July 20, 1937. W. A. DOPPELHEUER 2,087,839

BOILER PLANT

Filed Aug. 26, 1936 4 Sheets-Sheet 1

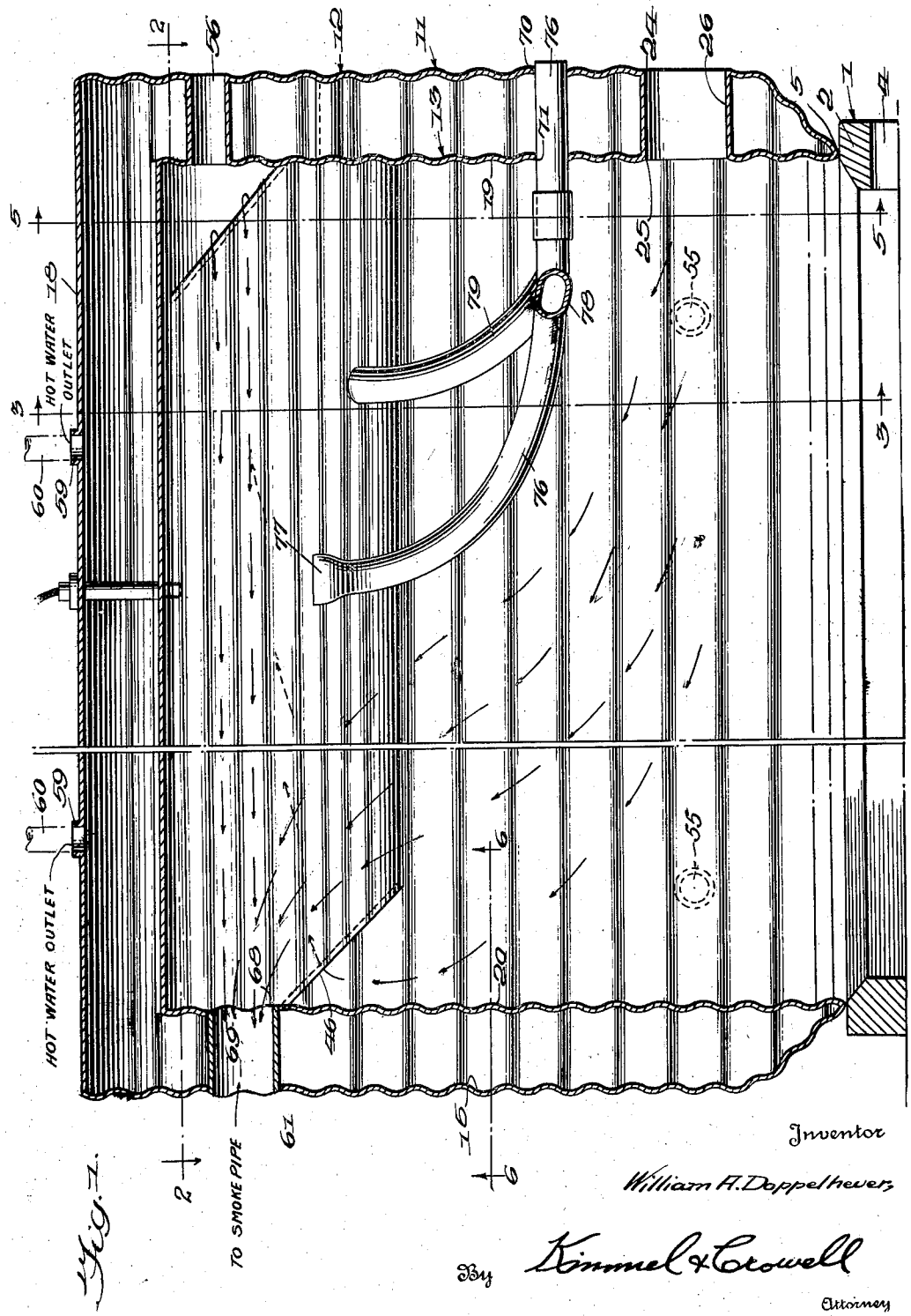

Fig. 1.

