

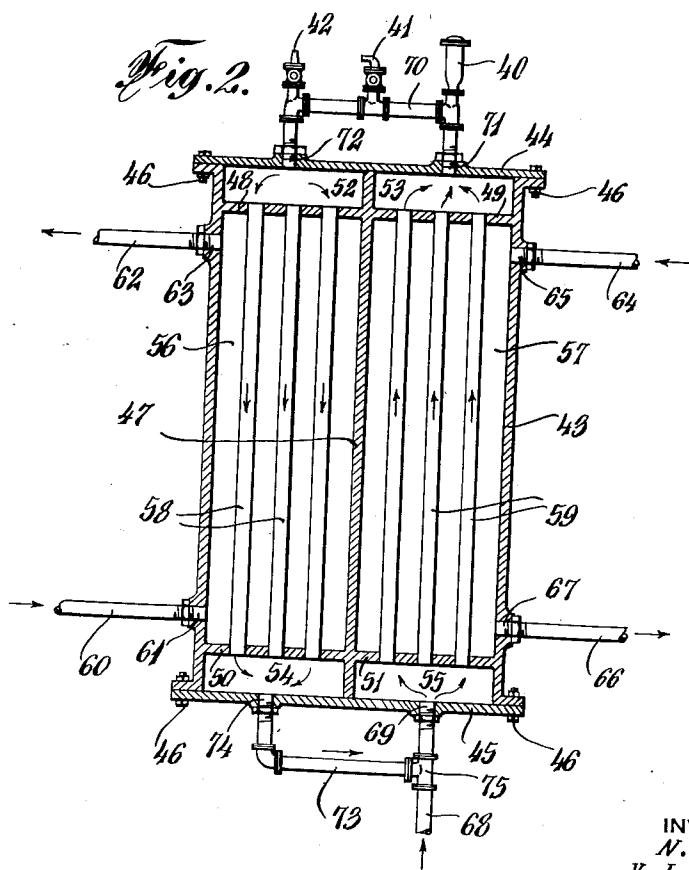
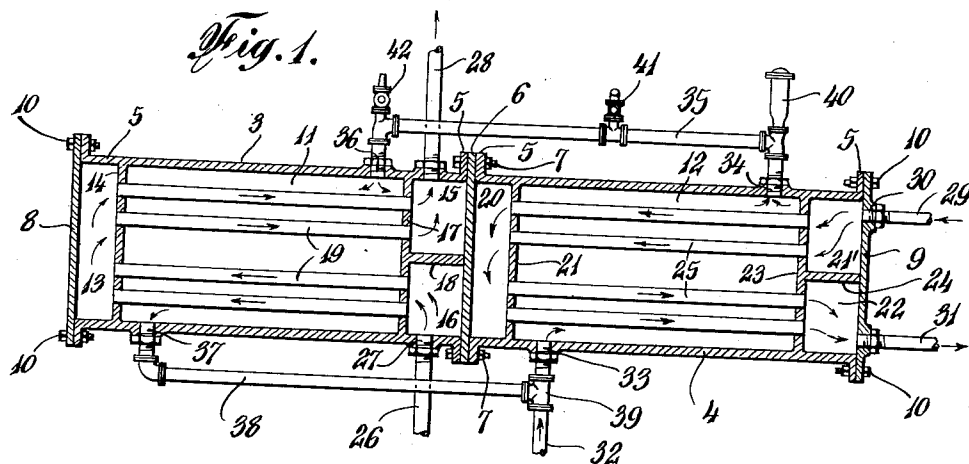
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METHOD OF AND MEANS FOR PREHEATING FUEL OIL

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METHOD OF AND MEANS FOR PREHEATING FUEL OIL

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This invention relates to a method and means for preheating heavy viscous fuel oil during its delivery or transmission from a source of supply, such as a tank, to a burner, such as a spraying nozzle, to reduce the viscosity of the oil and adapt the same to be readily sprayed and ignited.

In the present method of preheating heavy viscous fuel oil, the oil is forced through a coil directly heated by the heat transferring medium of the boiler in which the oil burner is mounted, said heat transferring medium being either water or steam, and it has been found that said coil frequently cracks or ruptures and the pressure of the oil being greater than either the head of the boiler water or the steam pressure causes the oil to flow either into the boiler proper if the boiler water is the heat transferring medium, or into the heat distributing system of the boiler if steam is the heat transferring medium, whereby the efficiency of the boiler and heating system thereof will be reduced.

