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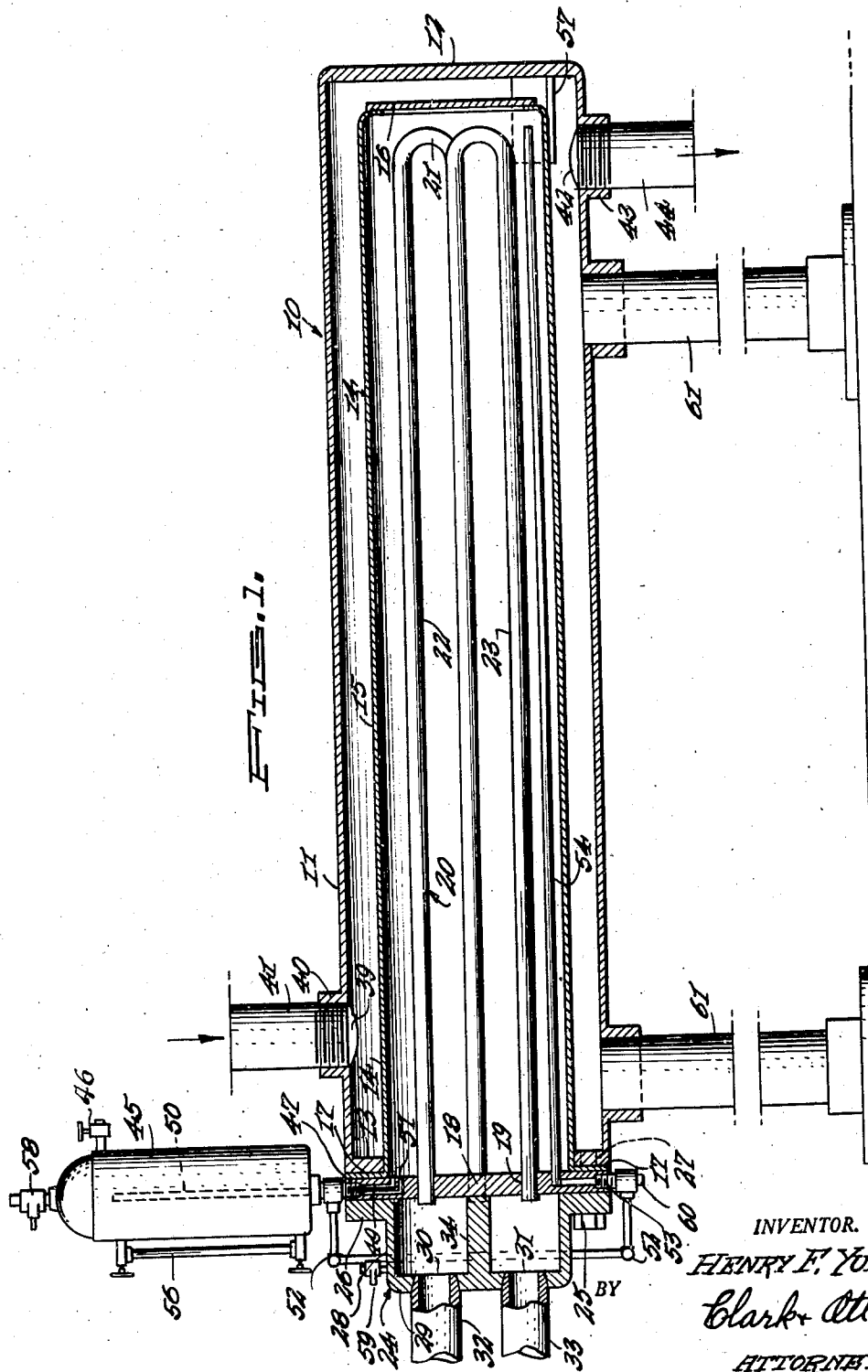
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2,457,022

