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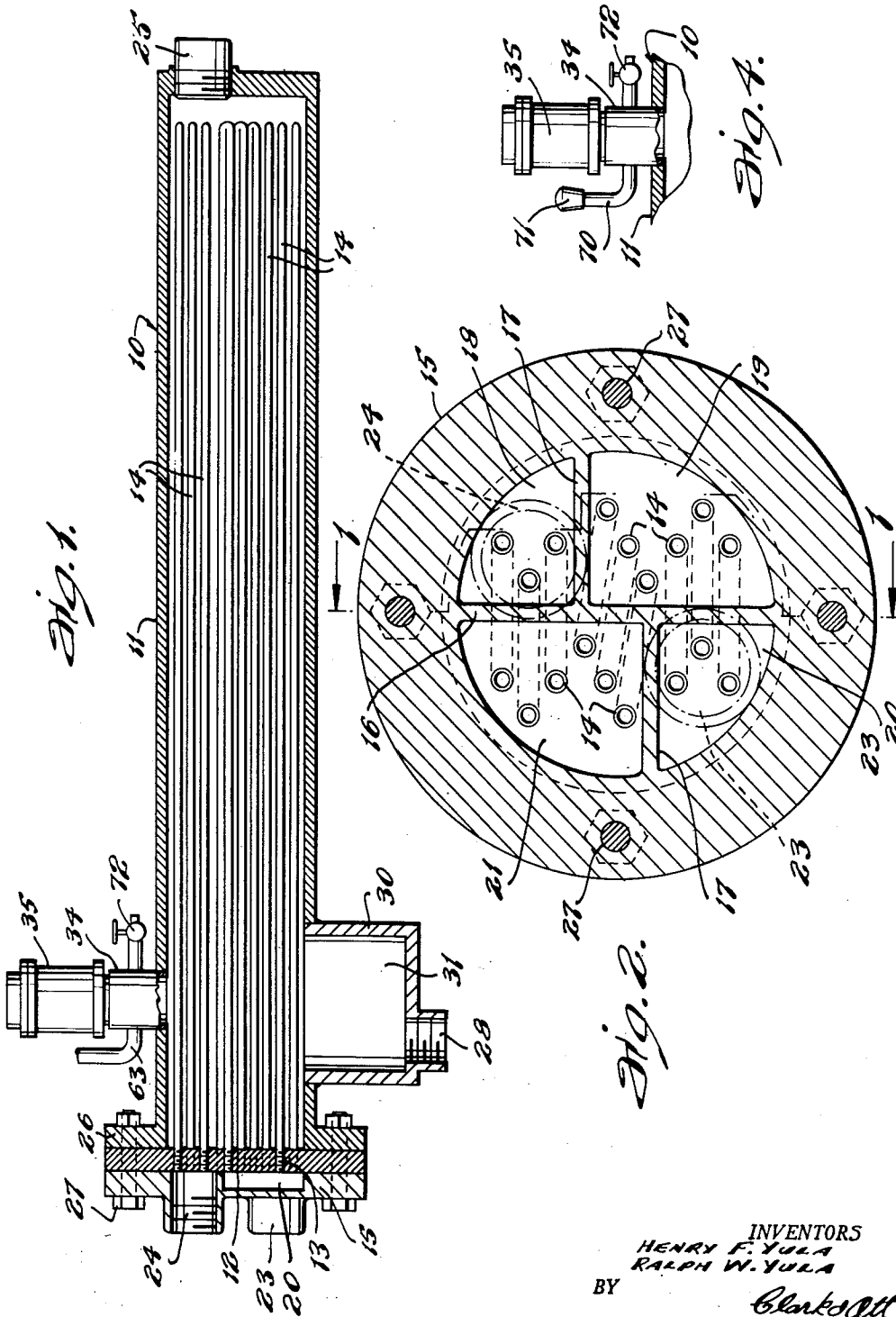
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FUEL OIL HEATER WITH MEANS FOR PREVENTING ENTRAINMENT
OF FUEL OIL WITH THE CIRCULATING MEDIUM