It is the principal object of the present invention to overcome the disadvantages of the present method of preheating fuel oil by preheating the oil through the use of an intermediate heat transferring medium which is first heated by contact with the heat transferring medium of the boiler and subsequently passing the heated intermediate heat transferring medium into contact with the oil to be heated, whereby the intermingling of the oil with the heat transferring medium of the boiler is eliminated.

It also has been proposed to preheat heavy viscous fuel oil by an electric heating element but it has been found that this method is much more expensive in operation than the preheating of the fuel oil by the heat transferring medium of the boiler.

It is another object of the invention to preheat fuel oil by using ordinary main water as an intermediate heat transferring medium and passing said water in a circuitous path successively into contact with the heat transferring medium of the boiler and the fuel oil, whereby the preheating of the fuel oil by the present method is not much more expensive than the preheating of the fuel oil directly by the heat transferring medium of the boiler.

It is a further object of the invention to provide alarm means in the circuit of the intermediate heat transferring medium to indicate the presence of the fuel oil in said circuit.

It is a still further object of the invention to provide an unitary and inexpensive apparatus for carrying out the present method of preheating

fuel oil comprising a housing divided into two chambers with one chamber connected in a circuit with and adapted to be heated by the heat transferring medium of the boiler and the other chamber arranged for the passage therethrough of the fuel oil being delivered from the source of oil supply to the oil burner, and the chambers arranged and connected to each other to provide a circuitous passage for an intermediate heat transferring medium entering from a source of supply thereof into the chamber heated by the heat transferring medium of the boiler to be heated by said latter heat transferring medium and flowing from said first chamber to the second chamber to transfer the heat thereof to the fuel oil passing through said second chamber, and finally flowing from said second chamber to the connection between the source of supply of said intermediate heat transferring medium and the first chamber.

Other objects and advantages of this invention will be set forth in the detail description of the embodiment of the invention.

In the drawing accompanying and forming a part of this application, Figure 1 is a sectional view of an apparatus for carrying out the method of preheating fuel oil forming the embodiment of the invention.

Figure 2 is a section of another form of apparatus for carrying out said method of preheating fuel oil.

The embodiment of the invention comprises the method of preheating heavy viscous fuel oil being delivered under pressure from a fuel oil supply tank to an oil burner mounted in or relative to a boiler having a heat transferring medium, such as water or steam. The fuel oil is indirectly heated by the heat transferring medium of the boiler through an intermediate heat transferring medium, preferably water, circulating in a closed circuit connected to a source of supply of said intermediate heat transferring medium, the initial portion of said closed circuit adjacent to the connection thereof with the source of supply coming into contact with a quantity of the heat transferring medium of the boiler to be heated and the final portion of the closed circuit of the intermediate heat transferring medium coming into contact with a quantity of oil between the oil supply tank and the oil burner to transfer the heat of the intermediate heat transferring medium to said quantity of oil and heat and reduce the viscosity of the oil entering the oil burner. This method of preheating fuel oil eliminates the possibility of the oil intermingling with the

heat transferring medium of the boiler and flowing into the boiler and its heat distributing system by separating the oil from said medium. Should there be an intermingling of the oil with the intermediate heat transferring medium by a rupture or break in the final portion of the closed circuit of the intermediate heat transferring medium, means are provided in said closed circuit to give an alarm, so that the supply of oil may be shut off to prevent a quantity of oil entering the closed circuit of the intermediate heat transferring medium. Should the fuel oil enter the closed circuit of the intermediate heat transferring medium, said oil would not intermingle with the heat transferring medium of the boiler, as the two heat transferring mediums are separated from each other.