PREHEATING APPARATUS

Filed Nov. 1, 1945

4 Sheets-Sheet 1



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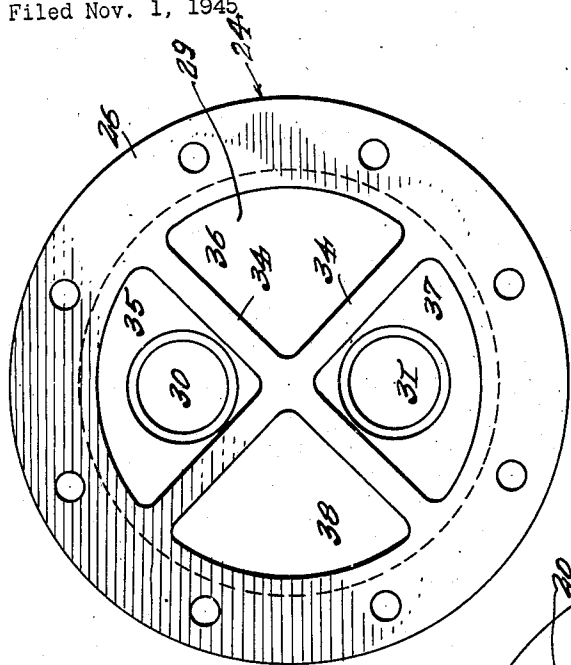


FIG. 3.

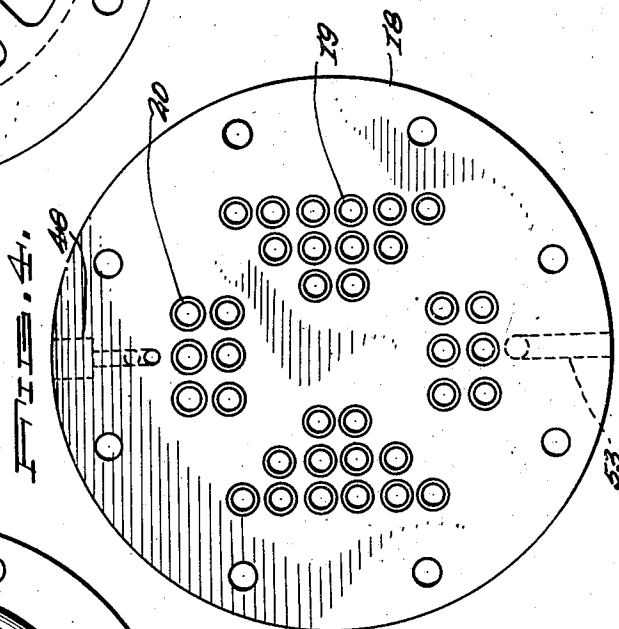


FIG. 4.

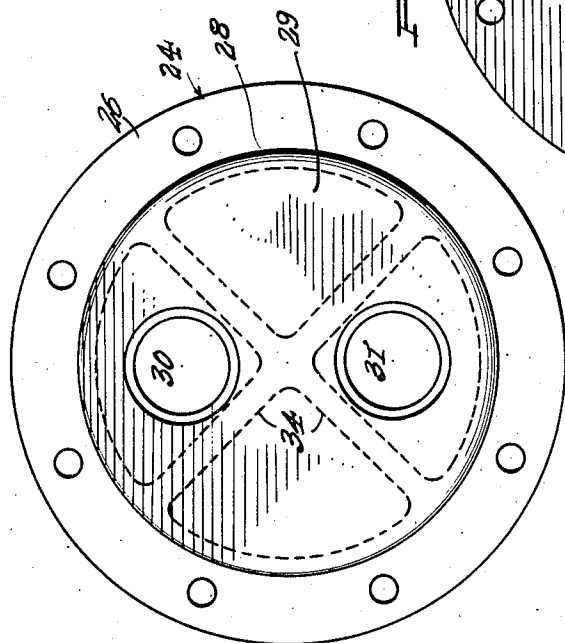


FIG. 2.

