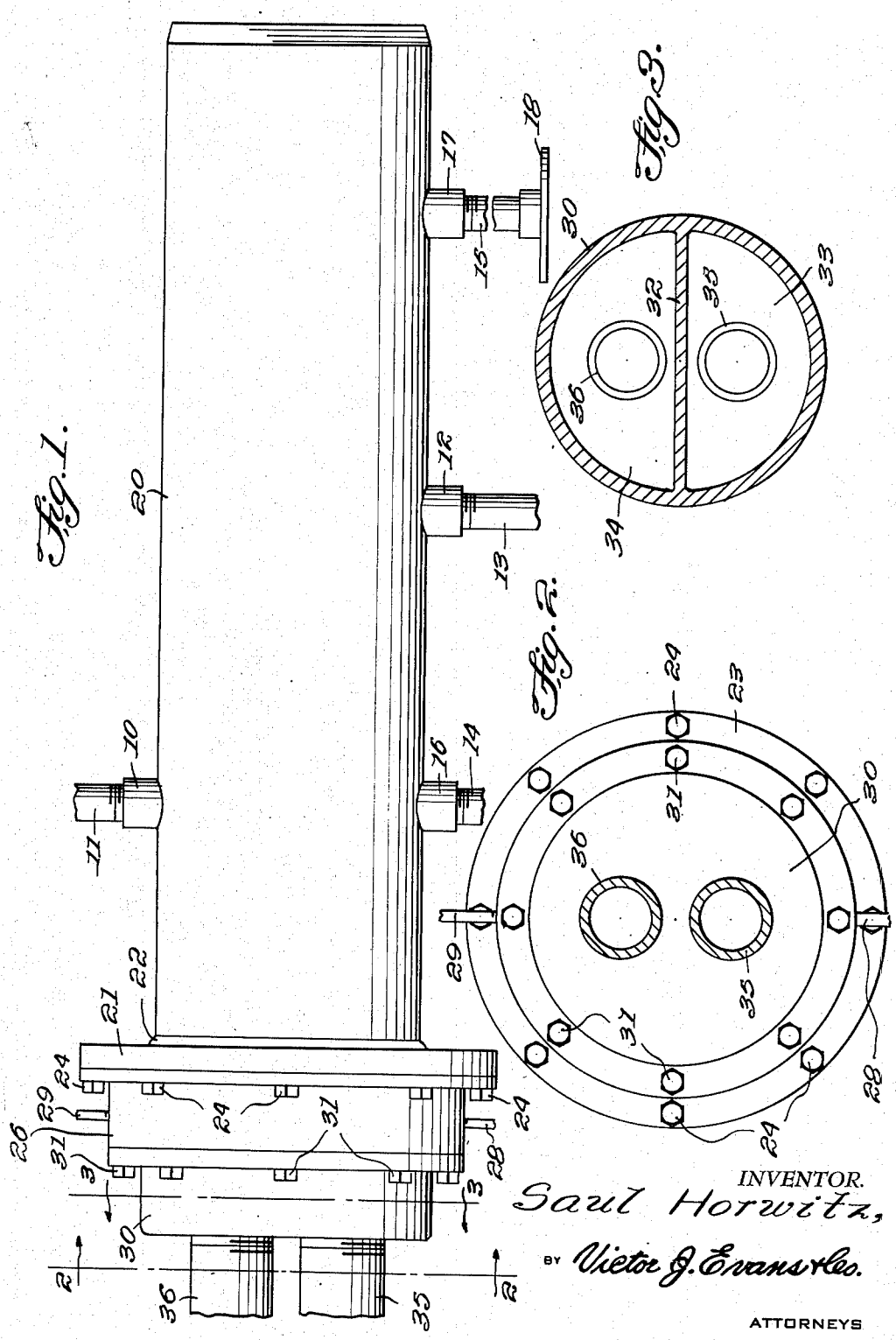
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PREHEATER-TYPE HEAT EXCHANGER

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Fig. 4.

