate section of the appropriate height required to produce a boiler of certain predetermined capacity.

Other objects will in part be obvious, and in part be pointed out hereinafter.

It is the usual practice when a round horizontally-sectional boiler is to be enlarged to accommodate an increased load imposed thereon by reason of additional radiators or heating surfaces being included in the system to add, above the sections forming the firepot and combustion chamber, merely one or more additional water-containing horizontal flue sections. In doing this, however, no attempt is made to proportion or balance the capacity of the firepot and combustion chamber with respect to the inner or heat absorbing surfaces thereof and to the increased fuel capacity necessary to compensate for such added flue surface, and the increased volume of heating fluid whose temperature must be raised to the predetermined degree necessary to cause all of the radiators of the heating system to function properly, i. e., to provide the maximum heat transfer efficiently. Where the size of a boiler is increased in this manner to take care of an increased load invariably one which is unbalanced as to heat absorbing surface, grate area or fuel capacity is installed which results in a poor performance and in uneconomical consumption of fuel.

Now, according to my invention, I am enabled to produce a boiler which for a given grate area can be enlarged or diminished between certain high and low limits, and provide a firepot and combustion chamber having an inner or heat absorbing surface of such proportion as will yield the best results both in relation to fuel economy and to heating performance.

In the accompanying drawings forming a part of this specification,

Figure 1 is a front elevation showing one form of boiler constructed according to and embodying said invention;

Fig. 2 is a central vertical section thereof; Fig. 3 is a transverse section on the line 3—3 of Figure 1;

Fig. 4 is a detail transverse section on the line 4—4 of Fig. 3;

Fig. 5 is a sectional view similar to Fig. 2 showing the boiler enlarged by the introduction of a larger sized intermediate section;

Figs. 6, 7, and 8, are front edge views of the several intermediate sections, showing the relative difference in the sizes thereof;

Figs. 6^a, 7^a, and 8^a, respectively, are detail perspective views partly in section, of said intermediate sections; and

Fig. 9 is a detail front elevation showing the upper part of a boiler illustrating a modification.

In said drawings 10 designates a round, sectional boiler comprising three horizontal sections, viz; a horizontal member 11, which forms the lower portion of the firepot, an intermediate section 13, which jointly with the member 11 forms the complete firepot and combustion chamber 12, and a top section 15. The members and sections 11, 13 and 15 are secured together in assembled relation by bolts 14, and are mounted upon a hollow base 16 which forms the ash pit. The base 16 is provided with an opening controlled by a door 16'. The firepot member 11 is provided at its lower front edge with a slicing opening 17 having a door 17^a, and above said slicing opening 17 and adjacent to the upper front edge of the firepot member 11 is provided the fuel opening 18 having a door 18'. Above the fuel opening 18, and at the junction of the intermediate section 13, and top section 15 is provided a flue clean-out opening 19 having a door 19^a.

In the construction illustrated the grate 20 is composed of bars 20^a suitably supported in convenient manner in the base 16. The firepot member 11 consists of an annular, double-walled fluid or water-containing structure adapted to support at its upper end an appropriate intermediate section 13 which consists of a hollow or double-walled crown sheet 13^a and hollow wall portions 13^b, whose depending portion along its periphery registers with the upper end of the vertical wall portion of the firepot member 11.

Upon the intermediate section 13 is disposed the hollow fluid or water-containing top section or dome 15 which is provided upon its under side with a substantially U-shaped depending water-backed baffle member 15^a whose lower edge contacts with the registering upper edge of a corresponding water-backed baffle member 13^c which partly encloses a longitudinal flue opening 15' arranged centrally in the intermediate section 13, and forming with the spaces between the outer sides of the baffle members 15^a, 13^c and the outer wall portions of the sections 13, 15, passages extending from the combustion chamber to the smoke hood 21.