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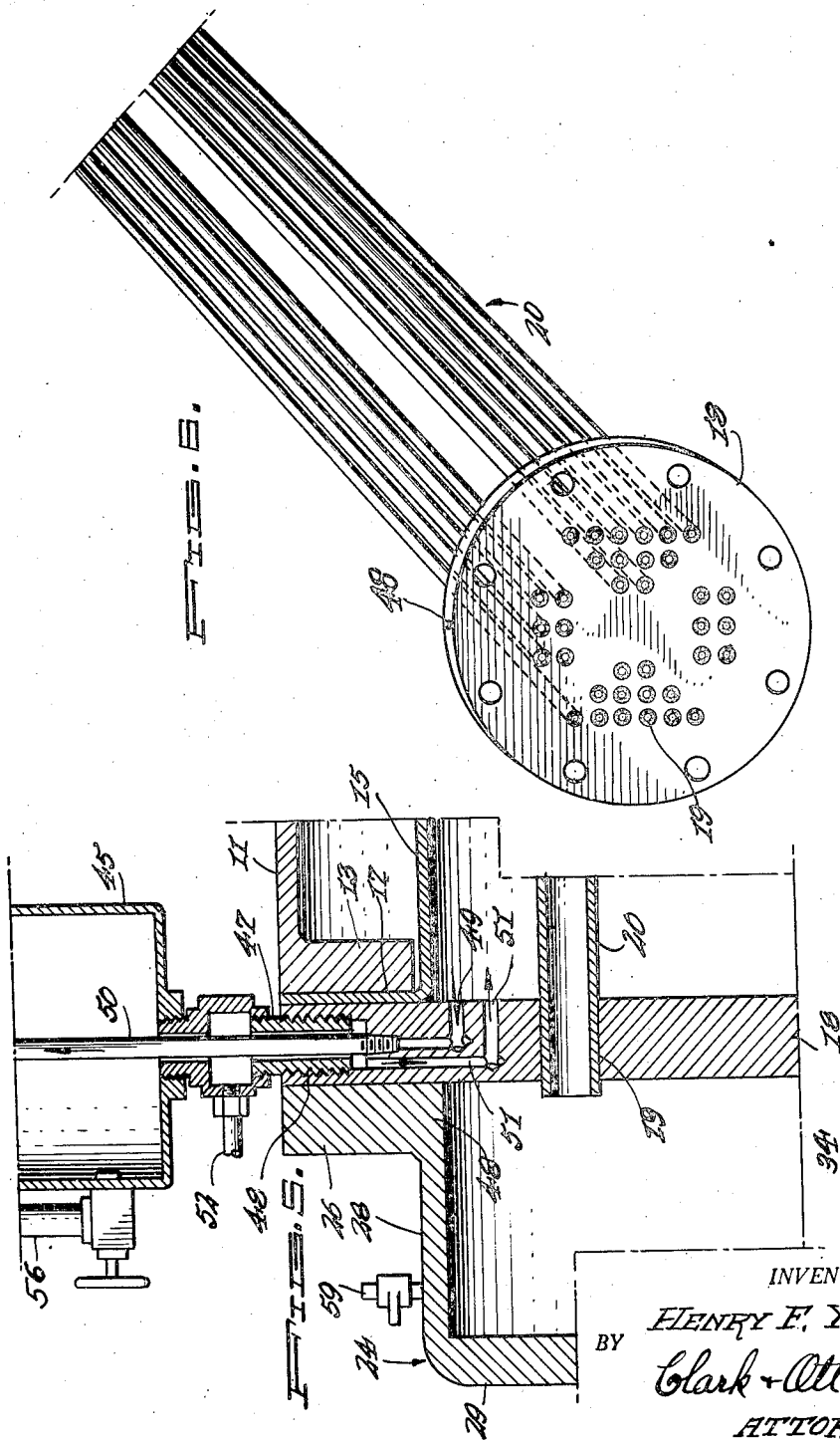
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