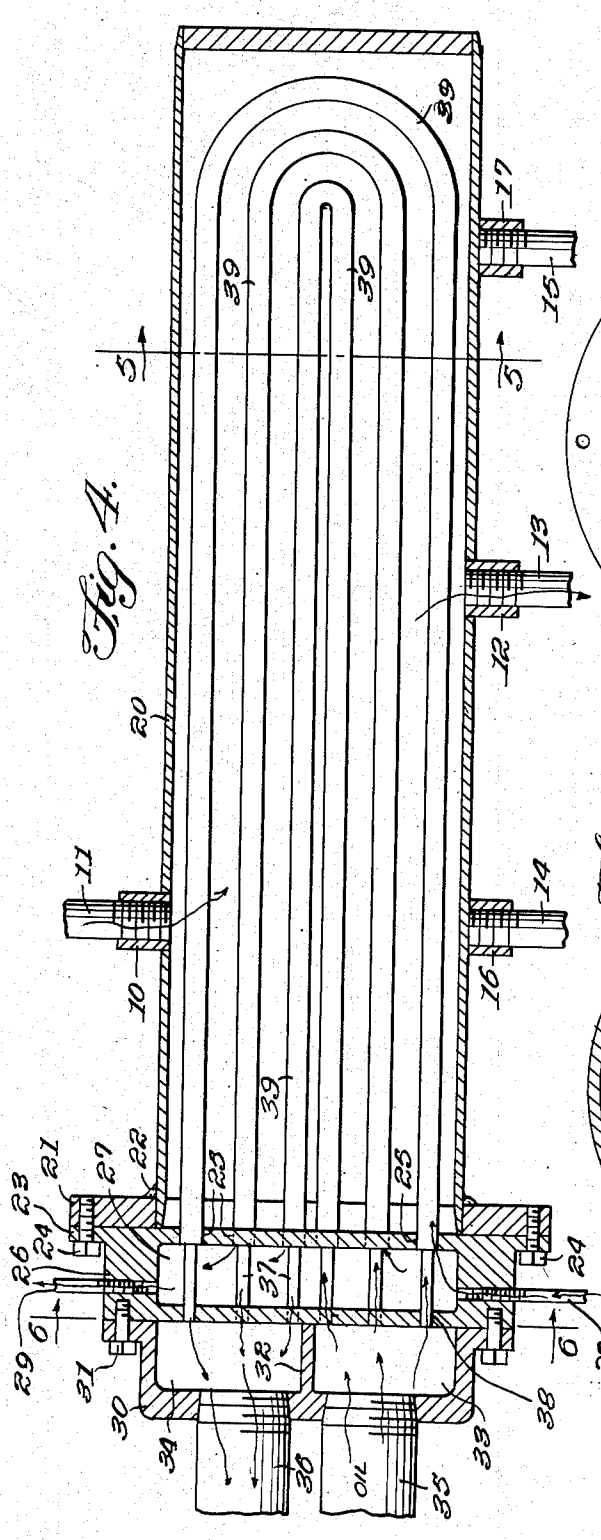


Fig. 6.

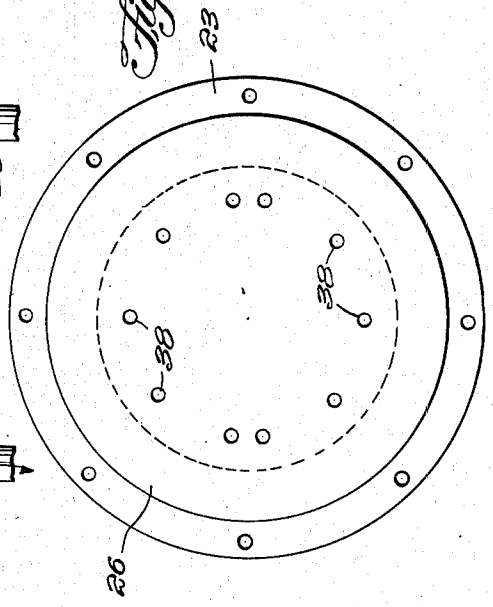
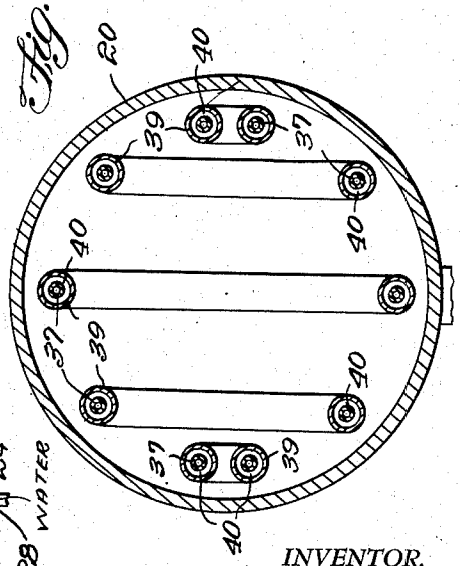


Fig. 5.