In the drawing I have shown four different heights of intermediate sections 13, 22, 23, 24, the section 13 when combined with the firepot member 11, as illustrated at Fig. 1, will jointly produce a firepot and combustion chamber whose inner or heat absorbing surface, to the area of the grate 20 will satisfy the formula

$$\frac{HS(FP + CC)}{GA} = 1 + \frac{44}{r} \quad 90$$

in which r represents the radius of the grate expressed in inches, and form the smallest size boiler embodying my said invention, while the section 24, when combined with the firepot member 11 and top 15 will form the largest size boiler, and have a total inner or heat absorbing surface which will constitute the high ration limit, and will satisfy the formula

$$\frac{HS(FP + CC)}{GA} = 1 + \frac{50}{r} \quad 100$$

The intermediate sized sections 22, 23, may be of any sizes larger than the section 13, and smaller than the section 24, and either of said sections 22, 23 taken together with the firepot section 11 will present an inner or heat absorbing surface which is less than that provided by the combined parts 11 and 24, and more than the combined parts 11 and 13, but all will still be within the formula high and low limits of the constant represented by 50 as the high limit, and 44 as the low limit.

To provide for the increase in size of the boiler to carry an increased predetermined load the fuel receptacle must be proportionately enlarged to accommodate the increased depth or height of the fuel mass. It will, of course, be obvious that the fuel level cannot be raised without correspondingly raising the lower edge of the fuel opening. To accomplish this I provide the fuel opening with an adjustable plate or frame 25 having a fuel opening therein provided along its edge with a laterally extending flange or rim 27, which registers with the edge of the door 18' hinged at one side to said plate or frame 25.

The upper horizontal portion 27^a and the side portions 27^b of the flange or rim 27 are

spaced equally from the adjacent edges of the plate or frame 25, while the lower horizontal portion 27^c of said flange or rim is spaced a greater distance from the adjacent lower edge of said plate or frame 25 in order to form a deep flange or apron 28.

In the smaller sized boilers the fuel opening is provided almost entirely in and bounded by the upper portion of the lower horizontal member or section 11, the upper edge of said opening being formed by the front horizontal lower edge of the intermediate section 13, while the upper and lower edges of the opening in the plate or frame 25, are, respectively, substantially flush with the corresponding horizontal edges of the intermediate section, and of the lower horizontal member or section 13, as seen at Fig. 1.

In the larger sizes of boilers, the fuel opening is provided partly in the lower member or section 11, and partly in the intermediate sections 22, 23, 24. In these larger sizes the upper horizontal edge of the fuel opening in the plate or frame 25 is substantially flush with the recessed horizontal edge 13^a of said intermediate sections 22, 23, 24, while the lower horizontal edge will lie more or less in a horizontal plane above the horizontal edge 18^x of the lower section or member 11. In all instances the plate or frame 25 is secured to the boiler sections or parts by bolts 29.

In order to permit of the due adjustment and securement of the plate or frame 25, the same may be provided adjacent to its upper edge and at the lower flange portion or apron 28 with holes to receive bolts 29 whose inner ends or heads are movably disposed within said slots 29' provided in the front wall of the lower horizontal member 11 and to the top section 15 to permit of the vertical adjustment of said plate or frame 25 and the door 18', and the securement of said plate in adjusted position.

To protect the inner or rear side of the plate or frame 25 from being burned out when said plate is secured in its raised adjusted position, a protective guard, such as a filler block of refractory or other material 30 may be inserted to the rear thereof and upon the lower horizontal edge 18^x of the fuel opening in the lower section 11 and secured in place by one or more bolts 30^a.

In the modification illustrated at Fig. 9, the boiler is of the same construction as hereinabove described, with the exception that the fuel supply door 18^a, and the flue door 19^a are mounted upon separate plates or frames 25^a, 25^b, respectively, and secured by bolts 18^a, 18^b. The bolts 18^a adjacent to the lower edge of the lower plate or frame 25^b have their heads slidably disposed within slots 29^a in the front of the lower horizontal member 11 to permit of the vertical adjustment of the fuel supply opening as hereinabove described.

It is to be noted particularly that by means

of my invention I am enabled to provide a series of sizes to form a boiler suited to different predetermined loads, between certain fixed high and low limits, by merely removing the section 13, located between the normal top and bottom sections, and inserting the proper sized section in place thereof, and further that by the novel arrangement of fuel opening and its closure I am enabled to correspondingly increase the height or depth of the fuel receptacle by adjusting the position of the fuel opening with respect to the grate, which may be readily attained by the mere adjustment of the plate or frame 25. By the arrangement and construction of said intermediate section 13, and of the adjustable fuel supply opening I am enabled to provide a boiler which is duly balanced with respect to grate area, fuel capacity and heat absorbing surface of the fuel receptacle and combustion chamber for all sizes between said specified high and low limits.