Filed Feb. 28, 1951

2 SHEETS—SHEET 1



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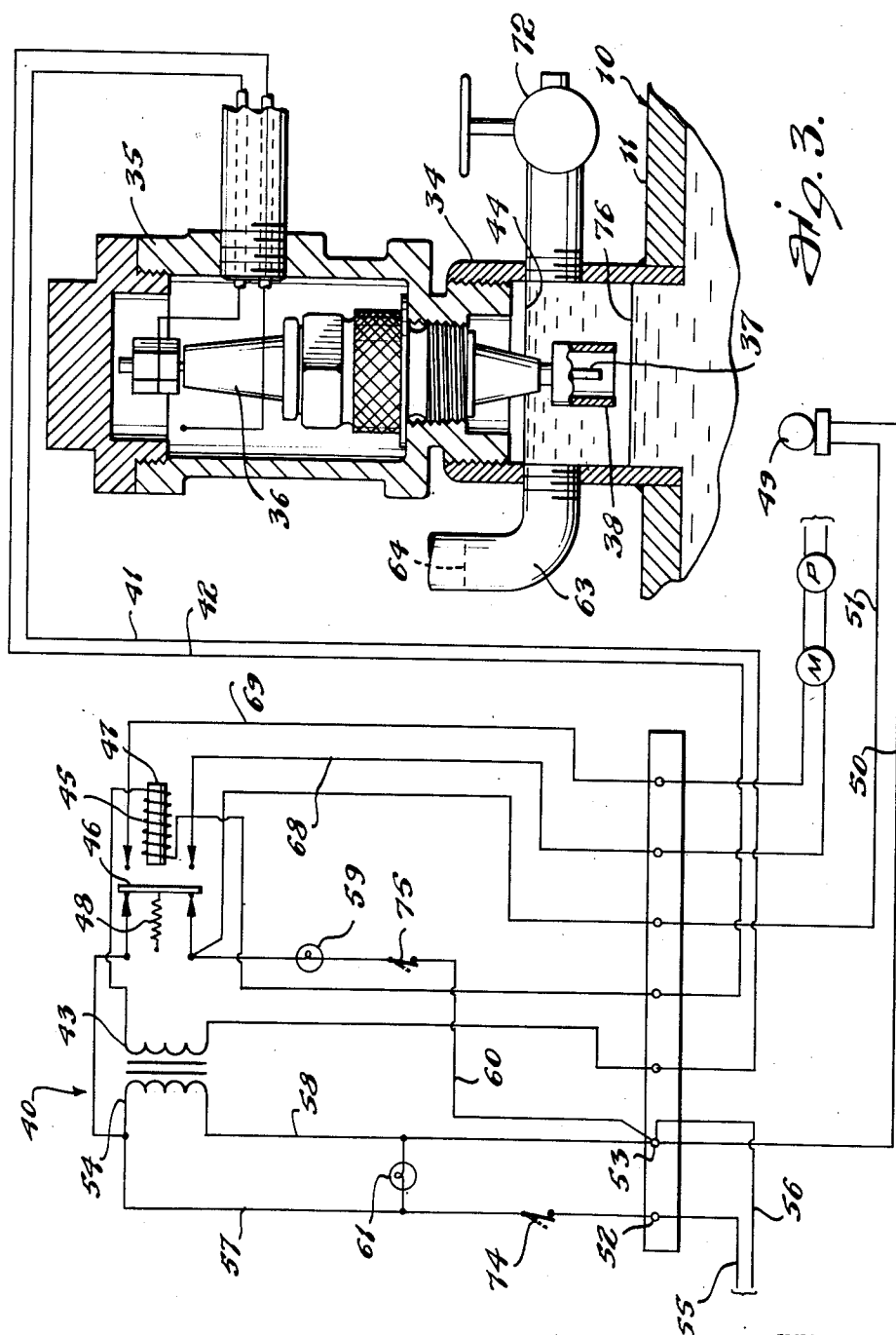


Fig. 3.

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FUEL OIL HEATER WITH MEANS FOR PREVENTING ENTRAINMENT OF FUEL OIL WITH THE CIRCULATING MEDIUM

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5 Claims. (Cl. 200—52)

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This invention relates to a fuel oil heater for preheating fuel oil as the same flows to the burner of a furnace, or boiler.

The invention comprehends a fuel oil heater which is constructed and arranged to prevent fuel oil which may escape through ruptured coils in the heater from circulating with the heating medium. Fuel oil heaters are provided with coils which are connected with the fuel oil supply leading to the burner of a furnace or boiler while the medium heated thereby such as water is conducted by piping to the fuel oil heater and circulates therethrough for heating the fuel oil circulating through the coils therein. Since the fuel oil supply flows through the coils under pressure any rupture occurring in the coils will result in fuel oil being forced into the circulating medium in the heater. A dangerous condition is thus produced since the circulating medium flows back to the furnace or boiler with the result that the fuel oil will become entrained therewith and flow into the water chamber of the furnace or boiler. In order to prevent entrainment of the fuel oil with the flow of the circulating medium means is provided for reducing the velocity of the flow of the circulating medium adjacent the discharge outlet. The specific gravity of the fuel oil being less than that of water, the oil will flow upwardly through the circulating medium to the top of the fuel oil heater when the velocity of the circulating medium is thus lessened.