Figure 1 shows one form of apparatus for carrying out the present method of preheating fuel oil comprising a housing composed of two hollow or tubular bodies 3 and 4 having laterally extending flanges 5 at the opposite ends. The housing bodies are connected to each other in end to end relation with a wall 6 interposed between the mating flanges 5 of said bodies and secured in said position by suitable means, such as bolts 7 engaged in the mating flanges and the peripheral portions of the wall. The free ends of the bodies 3 and 4 are closed by plates 8 and 9, respectively, secured to said bodies by bolts engaged in the peripheral portions of the plates and the flanges 5, as shown at 10. The bodies 3 and 4 assembled in this manner form two separate chambers 11 and 12, respectively, the chamber 11 being arranged at the free end with a header or transverse spaces 13 formed by a plate 14 secured at the peripheral edge to the side of the body or integral with said body to extend in parallel spaced relation to the closure plate 8 and having a series of spaced openings therein for a purpose to be hereinafter described. The opposite end of the chamber 11 is arranged with a header divided into two spaces 15 and 16 and formed by a plate 17 having a lateral portion 18 extending from a face thereof intermediate the peripheral edge thereof and said plate 17 being secured to or integral with the side of the body 3 to extend in parallel spaced relation to the dividing wall 6 with the end edge of the lateral portion 18 abutting the dividing wall 6 and the side edges of said lateral portion abutting or being integral with the side of the body 3 to form the two liquid tight spaces 15 and 16. The plate 17 is arranged with a series of openings in alignment with the openings in the plate 14, said openings being adapted for the mounting of the opposite ends of a series of parallel rows of tubes 19 in communication with spaces 13, 15 and 16. In the present instance, there are shown four rows of tubes, two rows being in communication with the upper portion of the space 13 and the space 15 and the other two rows being in communication with the lower portion of the space 13 and the space 16.

The other chamber 12 in the body 4 is also arranged with a transverse header or space 20 formed adjacent the dividing wall 6 by a plate 21 secured to or integral with the side of the body 4 to extend in parallel spaced relation to the dividing wall 6 and having a series of openings therethrough. The free end of the chamber 12 is arranged with a header having a pair of liquid tight spaces 21', 22 formed by a plate 23 having a lateral portion 24 extending from a face thereof intermediate the peripheral edge and said

plate secured to or integral with the side of the body 4 to extend in parallel spaced relation to the end closure plate 9 with the lateral portion 24 abutting said plate 9 and abutting or being integral with the body 4. The plate 23 is arranged with a series of openings in alignment with and cooperating with the openings in the plate 21 to support a series of parallel rows of tubes 25 in communication with the spaces 20, 21' and 22, in a manner similar to the mounting of the tubes 19 in the plates 14 and 17.

The housing 3, 4 is supported in any suitable manner and preferably adjacent to a boiler and in line with the feed line of fuel oil from a supply tank of fuel oil to an oil burner mounted in or relative to the boiler. The boiler, oil supply tank and oil burner are not shown in the present illustration of the invention as they do not form a part of the invention and different types of boilers and burners may be used without affecting the invention. The housing 3, 4 is connected in communication with a fuel oil supply tank by a pipe 26 mounted in an opening in the side of the body 3 entering the header space 16 of the chamber 11, as shown at 27, and as the oil is discharged from the tank under pressure, as by gravity or a pump, the oil entering the space 16 will flow, as indicated by the arrows, through the two lower rows of the tubes 19, the free end header 13, the two upper rows of the tubes 19, the space 15 of the inner header, and from said latter header space 15 into a pipe 28 connected at one end in communication with the header space 15 and the opposite end connected in communication with an oil burner.

The oil flowing through the housing body 3 is indirectly heated by the heat transferring medium of the boiler, which may be either steam or water, flowing from the boiler through a pipe 29 connected at one end to the steam or water jacket of the boiler and the opposite end connected in an opening leading into the space 21' of the outer end header of the chamber 12, as shown at 30, whereby said heat transferring medium flows, as indicated by the arrows, through the space 21', the two upper rows of tubes 25, the inner header space 20, the two lower rows of tubes 25, and the space 22 of the outer end header, and from said space 22 into a pipe 31 returning to the steam or water jacket of the boiler. By this circulation of the heat transferring medium of the boiler, the chamber 12 is heated and the hottest portion being the upper right hand portion thereof, looking at Figure 1, as said medium will give up its heat as it travels through the tubes 25 and the header spaces 20 and 22.