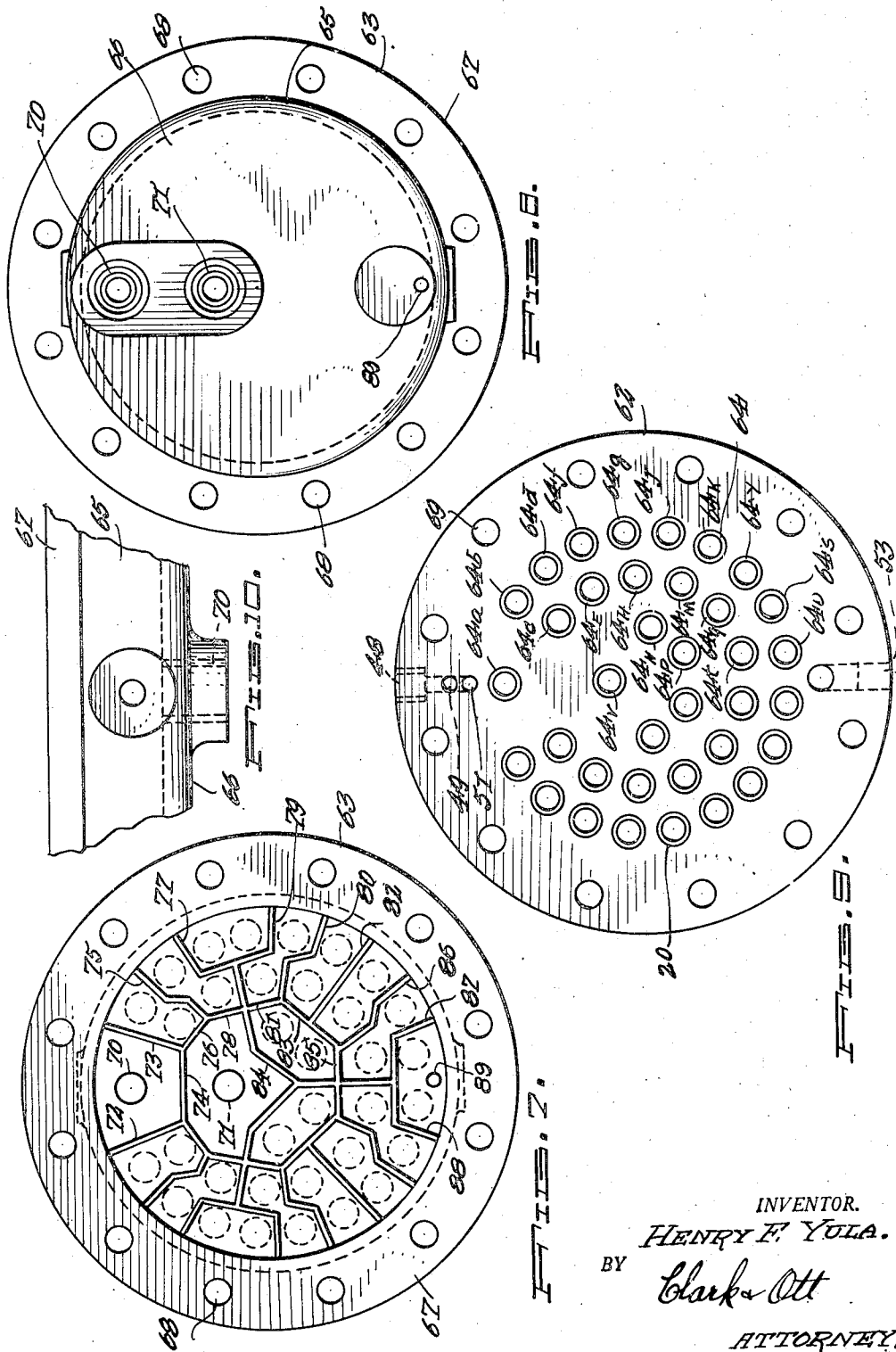
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PREHEATING APPARATUS