Still another object of the invention is to provide means for disconnecting the electrical circuit with the motor of the fuel oil pump when fuel oil escaping from the coils in the fuel oil heater ascends to the top of the circulating medium therein.

Still another object of the invention is to provide a warning signal when the electrical circuit with the fuel oil pump is disconnected.

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

In the drawings:

Fig. 1 is a longitudinal sectional view through a fuel oil heater constructed in accordance with the invention.

Fig. 2 is a vertical sectional view taken approximately on line 2—2 of Fig. 1.

Fig. 3 is a wiring diagram of an electrical circuit including an alarm and an electrical plug shown in position on the shell for disconnecting the circuit to the motor of the fuel oil pump.

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Fig. 4 is a fragmentary view showing modified means for maintaining the desired level of the circulating water in the heater.

Referring to the drawings by characters of reference, the fuel oil heater includes a shell 10 comprising a cylindrical wall 11 which is closed at one end by a tube sheet 12 having apertures 13 opening therethrough in which are secured the ends of a plurality of U-shaped tubes 14 extending longitudinally within the shell. Arranged on the tube sheet 12 is a head 15 provided with vertical and transverse partitions 16 and 17 forming chambers 18, 19, 20 and 21 between the head and the tube sheet into which the ends of the tubes 14 open. The head is provided with an oil inlet 23 which opens into the lower left hand chamber 20 as viewed from the front and an oil outlet 24 which opens into the right hand chamber 18. The inlet and outlet 23 and 24 are adapted to be connected in the fuel oil supply line leading from the fuel oil pump P to the burner of a furnace or boiler for preheating the fuel oil before the same is delivered to the burner. The cylindrical wall 11 is provided with a peripheral flange 26 at its forward end to which the tube sheet 12 and the head 15 are secured by circumferentially spaced bolts 27.

In order to heat the fuel oil as the same passes through the tubes 14, the shell 10 is provided with an inlet 25 in the rear wall thereof through which a heated circulating medium such as hot water is admitted to the shell and flows forwardly therethrough and is discharged through a discharge outlet 28. The inlet 25 is adapted to be connected by piping with the upper end of the hot water chamber of a furnace or boiler while the outlet 28 is connected with the bottom of the hot water chamber to thereby provide a positive circulation of the hot water through the shell for heating the fuel oil circulating through the tubes 14. The circulation of the heated medium through the shell 10 also functions to entrain any fuel oil which might escape from the tubes 14 due to rupture thereof and in order to prevent the fuel oil from being discharged with the heated circulating medium through the discharge outlet 28, the shell is provided with a depending extension 30 forming a discharge chamber 31 located adjacent the forward end of the shell and from the bottom of which extends the discharge outlet 28.

The cross-sectional area of the discharge chamber 31 is approximately three times the cross-sectional area of the discharge outlet 28 whereby the velocity of the heated circulating medium will be materially lessened in the discharge chamber

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31 before discharge thereof through the discharge outlet 28. This slowing up of the flow of the heated circulating medium will permit any fuel oil entrained therewith to rise to the top of the circulating medium since the specific gravity of the fuel oil is less than that of the medium. It will be understood that any fuel oil passing with the heated circulating medium through the discharge outlet 28 will be admitted to the hot water chamber of the furnace or boiler thus producing a dangerous condition.

Located above the discharge chamber 31 and in position to be acted upon by fuel oil passing upwardly from the discharge chamber 31 is means arranged in an electrical circuit with the motor M of the fuel oil pump P for disconnecting the circuit and for actuating an alarm when fuel oil has collected on the top of the heated circulating medium. The same means consists of a tubular fitting 34 welded or otherwise affixed to the top of the shell and having a housing 35 threadedly engaged in the upper end thereof. An electric plug 36 having a metallic projection 37 provided with an electric terminal 38 is threadedly secured in the housing 35 with the terminal 38 disposed in spaced relation from the wall of the tubular fitting 34.