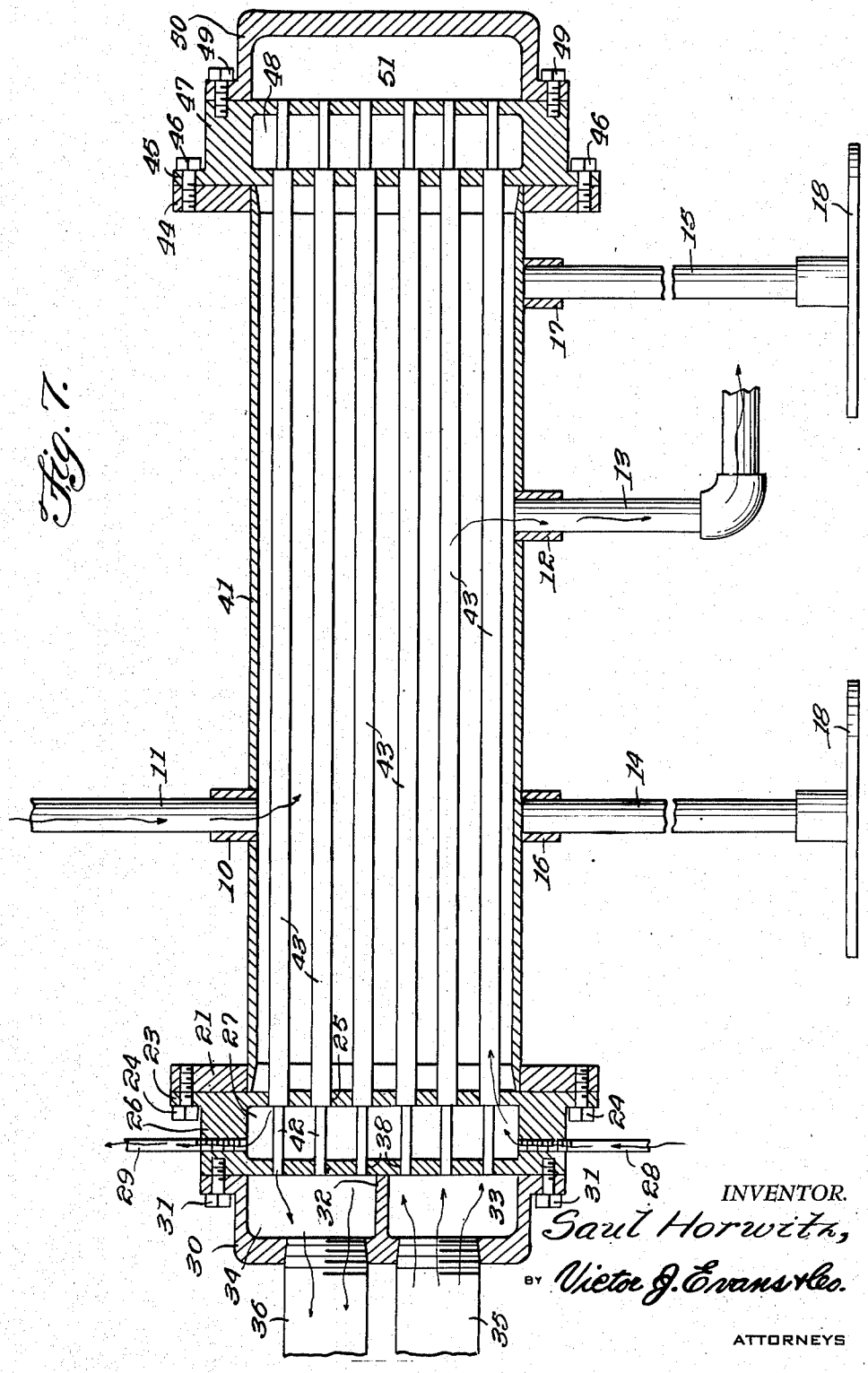
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Fig. 7.



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PREHEATER-TYPE HEAT EXCHANGER

Saul Horwitz, Jersey City, N. J.