Filed Nov. 1, 1945

4 Sheets-Sheet 4



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2,457,022

PREHEATING APPARATUS

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Application November 1, 1945, Serial No. 626,035

2 Claims. (Cl. 257—239)

1

This invention relates to apparatus for heating liquids and while not limited thereto the same has particular reference to an apparatus for preheating fuel oil for rendering the same relatively mobile when fed to the burner.

In the preheating of fuel oil for oil burners and the like, it has been the practice to conduct the fuel oil through coils arranged in a container connected in a bypass with the water chamber of the boiler. Such construction has the disadvantage that in the event of rupture of any one of the coils the fuel oil escapes into the bypass and is carried by the fluid therein to the water chamber of the boiler and thence throughout the heating system and the radiators. The present invention has in view an apparatus for preheating fuel oil which overcomes the aforesaid objections and avoids the possibility of damage resulting to the heating system by rupture of the coils and renders the use of the apparatus safe for all installations.

The invention further comprehends a preheating apparatus of the indicated character in which the heat is transmitted to the fuel oil by means of a circulating liquid separated from a heating fluid and maintained at a substantially constant predetermined temperature by continued motion of the heating fluid.

The invention also has for an object the provision of means for venting the circulating liquid container and for taking up expansion in the container and in the liquid.

With the foregoing and other objects in view reference is now made to the following specification and accompanying drawings in which is illustrated the preferred embodiment of the invention.

In the drawings:

Fig. 1 is a longitudinal vertical sectional view of a preheating apparatus constructed in accordance with the invention and diagrammatically illustrating two of the tubes only.

Fig. 2 is an enlarged outer face view of the outer head thereof.

Fig. 3 is an enlarged inner face view of the outer head thereof.

Fig. 4 is a face view of the intermediate head showing one arrangement of the tubes.

Fig. 5 is an enlarged fragmentary vertical sectional view through the forward portion of the apparatus.

Fig. 6 is a perspective view of the intermediate head and the tubes connected thereto.

Fig. 7 is an inner face view of a modified form of outer head.

2

Fig. 8 is an outer face view thereof.

Fig. 9 is an inner face view of the modified form of intermediate head.

Fig. 10 is a fragmentary top plan view of the modified outer head.

Referring to the drawings by characters of reference the apparatus includes an outer casing or shell 10 preferably fashioned from steel and including a cylindrical wall 11 closed at one end by a rear wall 12 and having an inturned annular head 13 welded or otherwise secured to the cylindrical wall 11 at the forward end thereof.

Located coaxially within the casing or shell 10 is a container 14 preferably constructed of copper or other non-corrosive metal and which consists of a cylindrical wall 15 having a closed end 16 and formed at its opposite end with an outwardly directed annular flange 17. The container 14 protrudes through the head 13 with the flange 17 thereof located between the head 13 and an intermediate circular head 18. The circular head 18 is formed with a plurality of apertures 19 in which apertures are secured the outer open ends of U-shaped tubes 20 which extend into the container 14 with the bight portion 21 thereof connecting the opposite longitudinal legs 22 and 23 of the tubes located adjacent the inner end of the container. As illustrated, the apertures 19 are thirty-six in number to receive therein eighteen of the tubes 20. The apertures 19 are arranged in quadrantly spaced groups the upper and lower groups each consisting of six apertures while the groups at the opposite sides each consist of twelve apertures. The apertures in the uppermost group have secured therein the open ends of the upper legs of six tubes 20 while the open ends of the lower legs thereof are secured in the six intermediate apertures in the group at the left side thereof. The six remaining apertures in said latter group have secured therein the open ends of the legs of six other tubes 20 while the open ends of the opposite legs thereof are secured in the corresponding apertures 19 in the group at the opposite side thereof. The remaining apertures 19 in the latter group similarly have secured therein the open ends of the upper legs of six additional tubes 20 with the open ends of the lower legs thereof secured in the lowermost group of apertures.

An outer head 24 is provided which is disposed in covering relation with the outer face of the intermediate head 18 and secured thereto by bolts 25 extending through openings in an outwardly directed flange 26 thereof and through aligned

3

openings in the intermediate head 18 and the flange 17 of the container 14 with the threaded inner ends of the bolt 25 anchored in threaded openings 27 in the head 13, thus clamping the flange of the container 14 between the heads 13 and 18 and securing the container 14 within the casing or shell 10. Gaskets may be provided if desired between adjacent faces of the said heads and between the opposite faces of the flange 17 and the adjacent heads for providing liquid tight joints.

The outer head 24 includes a cylindrical wall 28 projecting forwardly from the flange 26 thereof, the forward end of which is closed by a wall 29 provided with threaded inlet and outlet openings 30 and 31 therethrough which are adapted to be connected by piping 32 with a fuel pump and fuel tank (not shown) and by piping 33 with the fuel oil inlet of the oil burner. The head 24 is of hollow formation and is formed with cross-ribs 34 which intersect medially of the head and subdivide the hollow interior thereof into quadrantly spaced recesses 35, 36, 37 and 38 respectively opening through the inner face of the said head and overlying and separating the quadrant groups of apertures 19 in the intermediate head 18.