The heat or temperature of the chamber 12 and the tubes and headers therein is transferred to the fuel oil circulating through the housing body 3 by an intermediate heat transferring medium of any suitable substance, but in the present instance water is used due to its cheapness and adaptability of flowing in a closed circuit. The water is supplied from the ordinary water main and enters chamber 12 through a pipe 32 having the outlet end thereof mounted in an inlet opening 33 at the inner end of the chamber adjacent to the header space 20 and the series of tubes 25 returning the heat transferring medium of the boiler to the outlet space 22 and pipe 31, and the chamber 12 is arranged with an outlet 34 in diagonal relation to the inlet 33 and adjacent to the in-

let space 21' to cause the water entering the inlet 33 to flow around the entire length of the tubes 25 and into contact with the header plates 21 and 23 to absorb the heat of the heat transferring medium of the boiler passing through said tubes and the header spaces 20, 21' and 22, and the water leaving the chamber 12 will contact the hottest part of the tubes 25. The water flows through the outlet 34 into a U shaped pipe 35 having one leg portion connected in communication with said outlet 34 and the other leg portion connected in communication with an inlet 36 into the chamber 11 of the housing body 3 arranged in said chamber adjacent to the outlet space 15 of the inner end header of the chamber, so that the water of the highest temperature will contact the oil leaving the chamber 11 and assure the heating of the oil to the proper temperature. The water flowing into the chamber 11 through the inlet 36 thereof is caused to flow through the chamber 11 into contact with the entire length of the tubes 19 and the header plates 14 and 17 by arranging an outlet 37 from said chamber in diagonal relation to the inlet 36 and adjacent to the outer end header 13. The water passing through the outlet 37 is returned to the water supply pipe 32 through a pipe 38 having a right angle bent portion at one end connected in communication with the outlet 37 and the opposite end connected in communication with the pipe 32, as at 39.

An expansion chamber 40 is connected in communication with the U shaped pipe 35 at the leg portion thereof connected to the outlet 34 of the chamber 12 for the purpose of permitting expansion of the water in its heated condition. Air releasing means, such as a pet cock 41, is connected in communication with the U-shaped pipe 35 intermediate the leg portions thereof to facilitate the releasing of air from the water circulating system and prevent said system from becoming air bound and inoperative to transfer the temperature of the heat transferring medium of the boiler in the chamber 12 to the fuel oil in the chamber 11. The U shaped pipe 35 is also arranged with a relief valve 42 at the leg portion thereof connected to the chamber 11, said valve being adjusted to be operative to open position by a pressure below the pressure of the fuel oil passing through the header spaces 13, 15 and 16 and tubes 19, so that should the fuel oil seep from any of said elements into the water in the chamber 11, the added pressure of the oil in the water will escape through said valve and give an alarm that the oil is seeping into the water and the supply of oil should be shut off from the oil burner. The oil seeping into the water in the chamber 11 will not affect the boiler nor the heat transferring medium thereof as said heat transferring medium does not intermingle with the water in the chamber 12.

In Figure 2, there is shown another type of apparatus for carrying out the present method of preheating fuel oil being delivered to an oil burner comprising a housing 43 having laterally extending flanges at the opposite ends and said ends closed by plates 44, 45 secured to the housing by suitable means, such as bolts engaged in peripheral portions of the plates and the flanges of the housing, as shown at 46. The housing is arranged with a longitudinal wall 47 extending parallelly of and intermediate the side walls of the housing with the opposite ends

abutting the closure plates 44 and 45 to form liquid tight joints between the wall and closure plates and tube sheets 48, 49, 50 and 51 spaced inwardly from the opposite ends and extended from the opposite faces of the wall 47 with the free edges of said wall portions abutting the side walls of the housing 43 in liquid tight relation or integral with said side walls, whereby a pair of adjoining spaces 52, 53 and 54, 55 are provided in the opposite end portions of the housing 43 and a pair of longitudinal chambers 56 and 57 are formed in the intermediate portion of the housing between and in line with the spaces 52, 54 and 53, 55, respectively. The spaces 52, 53, 54 and 55 constitute headers and the oppositely paired headers 52, 54 and 53, 55 are connected in communication with each other by a series of parallel rows of tubes 58 and 59, respectively, connected in communication with said headers by fixing the opposite ends of the tubes in aligned openings in the tube sheets 48, 50 and 49, 51 respectively. The chamber 56 is adapted to be connected with and receive fuel oil from the oil supply through a pipe 60 having one end connected to the oil supply tank and the opposite end mounted in an opening in the side wall of the housing 43 and leading into the end portion of the chamber 56 adjacent to the header 54, as shown at 61, and a pipe 62 having one end mounted in an opening in the side wall of the housing 43 and leading from the end portion of the chamber 56 adjacent to the header 52, as shown at 63, and the opposite end of the pipe 62 connected in communication with the oil burner. The oil is delivered from the pipe 60 under pressure and will flow around the tubes 58 for the entire length thereof to the pipe 62.