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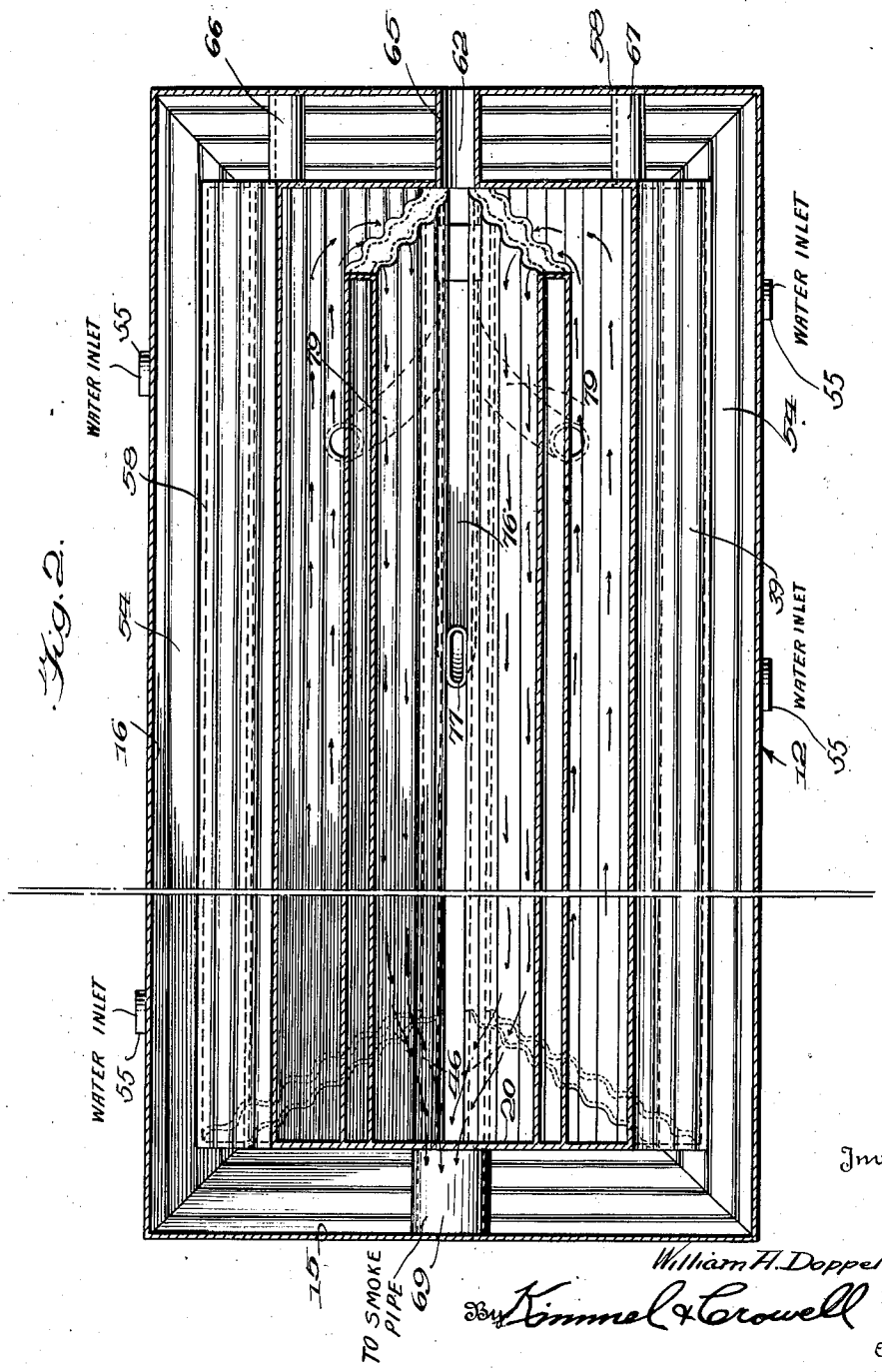

Fig. 2.

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Fig. 3.