The apparatus is adapted to be arranged in a by-pass pipeline connected with the water chamber of the heater and for this purpose the casing or shell 10 is provided with an inlet opening 39 at the top thereof adjacent the forward end which is provided with an interiorly threaded tubular boss 40 for receiving therein the inlet pipe 41 of said by-pass pipeline connected at the upper end with the water chamber of the heater somewhat below the level of the water therein. The said casing or shell 10 is also provided with an outlet opening 42 at the bottom thereof adjacent the rear of the shell and which opening is surrounded by an interiorly threaded tubular boss 43 for receiving therein the outlet pipe 44 of said by-pass pipeline connected at the lower end thereof with the water chamber of the heater adjacent the bottom. By this construction the heated water in the heater is circulated through the casing or shell 10 between the same and the container therein and returned to the water chamber of the heater.

The container 14 is also filled with water or other liquid in surrounding relation with the tubes 20 which are heated by the circulating water in the casing or shell 10 and convey the heat to the fuel oil circulating through the tubes 20 to render the same relatively mobile or fluid for atomizing and burning when conducted to the oil burner.

In order to provide means for taking up the expansion in the water or other liquid in the container 14, an expansion tank 45 is provided which as illustrated in detail in Fig. 5 of the drawings is secured by the piping 47 in the threaded opening 48 in the intermediate head 18. The inner end of the piping 47 is spaced from the bottom of the threaded aperture 48 and a reduced passageway 49 extends inwardly from the bottom of said threaded aperture and opens laterally into the interior of the container 14. A tube 50 is threadedly engaged in the upper end of said passageway 49 and protrudes upwardly through the piping 47 with the open upper end of the tube 50 disposed adjacent the top of the expansion tank 45. A passageway 51 adjacent to the passageway 49 also extends inwardly from the bottom of the threaded aperture 48 and opens laterally into the interior of the container 14. The

4

piping 47 has a branch pipe 52 connected thereto which leads to and is connected with a passageway 53 extending into the bottom of the intermediate head 18 and opening through the inner face thereof into the container 14. A longitudinally extending pipe 54 is connected to the inner end of said passageway 53 with the open end of said pipe being located adjacent the rear of the said container.

The container 14 is adapted to be filled with the water or other liquid through a valve 46 connecting with the expansion tank 45 which is maintained in a partially filled condition in order to insure that the container 14 is filled with the liquid, the expansion tank being provided with a gauge glass 56 for determining the height of the liquid therein. The liquid in the expansion tank 45 is admitted to the container 14 through the piping 47 and thence through the passageway 51. When the container 14 is being filled with the liquid the air therein is vented through the passageway 49 and tube 50 to the top of the expansion tank where it is exhausted to the atmosphere. The piping 47 being connected by the branch pipe 52, passageway 53 and pipe 54 with the bottom of the container 14 permits of the circulation of the liquid through the container and about the tubes 20. This is due to the fact that the liquid in the container will rise as the same becomes heated and will flow upwardly through the passageway 51 and thence through the piping 47 and branch pipe 52 and will be returned to the container through the pipe 54. The liquid thus circulating in the container will effectively heat the fuel oil passing through the tubes 20 so as to maintain the fuel in a mobile or fluid condition whereby it may be more readily atomized by the oil burner. The container 14 is slidably supported at the rear upon a saddle 57 secured to the rear wall of the shell 10 in order to permit of the expansion and contraction of the container.

The expansion tank 45 is provided with a self-sealing pressure relief valve 58 in the top thereof which may be set at any desired pressure such as 100 to 150 pounds so that the same will open to relieve the pressure within the container 14 should the pressure therein exceed the pressure set on the said relief valve 58. The outer head 24 is provided with a relief valve 59 in the cylindrical wall 28 thereof which is adapted to be set so as to relieve the pressure in the fuel oil entering through the inlet opening 30 should the pressure therein exceed the pressure set on the said relief valve. The branch pipe 52 is provided with a drainage opening in communication with the passageway 53 in order to drain the liquid from the container 14 through the pipe 54, the said drainage opening being normally closed by a screw plug 60.

The apparatus is supported in any desired manner in elevated position above a supporting surface in order to permit of the connection of the inlet and outlet openings 39 and 42 in the by-pass pipeline with the water chamber of the heater. For this purpose the shell or casing 10 is supported upon any desired supporting surface by means of flanged pipe standards 61 secured at their upper ends to couplings which are welded or otherwise secured to the under side thereof.