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

1. A boiler of the type described comprising a plurality of horizontal sections, certain of which jointly form the firepot and combustion chamber whose aggregate inner or heat absorbing surface in relation to grate area is in the proportion of about $1 + \frac{.47}{r}$, in which r represents the radius of the grate expressed in inches, substantially as specified.

2. A boiler of the type described comprising a plurality of horizontal sections, two of which jointly form the firepot and combustion chamber; one of said sections forming a portion of the side walls of said firepot and combustion chamber, and the other one forming the top and the remainder of the side walls and whose aggregate inner or heat-absorbing surface in relation to grate area is in the proportion of about $1 + \frac{.47}{r}$, and in which

r represents the radius of the grate expressed in inches, substantially as specified.

3. A boiler of the type described comprising a plurality of superimposed sections two of which sections jointly form the firepot and combustion chamber; one of said sections forming a portion of the side walls of the firepot and combustion chamber, and the other one forming the top and remainder of the side walls of said fuel receptacle and combustion chamber, and in which the aggregate area of the inner or heat absorbing surfaces of said firepot and combustion chamber in relation to grate area is in the proportion of not less than $1 + \frac{.44}{r}$, nor more than $1 + \frac{.50}{r}$, in

which r represents the radius of the grate expressed in inches, substantially as specified.

4. A boiler of the type described comprising

ing a plurality of horizontal sections, two of which jointly form the firepot and combustion chamber; one of said sections forming a portion of the side wall of said firepot and combustion chamber, and the other one forming the top and the remainder of the side wall of said firepot and combustion chamber, and in which the aggregate area of the inner or heat absorbing surfaces of said firepot and combustion chamber in relation to grate area will satisfy the equation

$$\frac{HS(FP + CC)}{GA} = 1 + \frac{C}{r}$$

in which equation—

HS=the inner or heat absorbing surface of the firepot and combustion chamber, exposed to the radiant heat of the fuel;

GA the grate area; and

C, is a constant whose value varies between 44 and 50, substantially as specified.

5. A boiler comprising a plurality of superimposed sections, two of which sections jointly form the firepot and combustion chamber; one of said sections forming the lower part, comprising a hollow annular portion, and the other of said sections forming the upper part, comprising a hollow top and a hollow annular wall portion depending from said hollow top and communicating therewith, the combined area of the inner or heat absorbing surfaces of said top and its side wall portion and of the bottom side wall portion in relation to grate area being in the proportion of about $1 + \frac{47}{r}$, and in which r represents the radius of the grate expressed in inches, substantially as specified.

6. A boiler comprising a plurality of superimposed fluid containing sections and comprising a hollow, annular bottom member and an upper member comprising a hollow top and hollow annular side walls depending from the edge of said top and registering with the annular bottom member and forming jointly therewith a firepot and combustion chamber, the aggregate inner or heat absorbing surface of which in relation to grate area is in the proportion of not less than $1 + \frac{44}{r}$ and not exceeding $1 + \frac{50}{r}$, and in which r represents the radius of the grate expressed in inches, substantially as specified.

7. A horizontal sectional boiler comprising a hollow dome, a hollow annular bottom section and a replaceable section intermediate said dome and bottom, comprising a horizontal hollow walled top and hollow walled annular wall portion depending from the edge of said top and communicating therewith and forming jointly with said bottom section a firepot and combustion chamber whose inner or heat absorbing surface is va-

riable by the removal of said intermediate section and replacement thereof by one of different size, in relation to grate area in the proportion of not less than $1 + \frac{44}{r}$ nor more

than $1 + \frac{50}{r}$, and in which r represents the radius of the grate expressed in inches, substantially as specified.

8. A boiler of the type described comprising a top section; and a firepot and combustion chamber portion comprising one part having a dimension of fixed value and a second separate part cooperating with said first named part and having a dimension of fixed value; the aggregate area of the inner or heat absorbing surfaces of said parts combined having a heat absorbing surface proportioned in accordance with a predetermined load to be imposed upon the boiler, and in which said heat absorbing surface in relation to grate area is in the proportion of about $1 + \frac{47}{r}$, and in which r represents the radius of the grate expressed in inches, substantially as specified.