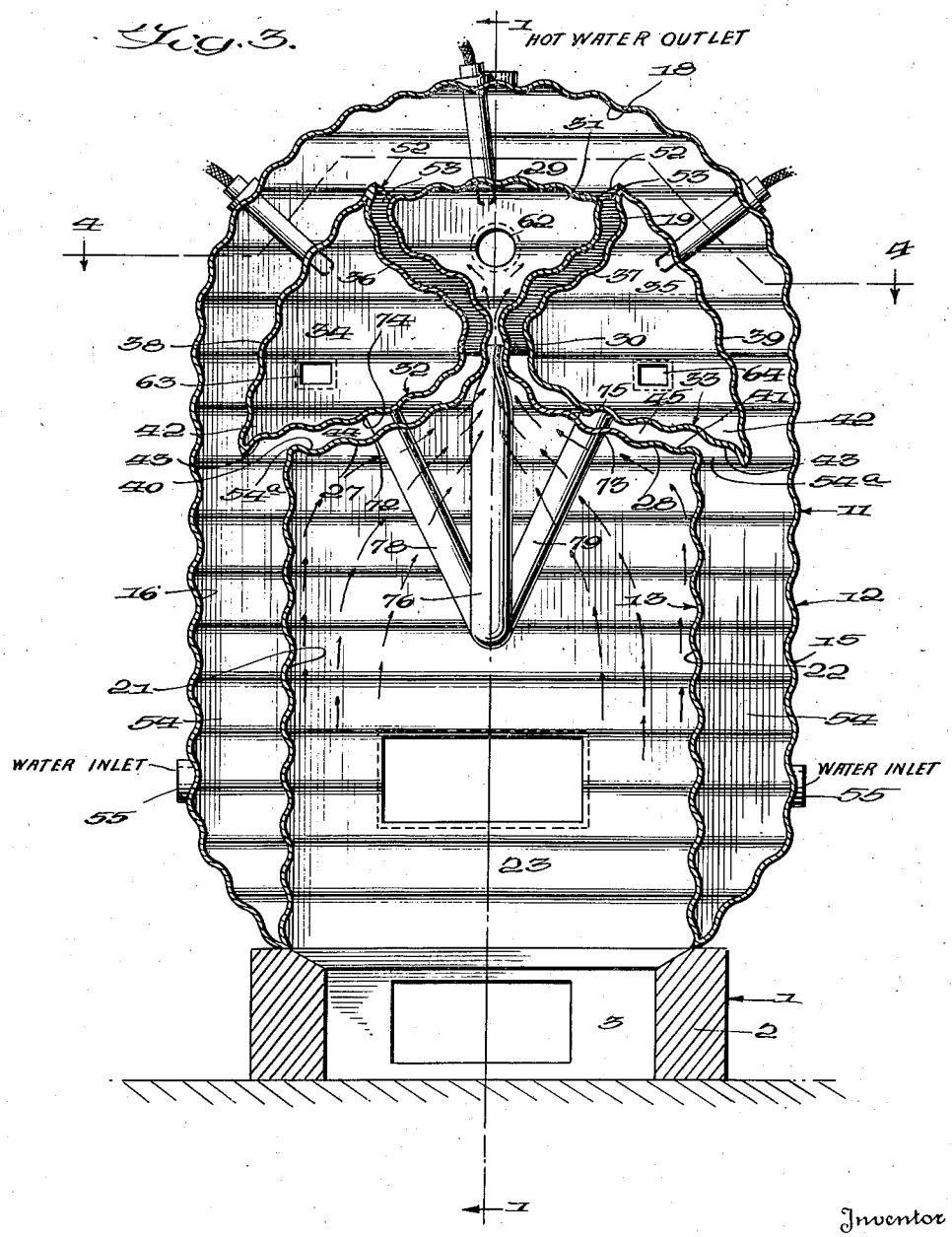

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Fig. 4

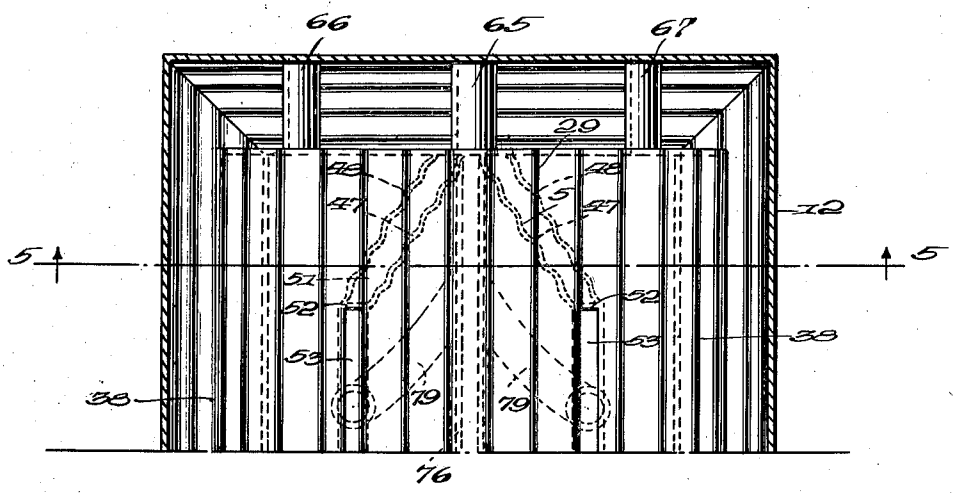


Fig. 5.