In Figs. 7 to 10 inclusive of the drawings a modified form of intermediate and outer heads 62 and 63 is illustrated which are constructed so as to provide for a relatively greater travel of the fuel oil through the tubes or coils and conse-

quently a greater number of times that the fuel oil traverses the length of the container 14.

The intermediate head 62 is provided with a plurality of apertures 64 opening through the opposite faces thereof which are arranged on circles concentric with the head and have secured therein the open ends of the tubes 20 as in the previous form. The outer head 63 consists of a cylindrical wall 65 closed at the outer end thereof by an end wall 66 and having an outwardly projecting peripheral flange 67 at the opposite end thereof secured in covering relation upon the intermediate head 62 by bolts such as the bolts 25 extending through openings 68 in said flange and through openings 69 in the intermediate head 62 with the inner ends of the bolts anchored in the threaded openings 27 in the head 13.

The outer wall 66 of the outer head 63 is provided with threaded fuel oil inlet and outlet ports 70 and 71 which open into the hollow interior of the head. The said head is formed with interconnected partitions which sub-divide the hollow interior thereof into a plurality of recesses or pockets which are arranged in overlying relation with and close the open ends of the tubes or coils 20.

As illustrated in Fig. 7 of the drawings the inlet port 70 opens into a recess defined by partitions 72 and 73 extending radially inward from the cylindrical wall 65 and connected at the inner end thereof with an intermediate wall 74, the said walls thus enclosing the open end of one of the legs of the tube 20 located in the aperture 64a. The opposite leg of said tube is located in the opening designated 64b which opens into a recess in the outer head 63 defined by the partition 73 and a partition 75 extending inwardly from the cylindrical wall 65 and which partitions connect at their inner end with an intermediate wall 76 which recess closes the open end of said tube and one of the legs of the tube located in the aperture 64c. The opposite leg of said tube is located in the aperture 64d which leg opens into the recess defined by the partition 75 and an angulated partition 77 which are connected at their inner end with an intermediate wall 78 and which recess closes the open end of said tube and one of the legs of a tube 20 located in the aperture 64e of said intermediate head 62. The opposite leg of said tube is located in the aperture 64f which opens into a recess defined by the angulated partition 77 and a similar partition 79 extending radially inward from the cylindrical wall 65. The said recess closes the open end of said tube and the open end of a leg of one of the tubes 20 located in an aperture 64g in the intermediate head 62 with the opposite leg of said tube located in the aperture 64h which latter leg opens into a recess defined by said partition 79, a portion of the partition 77, an angulated partition 80 and an intermediate wall 81. The said recess closes the leg of said tube and also one of the legs of a tube located in the aperture 64j of the intermediate head 62. The opposite leg of said tube is located in the aperture 64k and opens into a recess defined by said angulated partition 80 and a partition 82 extending radially inward from the cylindrical wall 65 and which partitions are joined by an intermediate wall 83. The said recess closes the open end of said leg and also the open end of a leg located in the aperture 64m in the intermediate head 62. The opposite leg of said tube is located in the aperture 64n in the head 62 which opens into a recess defined by the intermediate walls 81 and 83 and

intermediate walls 84 and 85. The said recess closes the open end of said leg and also closes the open end of a leg of one of the tubes 20 located in the aperture 64p. The opposite leg of said latter tube being located in the aperture 64q in the intermediate head 62 and opens into a recess defined by said partition 82 and an angulated partition 86 which partitions are connected at their inner ends by the intermediate wall 83. The said recess closes said leg and also closes one of the legs of another one of the tubes 20 which leg is located in the opening designated 64r. The opposite leg of said last mentioned tube is located in an aperture 64s in the intermediate head 63 and opens into a recess defined by the partition 86 and an angulated partition 87 which are connected by the intermediate wall 85. The said recess closes said last mentioned leg and also closes the open end of a leg of one of said tubes 20 located in the aperture 64t the opposite leg of said tube being located in the aperture 64u which opens into a recess defined by said partition 87 and an angulated partition 88.