Application June 1, 1949, Serial No. 96,494

2 Claims. (Cl. 257—237)

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This invention relates to a preheater, and more particularly to a device for preheating oil for supply to various kinds of oil burners.

The object of the invention is to provide a heat exchanger for preheating fuel oil for supply to various kinds of oil burners, the heat exchanger being constructed so that contamination of the fuel oil, or the primary heat medium, such as steam or boiler water is prevented in the event that there develops a leak in the oil circulating tubes.

Another object of the invention is to provide an oil preheater wherein the fuel oil circulates through small tubes that each are surrounded by tubes of a slightly greater diameter, there being a minute quantity of water circulating through the space between the smaller and larger tubes so that in the event of a leak in the small tubes carrying oil, contamination of the oil or heating medium is prevented.

Still another object of the invention is to provide a preheater which can be used for preheating an inexpensive oil, and which is constructed so that there is a high heat transfer efficiency between the oil and steam or hot water, requires a minimum of installation space, and wherein the complete heating unit can be readily withdrawn from the shell for inspection and cleaning.

A further object of the invention is to provide a preheater which is extremely simple and inexpensive to manufacture.

Other objects and advantages will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this application, and in which like numerals are used to designate like parts throughout the same:

Figure 1 is a side elevational view of the preheater, according to the present invention;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a sectional view taken on the line 3—3 of Figure 1;

Figure 4 is a vertical longitudinal sectional view of the preheater;

Figure 5 is a sectional view taken on the line 5—5 of Figure 4;

Figure 6 is a sectional view taken on the line 6—6 of Figure 4; and

Figure 7 is a vertical longitudinal sectional view of a modified preheater.

Referring in detail to Figures 1 through 6 of the drawings, the numeral 20 designates a housing or shell which is provided with an open end whereby a heating unit can be removed and replaced from the inside of the shell 20 as desired. Arranged adjacent the open end of the shell 20 is an annular rim or flange 21 which is secured to the exterior of the shell 20 by welding. Arranged contiguous to the flange 21 and normally closing the open end of the shell 20 is a body member 23, there being a plurality of securing elements such as headed bolts 24 extending through the body member 23 and into engagement with the flange 21 for maintaining the parts in assembled relation. The body member 23 is provided with a plurality of spaced openings or apertures 25 for a purpose to be later described.

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The body member 23 forms an end closure for the shell, and it comprises an integral hollow casting having a chamber 27 therein. The body member 23 forms a support for the concentric tubes. The chamber 27 is adapted to be connected to a source of fluid, such as city water, and a conduit 28 is threaded into a cap 26 and communicates with the chamber 27 for conveying water from a source of supply. A second conduit 29 is carried by the cap 26 and the conduit 29 serves to convey fluid away from the compartment 27. The conduit 29 is adapted to be connected to a sight glass which may be provided with a petcock so that in the event of a leak in the oil tubes in the shell 20, fluid passing through the pipe 29 will appear contaminated so that the heating unit can be repaired.

A header 30 is secured to the cap 26 by means of a plurality of securing elements, such as bolts 31. The header 30 is provided with a partition 32 and the partition 32 coacts with the cap 26 and with the header 30 to define a pair of compartments 33 and 34 for the ingress and egress therethrough of the fuel oil being heated. A conduit 35 is arranged in threaded engagement with the header 30 and communicates with the compartment 33 for conveying fuel oil from a source of supply. A similar conduit 36 is arranged in threaded engagement with the header 30 and communicates with the compartment 35 for the egress therethrough of the fuel oil after it has been heated in the shell 20.

The heating unit embodies a first set or plurality of U-shaped tubes 37 that extend longitudinally through the shell 20. The tubes 37 extend longitudinally through the shell 20 and the lower end of the tubes 37 extend through one of the openings 25 in the body member 23 through one of the openings 38 in the cap 26 so that the lower end of the tube 37 communicates with the compartment 33 while the upper end of the tubes 37 are arranged in communication with the other