9. A boiler of the type described comprising a top, a bottom and an intermediate section; said bottom section and said intermediate section jointly forming the firepot and combustion chamber, and in which said bottom section has a dimension of fixed value and is combinable with any single one of a series of intermediate sections each of which has a definite dimensional value differing from the other sections of said series, to provide an inner or heat absorbing surface for said firepot and combustion chamber whose area in relation to grate area is in the proportion of about $1 + \frac{47}{r}$, in which r represents the radius of the grate expressed in inches, substantially as specified.

10. A boiler of the type described comprising a top, a bottom and an intermediate section; said bottom section and said intermediate section jointly forming the firepot and combustion chamber, and in which said bottom section has a dimension of fixed value and is combinable with any single one of a series of intermediate sections each of which has a definite dimensional value differing from the other sections of said series, to provide an inner or heat absorbing surface for said firepot and combustion chamber whose area in relation to grate area is in the proportion of not less than $1 + \frac{44}{r}$, nor more than

$1 + \frac{50}{r}$, in which r represents the radius of the grate expressed in inches, substantially as specified.

11. A sectional boiler comprising a top, a bottom and an intermediate section, said bot-

tom and intermediate sections bounding the fuel opening, and a member having an opening therein adjustably secured to the boiler whereby to permit of the insertion between
 5 said top and bottom sections of intermediate sections of different heights whereby to vary the capacity of the boiler, substantially as specified.

12. A sectional boiler comprising a top, a
 10 bottom and an intermediate section, said bottom and intermediate sections bounding the fuel opening, and a plate having an opening therein registering with said fuel opening formed by said bottom and intermediate sections,
 15 adjustable means for securing said plate in position to certain of said sections to permit of the insertion between said top and bottom sections of intermediate sections of different heights whereby to vary the capacity
 20 of the boiler, substantially as specified.

13. In a sectional boiler having a fuel opening in the side thereof, means for varying the capacity of the boiler including, an adjustable member associated with said opening and
 25 having an opening therein, a cover for said last named opening, and means for securing said member in adjusted position whereby to vary the fuel capacity of the firepot, substantially as specified.

14. In a boiler of the type described having a fuel opening in the side thereof, means for varying the capacity of the boiler, the boiler including a plate disposed over said opening,
 30 and having an opening therein of smaller area than the opening in the side of said boiler, and means for securing said plate in adjusted position with respect to the grate level whereby to vary the fuel capacity of the
 35 firepot, substantially as specified.

15. In a boiler of the type described having a fuel opening in the side thereof, means for varying the capacity of the boiler including a plate adapted for securement in position
 40 over said opening and having an opening therein of smaller area than the opening in the side of the boiler, a cover for the opening in said plate, and means to permit of the
 45 shifting of said plate with respect to the grate

level whereby to vary the fuel capacity of the firepot, in accordance with the load imposed
 50 upon the boiler, substantially as specified.

16. In a sectional boiler of the type described, a plurality of horizontal sections, certain of said sections forming therebetween
 55 an opening, a plate disposed over said opening, and having an opening therein of smaller area than said first named opening, a cover for the opening in said plate, and means for adjustably securing said plate with respect to
 60 the grate level, whereby to permit of the varying of the fuel capacity of the firepot in accordance with the load imposed upon the boiler; substantially as specified.

17. In a sectional boiler of the type described, a plurality of horizontal sections, certain of said sections forming therebetween an opening, a plate disposed over said opening
 65 and having an opening therein of smaller area than said first named opening, a cover for the opening in said plate, and means for adjustably securing said plate in a vertical plane with respect to the grate level, whereby to
 70 vary the fuel capacity of the firepot, substantially as specified.

18. In a sectional boiler of the type described, a plurality of horizontal sections, certain of said sections forming therebetween an opening, a plate disposed over said opening,
 75 and having an opening therein registering with the opening formed between said sections, said opening being materially smaller in height than the height of the opening between said sections, and arranged nearer to
 80 one of the longitudinal edges of said plate than the other of said edges, a cover for the opening in said plate, and means for adjustably securing said plate in a vertical plane with respect
 85 to said grate level whereby to permit of the varying of the fuel capacity of the firepot, in accordance with the load imposed upon the
 90 boiler, substantially as specified.

Signed at the city of New York, in the county and State of New York, this 17th day of March, one thousand nine hundred and twenty-five.

ANDRÉ MANUEL MERTZANOFF.