The aforesaid arrangement of partitions and tubes is similar in construction for the opposite half of the intermediate head 62 and the outer head 63 to thus define a continuous passageway for the fuel oil entering through the orifice 70 and thence through each of the tubes 20 and out through the leg of one of the tubes located in the aperture designated 64u and thence through the tubes in the said opposite half of the intermediate head 62 and through 64v and through the outlet port 71 to the oil burner. The intermediate head 62 is similarly provided with a threaded opening 48 for connecting the expansion tank 45 thereto as in the previous form and at the bottom thereof the said head is provided with the passageway 53 similar to the previous form.

In use and operation the heated water in the water chamber of the heater is circulated by the by-pass pipeline through the casing 10 between the same and the container 14 therein so as to heat the liquid within the container 14 which surrounds the tubes or coils 20. The liquid within the container 14 being heated by the water circulating through the casing 10 transmits its heat to the fuel oil circulating through the tubes or coils 20 so as to render the fuel oil relatively mobile whereby the same will be more readily atomized and burned by the fuel oil burner. Any expansion in the liquid within the container 14 will flow upward into the expansion tank 45 so as to avoid excessive pressure in the container 14. The upward flow of the heated liquid therein will also cause a circulation thereof through the branch pipe 52 and return to the container through the pipe 54 so as to produce a circulation thereof about the tubes or coils 20. When not in use the coils 20 may be drained through a pipeline (not shown) leading to the fuel oil tank which pipeline is secured in a threaded opening 89 in the head 63 the same being normally closed by a valve and adapted to be opened when the tubes 20 are to be drained.

What is claimed is:

1. In an apparatus for preheating fuel oil for rendering the same relatively fluid when fed to a fuel oil burner, an outer casing, a container 70 located within said casing in spaced relation to the walls thereof, a head secured to said casing in closing relation with one end of said container and formed with a plurality of apertures opening through the opposite faces thereof, a plurality of 75 U shaped coils disposed within said container

having open ends secured in said apertures in said head, an outer head secured upon said first named head and having ribs providing a plurality of recesses between said inner and outer heads, said outer head having an inlet opening into one of said recesses and an outlet opening into another of said recesses, at least one of said coils having an open end opening through said inner head into said recess having the inlet opening and at least one of said coils having an open end opening through said inner head into said recess having the outlet opening and at least two of the remaining coils each having an open end opening through said inner head into the remaining recesses for admitting fuel to said coils for circulating the same therethrough and through said recesses, an expansion tank, said first named head mounting said expansion tank and having means establishing communication between said expansion tank and said container for venting said container through said expansion tank, said container and expansion tank being adapted to contain a fluid for circulation about the coils, said casing having inlet and outlet openings adapted to be connected with a source of heated fluid for circulation thereof between said casing and said container for heating the fluid in said container and a conduit connected with the container at the top and bottom thereof for permitting of the circulation of the fluid in the container for heating the fuel oil in the coils.

2. In an apparatus of the indicated character, an outer casing, a container located within said casing in spaced relation to the walls thereof, a head closing said container and formed with a plurality of apertures opening through the opposite faces thereof, a plurality of groups of coils disposed within said container having open ends secured in said apertures, an outer head secured upon said first named head and having ribs providing a plurality of recesses between said inner

and outer heads, said outer head having an inlet opening into one of said recesses and an outlet opening into another of said recesses, said groups of coils having their open ends opening through said inner head into said recesses to thereby provide for the circulation of a fluid from the inlet opening successively through said groups of coils, an expansion tank, said first named head mounting said expansion tank and having means establishing communication between said expansion tank and said container, a pipe connected with said first named head in communication with said container and extending upwardly through said expansion tank with the open end thereof located adjacent the top of the expansion tank for venting said container, said container and expansion tank being adapted to contain a fluid for circulation about the coils, said casing having inlet and outlet openings adapted to be connected with a source of heated fluid for circulation thereof between said casing and said container for heating the fluid in said container and a conduit connected to and establishing communication with the container at the top and bottom thereof adjacent the opposite ends for permitting of the circulation of the fluid in the container for heating the liquid in the coils.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,738,848	Starr	Dec. 10, 1929
2,056,920	Demann	Oct. 6, 1936
2,360,094	Arvins et al.	Oct. 10, 1944
2,360,408	Dunn et al.	Oct. 17, 1944
2,396,235	Arvins et al.	Mar. 12, 1946