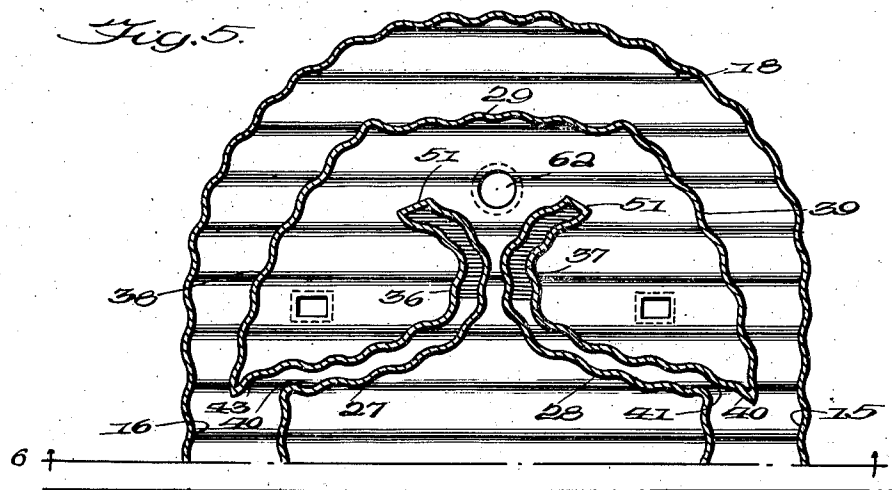
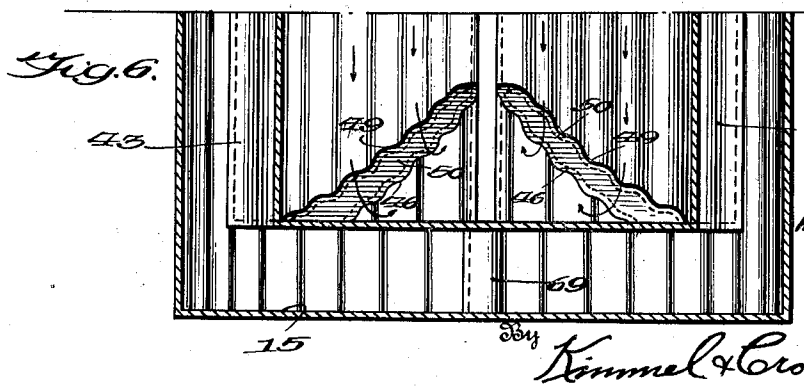


Fig. 6.



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Patented July 20, 1937 2,087,839

UNITED STATES PATENT OFFICE

2,087,839

BOILER PLANT

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Application August 26, 1936, Serial No. 98,057

14 Claims. (Cl. 122—135)

This invention relates to a boiler plant for producing hot water, steam or vapor for use for domestic and industrial purposes.

The invention aims to provide, in a manner as hereinafter set forth, a boiler of unitary construction whereby all of the several parts thereof are welded together or made integral in any suitable manner.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler having a water space, a plurality of combustion flues and a fire box and with the elements co-acting to provide the water space, combustion flues and a fire box being corrugated throughout.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler which will give an increased heating surface without requiring increased space therefor and which permits an unusually great expansion of the several wall forming parts of the boiler so as to prevent bursting or leakage of the same at the seams due to extraordinary conditions.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler so constructed and arranged to prevent the possibility of a steam lock therein.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler which may be heated when free of water and after which the water may be ejected therein without damage thereto.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler of corrugated construction throughout and formed of any suitable metallic material such as corrugated copper, Maly steel whereby rust growth is prevented.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler which has a minimum contact with a supporting surface whereby loss of heat from the boiler through radiation is greatly minimized.

A further object of the invention is to provide, in a manner as hereinafter set forth, a construction of boiler which when containing a little water within the same and the entire quantity of water is converted into steam the boiler walls will not burst or the seams or connections between the walls spring open.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler having wall forming parts corrugated throughout for not only reinforcing such walls but for increasing heat radiating surfaces.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler having its wall forming parts so constructed to prevent cracking or bursting thereof when the boiler is operating under very high temperatures.

A further object of the invention is to provide, in a manner as hereinafter set forth, a corrugated boiler formed of metallic material possessing a non-rusting characteristic.

A further object of the invention is to provide, in a manner as hereinafter set forth, a boiler including a fire box, a series of combustion flues arranged over the fire box, a water space surrounding the flues and fire box and with the flues arranged relatively to each other in a manner to provide oppositely disposed water passages leading from and opening into the water space and with the parts of the boiler co-acting to provide the water space, the fire box and the flues corrugated throughout.

Further objects of the invention are to provide, in a manner as hereinafter set forth, a boiler which is comparatively simple in its construction and arrangement, strong, durable, compact, formed of an integral structure, readily assembled, thoroughly efficient in its use and comparatively inexpensive to build.