The chamber 57 is adapted for the circulation of the heat transferring medium of the boiler by a pipe 64 connected at one end in communication with the steam or water drum of the boiler to receive said steam or water and deliver the same to the chamber 57 by connecting the opposite end of the pipe 64 in communication with an opening 65 in the side wall of the housing 43 and entering the end portion of the chamber 57 adjacent to the header 53. The heat transferring medium of the boiler is returned from the chamber 57 to the steam or water drum of the boiler by a pipe 66 connected at one end in an opening 67 from the opposite end portion of the chamber 57 adjacent to the header 55 and the opposite end of the pipe 66 connected in communication with the steam or water drum of the boiler, so that the heat transferring medium of the boiler will circulate through the entire length of the chamber 57 and around the tubes 59 for the entire length thereof to heat said tubes, the headers 53, 55 and the dividing wall 47.

A small amount of the heat of the heat transferring medium of the boiler in the chamber 57 is transferred directly to the fuel oil in the chamber 56 through the wall 47 but the major part of the heat of said medium is transferred to an intermediate transferring medium, such as water, circulating through the header 54, tubes 59, headers 53, 52, tubes 58 and header 54 by connecting the header 55 to a source of supply of said intermediate transferring medium, such as a water main, by a pipe 68 connected at one end to said water main, not shown, and the opposite end engaged in an opening 69 in the plate 45 leading to the header 55. The water flows from the header 55 into and through the tubes 59

into the header 53 and absorbs the heat of the heat transferring medium of the boiler through the wall of the tubes 59 and headers 55, 53. The headers 53 and 52 are connected in communication with each other by a U shaped pipe 70 having one leg portion engaged in an opening 71 in the plate 44 leading from the header 53 and the other leg portion mounted in an opening 72 in the plate 44 leading into the header 52. The heated water will flow from the header 53 through the U shaped pipe 70 to the header 52 and from said header 52 through the tubes 58 to the header 54. The heat of the hot water passing through the tubes 58 from header 52 to the header 54 is also transferred through the wall of the tubes 58 to the fuel oil circulating through chamber 56. The circulation of the intermediate heat transferring medium through the header 55, tubes 59, header 53, U pipe 70, header 52, tubes 58 and header 54 is completed by connecting the header 54 in communication with the supply pipe 68 through an angle shaped pipe 73 having one end connected to an opening 74 in plate 45 leading from the header 54 and the opposite end connected in communication with the pipe 68, as shown at 75. The direction of flow of the fuel oil, the heat transferring medium of the boiler and the intermediate heat transferring medium is appropriately indicated by arrows.

The U shaped pipe 70 is also arranged with the expansion chamber 40, pet cock 41 and relief valve 42 in the same manner and for the same purposes as in apparatus shown in Figure 1.

Having thus described our invention, we claim:

1. The method of heating fuel oil delivered from a supply of the oil to a burner firing a boiler, which consists in circulating the heat transferring medium of the boiler in heat transfer relation with an intermediate circulating fluid medium to heat said intermediate circulating fluid medium, and circulating said heated fluid medium and the fuel oil in heat transfer relation with each other to transfer the heat of the intermediate fluid medium to the fuel oil and thereby heat the fuel oil.

2. The method of heating fuel oil delivered from a supply thereof to a burner firing a boiler, which consists in circulating water and the heat transferring medium of the boiler in heat transfer relation with each other to transfer the heat of the heat transferring medium of the boiler to the water and heat the water, and circulating the fuel oil independently of the heat transferring medium in heat transfer relation with the heated water to transfer the heat of the water to the fuel oil and heat the fuel oil.

3. In apparatus for heating fuel oil delivered from a supply of the oil to a burner firing a boiler, a casing having a pair of chambers therein connected with a source of water and in communication with each other for circulation of the water through the chambers and each chamber arranged with a header at one end and a pair of headers at the opposite end, tubes extending longitudinally through each chamber connecting the headers of said chamber in circulation with each other, the pair of headers at the one end of one chamber being adapted to be connected with the boiler in circulation with the heat transferring medium of the boiler to provide circulation of said medium through said pair of headers, the connecting tubes and the header at the opposite end of said chamber in heat transfer relation with the water in said chamber to heat said water, and one header of the pair of headers at

the one end of the other chamber adapted to be connected with the fuel oil supply and the other header of said pair of headers being connected to the burner for circulation of the fuel oil through said pair of headers, the connecting tubes and the header at the opposite end of said second chamber in heat transfer relation with the heated water in said second chamber to heat the fuel oil.