compartment 34 in the header 30, as shown in Figure 4. The heating unit further includes a second set or plurality of U-shaped tubes 39 which are of a slightly larger diameter than the tubes 37. The tubes 37 and 39 are each fabricated of a material having a high coefficient of heat transmission, such as copper, and one of the tubes 37 is arranged in spaced concentric relation within each of the tubes 39. Thus, the tubes 37 and 39 coact to define a space 40 therebetween. The ends of the tubes 37 terminate in the openings 25 in the template 23 and the ends of the tubes 39 are arranged in communication with the compartments 33 and 34. A bushing 10 is secured to the shell 20 and a conduit 11 is arranged in threaded engagement with the bushing 10, the conduit 11 serving to convey the primary heat medium, such as hot water or steam from a source of supply to the interior of the shell 20 for heating the fuel oil in the tubes 37. A second bushing 12 is secured to the shell 20 and a conduit 13 is connected to the bushing 12 whereby the heating medium can be conveyed away from the shell 20. A means is provided for supporting the preheater and this means comprises a plurality of pipes or uprights 14 and 15 which are arranged in threaded engagement with collars or bushings 16 and 17, the bushings 16 and 17 being secured to the exterior surface of the shell 20. A base 18 is connected to the lower end of each of the pipes 14 and 15, Figure 7, whereby the preheater can be conveniently supported on a supporting surface.

In use, fluid to be heated, such as fuel oil, passes from a source of supply through the pipe or conduit 35, into the compartment 33, then into the lower ends of the tubes 37. This oil then circulates through the tubes 37 and finally is discharged from the upper ends thereof as shown by the arrows in Figure 4, and the heated fuel oil discharges into the compartment 34 and then out through the conduit 36 which may lead to a suitable oil burner. The primary heating medium such as hot water or steam is conveyed from a source of supply through the conduit 11 into the interior of the drum 20 and after the heating medium has traveled through the shell 20, heating medium is discharged from the shell through the conduit 13. Also, a minute quantity of fluid, such as water from a suitable source of supply passes through the conduit 28 into the chamber 27, then into the space 40 which is provided between the tubes 37 and 39. This water circulates through the space 40 and finally passes through the conduit 29 which may be connected to a sight glass. The primary purpose of the film of water in the space 40 is to provide a means for detecting leaks in the oil conveying tubes 37, since in the event of a leak in the tubes, the oil or primary heating medium will be contaminated. Thus, in the event that a leak develops in the tubes 37, oil will enter the space and intermix with the water therein, and this oil will show upon a sight gauge or glass which is connected to the conduit 29 so that the operator can observe that the heating unit needs repair or replacement.

Referring to Figure 7, there is shown a preheater which has substantially the same construction and method of operation as the preheater of Figures 1 through 6. However, in the device of Figure 7, the U-shaped tubes 37 and 39 are replaced by straight tubes 42 and 43. The preheater of Figure 7 includes a shell 41 having an annular rim or flange 44 secured to the right

end thereof. A template 45 is arranged contiguous to the flange 44 and is secured thereto by suitable securing elements, such as headed bolts 46. Formed integral with the template 45 or secured thereto is a cap 47 which is provided with a chamber 48 therein. A plurality of securing elements 49 detachably connect the cap or header 50 to the cap 47 and the header 50 coacts with the cap 47 to define a compartment 51 therein. In using the preheater of Figure 7, fuel oil is conveyed by the conduit 35 from a source of supply, the fuel oil enters the compartment 33 in the header 30, then the fuel oil to be heated passes through the tubes 42 which convey the fuel through the shell 41 to the opposite end thereof and te fuel is received in the compartment 51. This fuel then enters the upper end of the tubes 42 and again passes longitudinally through the shell 41 where it discharges into the compartment 34 and finally is conveyed through the pipe or conduit 36 to a suitable oil burner. During the passage of the oil through the tubes 42, the oil is heated by the hot water or steam which enters the shell 41 through the conduit 11. In the preheater of Figure 7, the tubes 43 are of a slightly larger diameter than the tubes 42 and are arranged in concentric relation with respect to the latter to define a space therebetween for the passage therethrough of a minute quantity of fluid, such as city water, as previously described, so that leaks in the oil conveying tubes can be readily detected.

From the foregoing it is apparent that a preheater or heat exchanger has been provided which is especially suitable for preheating oils for supply to various kinds of oil burners, the preheater being constructed so that contamination of the fuel oil or the primary heat medium such as hot water or steam is prevented in the event that a leak develops in the oil circulating tubes. Further, the shell 20 or 41 of the preheater may be entirely eliminated and the sets of concentric tubes may be installed directly in a steam boiler so as to effect an economy in heating costs. Also, baffles may be installed over the tubes 39 or 43 in order to increase the surface area over which the heating medium travels. The concentric tubes can be made of any suitable material, such as copper, aluminum or steel. Further, instead of having the oil circulating through the inner tubes, the oil can be made to circulate through the shell of the preheater and the heating medium and city water can be circulated through the inner tubes and through the space between the concentric tubes as desired.