With the foregoing and other objects which may hereinafter appear, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and as are illustrated in the accompanying drawings wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:—

Figure 1 is a longitudinal sectional view of the boiler, broken in two, intermediate its ends,

Figure 2 is a sectional plan of the boiler, broken in two, intermediate its ends,

Figure 3 is a section on line 3—3 Figure 1,

Figure 4 is a section on line 4—4 Figure 3,

Figure 5 is a section on line 5—5 Figure 4, and

Figure 6 is a fragmentary view in inverted sectional plan on the line 6—6, Figure 5.

There is illustrated by way of example a base structure 1 for supporting a superstructure. The latter includes the elements of the boiler in accordance with this invention. The base structure as shown is in the form of a rectangular frame 2 forming a chamber 3. The frame 2 has an entrance opening 4 for chamber 3. The latter may be used as an ashpit or for the reception of a gas or oil burner. The superstructure will include

a fire box and its source of heat may be obtained from a gas burner, an oil burner or any suitable combustible material.

Mounted on the top edge 5 of the frame is the superstructure referred to generally indicated at 11. The superstructure includes an open bottom outer shell or housing 12 and an open bottom inner shell 13. The shell 12 is formed throughout of corrugated metallic material possessing non-rusting characteristics and is of rectangular contour in plan. The shell 13 is also formed throughout of corrugated metallic material possessing a non-rusting characteristic and is of rectangular contour in plan. The shell 13 is arranged in spaced relation to the sides, ends and top of shell 12.

The shell 12 includes a front wall 14, a rear wall 15, a pair of side walls 16, 17 and a dome-shaped top wall 18. The shell 13 includes a front wall 19, a rear wall 20 and a pair of side walls 21, 22. The shell 13 also includes a top wall which will be hereinafter referred to. The lower end terminal portions of the walls 14, 15, 16, 17 and 18 of the shell 12 are inturned and the lower ends of such portions are welded to or otherwise formed integral with the lower ends of the front, rear and side walls of the shell 13. The shell 13 forms a fire box or chamber 23 which opens into the chamber 3. The front wall of the shell 12 is formed with an opening 24 which aligns with an opening 25 formed in the front wall of the shell 13. Integral with or connected to the walls 14, 19 and registering with the openings 24, 25 respectively is a tubular member 26 which forms an entrance for the fire box 23. Any suitable means may be employed for closing the outer end of the tubular member 26.

The top wall of the shell 13 consists of a pair of oppositely extending outwardly curved parts 27, 28 merging at their upper ends into an arcuate part 29. The parts 27, 28 intermediate their ends provide a passage 30 which is of the same length as the fire box and leads from the latter into a combustion or heating flue 31 provided by the part 29 in connection with the upper portions of the parts 27, 28 of the top wall of the shell 13. The combustion flue 31 is of substantially triangular contour in cross section and is disposed above and centrally with respect to the fire box 23.

The front and rear walls of the shell 13 are of greater height than and extend above its side walls. The upper portions of said front and rear walls of shell 13 having parts thereof constitute end closures for the passage 30 and the flue 31. Secured to the upper portions of the front and rear walls of the shell 13 are the ends of a pair of corrugated oppositely disposed hollow members 32, 33 providing combustion or heating flues 34, 35 respectively. The members 32, 33 are formed of curved substantially V-shaped inner parts 36, 37 respectively and substantially segmental outer parts 38, 39 respectively connecting the ends of the parts 36, 37 respectively together. The members 32, 33 extend into and are arranged in spaced relation to the parts 27, 28 respectively.

The members 32, 33 coact with the parts 27, 28 respectively to form oppositely disposed V-shaped heated water conducting passages 40, 41 respectively positioned between the combustion flues 31, 34 and 35. The bottoms of the parts 36, 37 of the members 32, 33 respectively project in lateral relation with respect to the upper ends of the side walls 31, 32 respectively of the shell 13. The projecting portions of the bottoms of the parts 36, 37 are indicated at 42 and constitute deflectors 43 at the intakes 44 of the passages 40, 41. The wall 19 directly above the parts 27, 28 of the top wall of shell 13 is provided with a pair of oppositely disposed spaced curved cutouts forming slots 44, 45 open at their outer ends. Portions of the end wall 19 extending from the closed ends of the aforesaid slots to the top edge of such walls provide closures for the major portion of one side of the passages 40, 41.