4. In apparatus for heating fuel oil delivered from a supply of oil to a burner firing a boiler, a pair of housings mounted in end to end relation with each other, a wall interposed between the housings and closing the abutting ends of the housings and each housing having a closure at the opposite end, tube sheets spaced inwardly from the opposite ends of the housings and forming headers at and within the closed abutting ends and the outer ends of the housings and a chamber between the tube sheets of each housing, and a partition separating a header at one end of each housing into a pair of headers, tubes extending through the chamber in each housing fixed at the opposite ends in the tube sheets and connecting the pair of headers at one end of the housings with the header at the opposite end of the housings, means connecting the chambers with a source of water and the chambers in water circulation with each other, the pair of headers at the one end of one of the housing chambers being adapted for connection with the boiler for circulation of the heat transferring medium of the boiler through said pair of headers, the connecting tubes and the header in the opposite end of said chamber for circulation of said medium in heat transfer relation with the water to heat the water, and one of the headers of the pair of headers at the one end of the other housing chamber adapted to be connected with the oil supply and the other of said pair of headers connected to the burner for circulation of the fuel oil through the pair of headers, connecting tubes and the head in the opposite end of said chamber in heat transfer relation with the heated water in said chamber to heat the oil.

5. In apparatus for heating fuel oil delivered from a supply of the fuel oil to a burner firing a boiler, a housing having side and end walls and a longitudinal wall extending from the end walls and between the side walls to separate the housing into two parallelly extending chambers, tube sheets spaced inwardly from the opposite end walls of the housing and extending between the longitudinal wall and the side walls of the housing to arrange a header at each end of the chambers, a series of tubes extending longitudinally in each chamber and mounted at the ends in openings in the tube sheets to connect opposite headers in each chamber in communication with each other, one of the chambers being adapted for connection to the boiler in circulation with the heat transferring medium of the boiler to heat said tubes in said chamber, the other chamber having an inlet adapted to be connected in communication with the oil supply and an outlet adapted to be connected in communication with the oil burner for circulation of the oil around the tubes in said chamber, means adapted to connect the headers at one end of both chambers with a source of water, and means connecting the headers at the opposite end of both chambers in water circulation with each other, whereby the water circulating through the tubes in the chamber connected with the boiler in circulation with the heat transferring medium of the boiler is

heated by the transference of the heat of said medium through the walls of said tubes, and the heated water passing from said tubes into and through the connected headers and the connecting tubes in the other chamber in heat transfer relation with the oil circulating around the tubes in said latter chamber heats said oil.

6. In apparatus for heating fuel oil delivered from a supply of the fuel oil to a burner firing a boiler, a housing having a pair of chambers therein, means to connect the chambers in communication with a source of a fluid medium, means to connect the chambers in communication with each other for the circulation of the fluid medium through said chambers, means to connect one of said chambers with the boiler, means to independently circulate the heat transferring medium of the boiler through said chamber in heat transfer relation with the fluid medium to heat the fluid medium, means to connect the second chamber with the burner and the fuel oil supply, and means to provide independent circulation of the fuel oil through said second chamber in heat transfer relation with the fluid medium to heat the fuel oil.

5 7. In apparatus for heating fuel oil as claimed in claim 6, an expansion chamber arranged in the means connecting the housing chambers to each other and automatically operative by the expansion of the fluid medium in said housing chambers to relieve the housing chambers of excessive pressure.

8. In apparatus for heating fuel oil as claimed in claim 6, a relief valve arranged in the means connecting the housing chambers to each other and adapted to be actuated by the pressure in the housing chambers to permit escape of pressure from said housing chambers.

9. In apparatus for heating fuel oil delivered from a supply of oil to a burner firing a boiler as claimed in claim 3, a pipe connecting the intermediate portions of the first and second chambers to transfer heated water from the first chamber to the second chamber, and an expansion chamber mounted in communication with said pipe to permit expansion of the water.

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