The plug 36 is arranged in the secondary circuit of a transformer 40 by conductor wires 41 and 42 leading to the secondary coil 43 thereof, the conductor wire 41 also being in circuit with the terminal 38 through the plug 36 and the conductor wire 42 being in circuit with the tubular fitting 34. The gap between the terminal 38 and the tubular fitting 34 is normally closed by the heated circulating medium in the shell which is normally maintained at a level indicated by the line 44 and in the event that fuel oil escapes into the shell and rises to the top thereof to displace the heated circulating medium in the fitting 34, the secondary circuit will be disconnected by the fuel oil between the terminal and the tubular fitting.

Also interposed in the secondary circuit is a relay 45 having an armature 46 which is attracted by the core 47 to bridge the conductor wires 68 and 69 leading to the motor M of the fuel oil pump P whereby the fuel oil pump is in operation to pump fuel oil through the fuel oil heater and to the burner when the secondary circuit is closed. If, however, the secondary circuit is opened by means of fuel oil rising to the top of the shell 10, the armature 46 will be moved by the spring 48 to close the circuit leading to an electrically actuated bell or alarm 49. The bell or alarm 49 is connected by a conductor wire 50 to a terminal 53 and by a conductor wire 51 to a terminal 52 through the armature 46 and one side of the primary circuit, the terminals 52 and 53 being connected with a source of current supply by conductor wires 55 and 56. The primary coil 54 of the transformer is connected to said terminals 52 and 53 by conductor wires 57 and 58. Thus when the secondary circuit is opened the armature 46 will be moved to close the circuit with the alarm 49 so as to sound the alarm and thereby indicate the presence of fuel oil in the shell 10 and to simultaneously shut off the motor M of the fuel oil pump P. An electric light 59 is arranged in parallel with the alarm 49 by a conductor wire 60 which will be lighted simultaneously with the sounding of the alarm and an electric light 61 is interposed in the primary circuit so as to indicate when the transformer is energized.

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The tubular fitting 34 has an equalizing pressure pipe 63 connected to one side thereof which extends upwardly and is then connected with the steam chamber above the hot water chamber of the furnace or boiler (not shown) to which the fuel oil is supplied. The equalizing pressure pipe 63 is normally filled with the heated circulating water to the level indicated by the reference character 64 which is the level of the water in the hot water chamber of the said furnace or boiler. This is due to the fact that the water in the hot water chamber and the circulating water in the pipe 63 will have the pressure maintained in the steam chamber on the surface thereof. It follows therefore that when fuel oil escapes from the tubes in the shell and has displaced the water in the equalizing pressure pipe 63 and the tubular fitting 34 to a point below the terminal 38, the electrical connection between the terminal 38 and the tubular fitting 34 will be broken. In the event that the heated circulating water should drop below the terminal 38, the electrical connection therebetween will also be broken so as to sound the alarm and disconnect the motor driving the fuel oil pump.

Instead of the equalizing pressure pipe 63, the tubular fitting 34 is provided with an upwardly extending pipe 70 having an air valve 71 at the top thereof which is adapted to vent air rising in the pipe to the atmosphere and to maintain the level of the heated circulating water above the terminal 38. This type of construction is employed when the circulating water is received from a furnace or boiler connected in a hot water heating system. In both forms of construction the tubular fitting 34 is provided with a globe valve 72 for exhausting the air from the shell during filling thereof with the circulating water.

The electric plug 36 is similar to the usual spark plug with the exception that the same has but one terminal as indicated by the reference character 38, which is insulated from the tubular fitting 34, the latter forming the other electrical terminal in the secondary circuit.

The tubes 14 may be arranged in any desired manner to circulate the fuel oil through the heater. As illustrated, the fuel oil enters through the inlet 23 into the chamber 20 and thence flows through certain of the tubes 14 and is admitted into the chamber 19 where it enters certain other of the tubes 14 and passes therethrough and is admitted to the chamber 21. From the chamber 21 the fuel oil enters certain other of the tubes adjacent the top of the heater and passes there-through and is discharged into the chamber 18 and thence through the outlet 24 to the burner of the furnace or boiler.

A hand switch 74 is interposed in the primary circuit and a hand switch 75 is arranged in circuit with the light 59. By means of these switches the circuit to the primary coil 54 may be opened and the circuit to the light 59 may be closed as desired.

As illustrated in Fig. 3 of the drawings, the secondary circuit is broken by means of a quantity of oil floating on top of the circulating liquid between the lines 44 and 76. This causes the spring 48 to pull the armature 46 to close the circuit with the alarm 49.