Adjacent the wall 20, the bottom at one end of each of the parts 27, 28 is cut out, as indicated at 46. The top at the other end of each of the parts 27, 28 is cut out as indicated at 47. The top of the inner part of each of the members 32, 33 is cut out as at 48. The bottom of the inner part of each of the members 32, 33 is cut out as at 49. The edges of the cutouts 46 are connected to the edges of the cutouts 49 by wall forming parts 50. The edges of the cutouts 47 are connected to the edges of the cutouts 48 by wall forming parts 51. The wall forming parts 50 in connection with the end wall 20 provide for permanently establishing communication between the fire box 23 and the flues 34, 35 at the rear ends of such flues. The wall forming parts 51 in connection with the end wall 19 provide for permanently establishing communication between the flue 34 with the flue 31 and the flue 35 with the flue 31. The parts 50, 51 also act as closures between the flues and passages 40, 41.

The part 29 and members 32, 33 at the end terminal portions thereof adjacent the end walls 19, at their tops, are connected together by bridge pieces 52 which close a portion of the outlets 53 of the passages 40, 41. The bridge pieces 52 at their outer ends are integral with the end wall 19.

The shell 12 in connection with the shell 13 and the members 32, 33 provides a water heating space or chamber 54 which surrounds the shell 13 and the ends and outer parts of the members 32, 33. The passages 40, 41 extend from a point intermediate the sides of the water space to the upper portion of the latter. The intakes 54a of the water passages are arranged at the top of the side walls of shell 13. The outlets 53 of the water passages are arranged at the upper end of and adjacent each side of the longitudinal median of the top wall of the top wall of shell 13.

The side walls of the shell 12 in proximity to their lower ends are provided with a pair of water intake nipples as indicated at 55. The end wall 14 of shell 12 is formed near its top with an opening 56 and below the latter and between the vertical median and each side edge thereof with an opening, as indicated at 57, 58. The top wall 18 of shell 12 is provided with a pair of water outlet openings 59 to which are to be connected hot water conducting off pipes 60 as indicated in dotted lines. The end wall 15 of shell 12 is provided centrally of its upper portion with an opening 61. The end wall 19 of shell 13 is formed in its upper portion with openings 62, 63 and 64 which align with and are connected to the openings 56, 57, 58 by tubes 65, 66, 67 respectively anchored to the walls 14, 19, in registry with such openings. The end wall 20 of shell 13 is formed with an opening 68 aligning with the opening 61. The latter and opening 68 are connected together by a tubular member 69 anchored in the walls 15, 20 constituting an exhaust or discharge leading to a smoke pipe not shown. The end walls 21, 13 of the shells 12, 13 respectively are provided with aligning openings 70, 71 respectively for a purpose to be referred to. The parts 27, 28 of the top wall of shell 13 are provided with openings 72, 73

respectively. The bottom of the inner parts 36, 37 of members 32, 33 respectively are formed with openings 74, 75 respectively which align with the openings 72, 73. The purpose of the aligning openings 72, 73, 74, 75 will be referred to. The several tubes referred to function as couplers and spacers for the shells. The tube 65 constitutes a clean out opening for flue 31; the tubes 66, 67 constitute clean out openings for the flues 34, 35 respectively; and the tube 69 constitutes an outlet for flue 31.

There is associated with the flues 31, 34, 35 a hot air supplying element for increasing the combustion of the gases supplied to said flues from the fire box 23. The said element has its major portion arranged within and whereby the air passing therethrough is heated from the heat generated in the fire box. The said element includes a hot air conducting pipe 76 which extends through the aligned openings 70, 71 into the fire box and thence upwardly into the passage 30. The upper end of pipe 76 has a nozzle 77 which discharges hot air into the flue 31. Formed integral with and opening into the pipe 76 is a pair of upstanding oppositely disposed hot air conducting branches 78, 79 having their major portions arranged in fire box 23. The branch 78 extends through the opening 74, across passage 40, into opening 72, is anchored to member 32 and discharges into flue 35. The branch 79 extends through opening 75, across passage 41, into opening 73, is anchored to member 33 and discharges into the flue 35.

The passages 40, 41 prevent any possibility of a steam lock in the structure as during the operation of the boiler the passages will provide for the circulation of water from the sides to the top of the water space. Heat radiating from the side and end walls of the fire box will heat the water in the lower portion of the water space, but that part of the water nearest the walls of the fire box will be a greater temperature than that portion of the body of water adjacent the lower part of the sides and end walls of the shell 12. As the heated water rises that portion of the body of the water of lower temperature will be deflected by the deflectors 43 around the top of and have its temperature increased by the flues 31, 34, 35. That portion of the body of the water of greater temperature will be deflected to pass upwardly through the passages 40, 41 and have its temperature increased by the flues 31, 34, 35. The water passing through the passages 40, 41 when discharged will admix with and increase the temperature of the water which travels upwardly around the outer walls of the flues 31, 34, 35.