The heating unit can also be positioned directly in a fuel oil tank. The arrangement of the straight tubes 42 and 43 in Figure 7, rather than the U-shaped tubes of Figures 1 through 6 reduces the film resistance of the oil circulating therethrough and also increases the turbulence of the circulating fluid. The preheater of the present invention thus serves to prevent contamination of the fuel oil by the heating medium or vice versa. Further, this preheater is constructed so that the heat lost is at a minimum whereby the cost of heating the fuel will be at a minimum. By constructing the preheater as previously described, it will be impossible for the oil to become intermixed with the boiler water of the preheater in case of breakage or leakage of one of the oil carrying tubes or coils. Further, the preheater of the present invention enables the user to burn less expensive oil in the burner. The preheater requires a minimum amount of in-

stallation space and either horizontal or vertical installation is possible with equal efficiency, and the complete preheater may be withdrawn from the shell for inspection and cleaning. The space between the concentric sets of tubes is very small so that the amount of water circulating therethrough is also very small whereby there will be a high heat transfer between the heating medium and the fuel oil. By a proper arrangement of the shape of the tubes of the preheater, the preheater can be installed in a domestic heating system.

What I claim:

1. In a preheater, a shell provided with an open end, an annular flange arranged adjacent to the open end of said shell and secured thereto, a body member secured to said flange for closing the open end of said shell, said body member having a chamber therein, conduit means connected to said chamber for the ingress and egress therethrough of fluid, said conduit means comprising a first conduit extending through said body member for conveying fluid from a source of supply to said chamber, and a second conduit extending to said body member and adapted to convey fluid from the chamber to a sight glass, there being a plurality of spaced openings in said body member, a header releasably connected to said body member, a partition arranged in said header and coacting with the latter to define a pair of compartments, a first set of U-shaped tubes of different sizes extending longitudinally through said shell and through the openings in said body member, the lower ends of said tubes being arranged in communication with one of said compartments and the upper ends of said tubes being arranged in communication with the other of said compartments, conduit means communicating with said compartments for the ingress and egress therethrough of the fluid being heated, a second set of U-shaped tubes extending longitudinally through said shell and each having an end communicating with said chamber, each of the tubes of said first set being arranged in concentric relation with respect to a corresponding tube of said second set and defining a space therebetween for the circulation therethrough of the fluid from said chamber, conduit means connected to said shell for the conveyance therethrough of a heating medium, a plurality of bushings secured to the bottom of said shell, and an upright arranged in engagement with each of said bushings for supporting said preheater.

2. In a preheater, a shell provided with an open end, an annular flange arranged adjacent to the open end of said shell and secured thereto, a body member secured to said flange for closing the open end of said shell, said body member having a chamber therein, conduit means connected to said chamber for the ingress and egress therethrough of fluid, said conduit means comprising a first conduit extending through said body member for conveying fluid from a source of supply to said chamber, and a second conduit extending to said body member and adapted to convey fluid from the chamber to a sight glass, there being a plurality of spaced openings in said body member, a header releasably connected to said body member, a partition arranged in said header and coacting with the latter to define a pair of compartments, a first set of U-shaped tubes of different sizes extending longitudinally through said shell and through the openings in said body member, the lower ends of said tubes being arranged in communication with one of said compartments and the upper ends of said tubes being arranged in communication with the other of said compartments, conduit means communicating with said compartments for the ingress and egress therethrough of the fluid being heated, said last-named conduit means including a first conduit extending through said header and communicating with one of said compartments for conveying fluid to be heated from a source of supply, and a second conduit extending through said header and arranged in spaced parallel relation with respect to said last-named conduit and communicating with said second compartment for the egress therethrough of the heated fluid, a second set of U-shaped tubes extending longitudinally through said shell and each having an end communicating with said chambers, each of the tubes of the first set being arranged in concentric relation with respect to a corresponding tube of said second set and defining a space therebetween for the circulation therethrough of the fluid from said chamber, conduit means connected to said shell for the conveyance therethrough of a heating medium, a plurality of bushings secured to the bottom of said shell, and an upright arranged in engagement with each of said bushings for supporting said preheater.

SAUL HORWITZ.

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