What is claimed is:

1. In a fuel oil heater, a shell having inlet and outlet openings, a plurality of tubes arranged in said shell for circulating fuel oil admitted through said inlet and discharged through said outlet, said shell having a circulating liquid inlet

at the rear end thereof for admitting heated circulating liquid for heating the fuel oil circulating in said tubes, a tubular extension depending from said shell adjacent the forward end thereof and having an outlet, and said tubular extension providing a discharge chamber for reducing the velocity of the flow of the heated circulating liquid prior to the discharge thereof through said outlet to thereby permit fuel oil which may escape from ruptures in said coils and entrained with the circulating liquid to flow to the top of the shell, and a circuit breaker carried by the shell and having spaced electrical terminals located above the discharge chamber and normally closed through the circulating liquid and said circuit breaker being adapted to be opened by fuel oil escaping from a rupture in the coils flowing to the top of the shell and displacing the liquid between said terminals.

2. In a fuel oil heater, a shell having inlet and outlet openings, a plurality of tubes arranged in said shell for circulating fuel oil admitted through said inlet and discharged through said outlet, said shell having a circulating liquid inlet for admitting heated circulating liquid for heating the fuel oil circulating in said tubes, a tubular extension depending from said shell and having an outlet, and said tubular extension providing a discharge chamber for reducing the velocity of the flow of the heated circulating liquid prior to the discharge thereof through said outlet to thereby permit fuel oil which may escape from ruptures in said coils and entrained with the circulating liquid to flow to the top of the shell, and a circuit breaker carried by the shell and having spaced electrical terminals located above the discharge chamber and normally closed through the circulating liquid and said circuit breaker being adapted to be opened by fuel oil escaping from a rupture in the coils flowing to the top of the shell and displacing the liquid between said terminals.

3. In a fuel oil heater, a shell having inlet and outlet openings, a plurality of tubes arranged in said shell for circulating fuel oil admitted through said inlet and discharged through said outlet, said shell having a circulating liquid inlet at the rear end thereof for admitting heated circulating liquid for heating the fuel oil circulating in said tubes, a tubular extension depending from said shell adjacent the forward end thereof and having an outlet, said tubular extension providing a discharge chamber for reducing the velocity of the flow of the heated circulating liquid prior to the discharge thereof through said outlet to thereby permit fuel oil which may escape from ruptures in said coils and entrained with the circulating liquid to flow to the top of the shell, a tubular extension connected with the top of said shell in alignment with said discharge chamber, and a circuit breaker located in said last mentioned tubular extension above said discharge chamber and including spaced electrical terminals normally closed through the circulating liquid and said circuit

breaker being adapted to be opened by fuel oil escaping from a rupture in the coils flowing to the top of the shell and displacing the liquid between said terminals.

4. In a fuel oil heater, a shell having inlet and outlet openings, a plurality of tubes arranged in said shell for circulating fuel oil admitted through said inlet and discharged through said outlet, said shell having a circulating liquid inlet for admitting heated circulating liquid for heating the fuel oil circulating in said tubes, a tubular extension depending from said shell and having an outlet, said tubular extension providing a discharge chamber for reducing the velocity of the flow of the heated circulating liquid prior to the discharge thereof through said outlet to thereby permit fuel oil which may escape from ruptures in said coils and entrained with the circulating liquid to flow to the top of the shell, a tubular extension connected with the top of said shell in alignment with said discharge chamber, and a circuit breaker located in said last mentioned tubular extension above said discharge chamber and including spaced electrical terminals normally closed through the circulating liquid and said circuit breaker being adapted to be opened by fuel oil escaping from a rupture in the coils flowing to the top of the shell and displacing the liquid between said terminals.

5. In a fuel oil heater, a shell having inlet and outlet openings, a plurality of tubes arranged in said shell for circulating fuel oil admitted through said inlet and discharged through said outlet, said shell having a circulating liquid inlet for admitting heated circulating liquid for heating the fuel oil circulating in said tubes, a tubular extension depending from said shell and having an outlet, said tubular extension providing a discharge chamber for reducing the velocity of the flow of the heated circulating liquid prior to the discharge thereof through said outlet to thereby permit fuel oil which may escape from ruptures in said coils and entrained with the circulating liquid to flow to the top of the shell, a tubular fitting mounted on the top of said shell above said discharge chamber, and a circuit breaker located in said tubular fitting above the discharge chamber and including spaced electrical terminals normally closed through the circulating liquid and said circuit breaker being adapted to be opened by fuel oil escaping from a rupture in the coils flowing to the top of the shell and displacing the liquid between said terminals.

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