The flues 31, 34 and 35 are equipped with electric igniters 80, 81, 82 for igniting the gases received therein from the fire box 23. The igniters have threaded engagement with top wall 18. The igniters 80, 81, 82 have threaded engagement with the parts 29, 38, 39 respectively.

The using of the structure as a steam or vapor generator will depend upon the level of the water within the water space.

The gases from the fire box enter the flues 34, 35 at the rear ends of these latter. The gases travel forwardly of the flues 34, 35 and pass from the forward ends of such flues into the forward end of the flue 31. The gases travel rearwardly of flue 31 and are discharged through the tubular member 69.

The water is supplied to the lower portion of the water space through the inlets 55. On operating the plant, the water will be deflected to not only pass over the top of flue 31, but also against the outer sides of flues 34, 35, as well as between the fire box and flues 34, 35. The water circulating through passages 40, 41 will be heated to a greater temperature than that which passes against the sides of flues 34, 35. The water traveling through the passages 40, 41 is discharged into the water which passes around the outer sides of flues 34, 35 whereby the temperature of the water at the upper end of the water space will be increased.

What I claim is:—

1. In a boiler structure comprising inner and outer shells arranged in spaced relation and coacting to form a water space surrounding the inner shell, said shells being closed at their tops and open at their bottoms, the lower end of the walls of the inner shell having a closed connection with the lower end of the walls of the outer shell, said inner shell having parts thereof coacting to provide a fire box of less height than the outer shell, said inner shell having other parts thereof coacting to form a centrally disposed combustion flue arranged over and permanently communicating with the fire box, a pair of outer flue forming members arranged over the fire box at opposite sides of the said central flue, connected to opposed walls of the inner shell and each opening at the ends of its inner sides into the central flue through the ends of one side of the latter, and the said several flues being arranged in spaced relation and in connection with wall portions of the fire box forming spaced oppositely extending water passages leading from the lower portion to spaced points of the upper portion of said water space.

2. In a boiler structure comprising inner and outer shells arranged in spaced relation and coacting to form a water space surrounding the inner shell, said shells being closed at their tops and open at their bottoms, the lower end of the walls of the inner shell having a closed connection with the lower end of the walls of the outer shell, said inner shell having parts thereof coacting to provide a fire box of less height than the outer shell, said inner shell having other parts thereof coacting to form a centrally disposed combustion flue arranged over and permanently communicating with the fire box, a pair of outer flue forming members arranged over the fire box at opposite sides of the said central flue, connected to opposed walls of the inner shell and each opening at the ends of its inner sides into the central flue through the ends of one side of the latter, the said several flues being arranged in spaced relation and in connection with wall portions of the fire box forming spaced oppositely extending water passages leading from the lower portion to spaced points of the upper portion of said water space, and a hot air supply element extending through said fire box, across said water passages and opening into said flues.

3. The invention as set forth in claim 1 having said central flue of substantially triangular contour and each of the flue forming members consisting of a substantially V-shaped inner portion and a segmental-shaped outer portion integral with the ends of the inner portion.

4. The invention as set forth in claim 2 having said central flue of substantially triangular contour and each of the flue forming members consisting of a substantially V-shaped inner portion and a segmental-shaped outer portion integral with the ends of the inner portion.

5. The invention as set forth in claim 1 having

said flue forming members at their bottoms extended in lateral relation with respect to the top of the opposed walls of the inner shell to form deflectors at the intakes of the water passages.

6. The invention as set forth in claim 2 having said flue forming members at their bottoms extended in lateral relation with respect to the top of the opposed walls of the inner shell to form deflectors at the intakes of the water passages.

7. In a boiler structure inner and outer shells, said shells being disposed in spaced relation and coacting to form a closed water heating space surrounding the inner shell, said inner shell having parts thereof providing a fire box and other parts thereof coacting to form a central combustion flue arranged over and opening into the fire box, spaced means arranged within and connected to said inner shell for providing a pair of outer combustion flues arranged over the fire box at opposite sides of the central flue, the walls of the said several flues in connection with wall portions of the fire box providing oppositely disposed water passages leading from spaced points of the lower portion to spaced points of the upper portion of the water space.

8. In a boiler structure inner and outer shells, said shells being disposed in spaced relation and coacting to form a closed water heating space surrounding the inner shell, said inner shell having parts thereof providing a fire box and other parts thereof coacting to form a central combustion flue arranged over and opening into the fire box, spaced means arranged within and connected to said inner flue for providing a pair of outer combustion flues arranged over the fire box at opposite sides of the central flue, the walls of the said several flues in connection with wall portions of the fire box providing oppositely disposed water passages leading from spaced points of the lower portion to spaced points of the upper portion of the water space, and a hot air supply element extending through said fire box and opening into said flues.

9. In a boiler structure inner and outer shells, said shells being disposed in spaced relation and coacting to form a closed water heating space surrounding the inner shell, said inner shell having parts thereof providing a fire box and other parts thereof coacting to form a central combustion flue arranged over and opening into the fire box, spaced means arranged within and connected to said inner flue for providing a pair of outer combustion flues arranged over the fire box at opposite sides of the central flue, the walls of the said several flues in connection with wall portions of the fire box providing oppositely disposed water passages leading from spaced points of the lower portions to spaced points of the upper portion of the water space, a clean out for each of said flues, an outlet for said central flue, water inlets at the sides of said water space, and hot water outlets at the top of said water space.

10. In a boiler structure inner and outer shells, said shells being disposed in spaced relation and coacting to form a closed water heating space surrounding the inner shell, said inner shell having parts thereof providing a fire box and other parts thereof coacting to form a central combustion flue arranged over and opening into the fire box, spaced means arranged within and connected to said inner flue for providing a pair of outer combustion flues arranged over the fire box at opposite sides of the central flue, the walls of the said several flues in connection with wall portions of the fire box providing oppositely disposed water passages leading from spaced points of the lower portions to spaced points of the upper portion of the water space, a clean out for each of said flues, an outlet for said central flue, water inlets at the sides of said water space, hot water outlets at the top of said water space, and a hot air supply element extending through said fire box and opening into said flues.

11. In a boiler structure comprising inner and outer shells arranged in spaced relation and coacting to form a water space surrounding the inner shell, said shells being closed at their tops and open at their bottoms, the lower end of the walls of the inner shell having a closed connection with the lower end of the walls of the outer shell, said inner shell having parts thereof coacting to provide a fire box of less height than the outer shell, said inner shell having other parts thereof coacting to form a centrally disposed combustion flue arranged over and permanently communicating with the fire box, a pair of outer flue forming members arranged over the fire box at opposite sides of the said central flue, connected to opposed walls of the inner shell and each opening at the ends of its inner sides into the central flue through the ends of one side of the latter, and the said several flues being arranged in spaced relation and in connection with wall portions of the fire box forming spaced oppositely extending water passages leading from the lower portion to spaced points of the upper portion of said water space, and an electrical igniter extended into each of said flues.

12. In a boiler structure comprising inner and outer shells arranged in spaced relation and coacting to form a water space surrounding the inner shell, said shells being closed at their tops and open at their bottoms, the lower end of the walls of the inner shell having a closed connection with the lower end of the walls of the outer shell, said inner shell having parts thereof coacting to provide a fire box of less height than the outer shell, said inner shell having other parts thereof coacting to form a centrally disposed combustion flue arranged over and permanently communicating with the fire box, a pair of outer flue forming members arranged over the fire box at opposite sides of the said central flue, connected to opposed walls of the inner shell and each opening at the ends of its inner sides into the central flue through the ends of one side of the latter, the said several flues being arranged in spaced relation and in connection with wall portions of the fire box forming spaced oppositely extending water passages leading from the lower portion to spaced points of the upper portion of said water space, and a hot air supply element extending through said fire box, across said water passages and opening into said flues, and an electrical igniter extending into each of said flues.

13. In a boiler structure inner and outer shells, said shell beings disposed in spaced relation and coacting to form a closed water heating space surrounding the inner shell, said inner shell having parts thereof providing a fire box and other parts thereof coacting to form a central combustion flue arranged over and opening into the fire box, spaced means arranged within and connected to said inner flue for providing a pair of outer combustion flues arranged over the fire box at opposite sides of the central flue, the walls of the said several flues in connection with wall portions of the fire box providing oppositely dis-

posed water passages leading from spaced points of the lower portion to spaced points of the upper portion of the water space, and an electrical igniter extended into each of said flues.

14. In a boiler structure inner and outer shells, said shells being disposed in spaced relation and coacting to form a closed water heating space surrounding the inner shell, said inner shell having parts thereof providing a fire box and other parts thereof coacting to form a central combustion flue arranged over and opening into the fire box, spaced means arranged within and connected to said inner flue for providing a pair of outer combustion flues arranged over the fire box at opposite sides of the central flue, the walls of the said several flues in connection with wall portions of the fire box providing oppositely disposed water passages leading from spaced points of the lower portion to spaced points of the upper portion of the water space, and a hot air supply element extending through said fire box and opening into said flues, and an electrical igniter extended into each of said flues.

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