July 30, 1946. W. S. LANDON 2,404,853

FLUID CONTROL FOR OIL BURNERS

Filed April 24, 1944 2 Sheets-Sheet 1

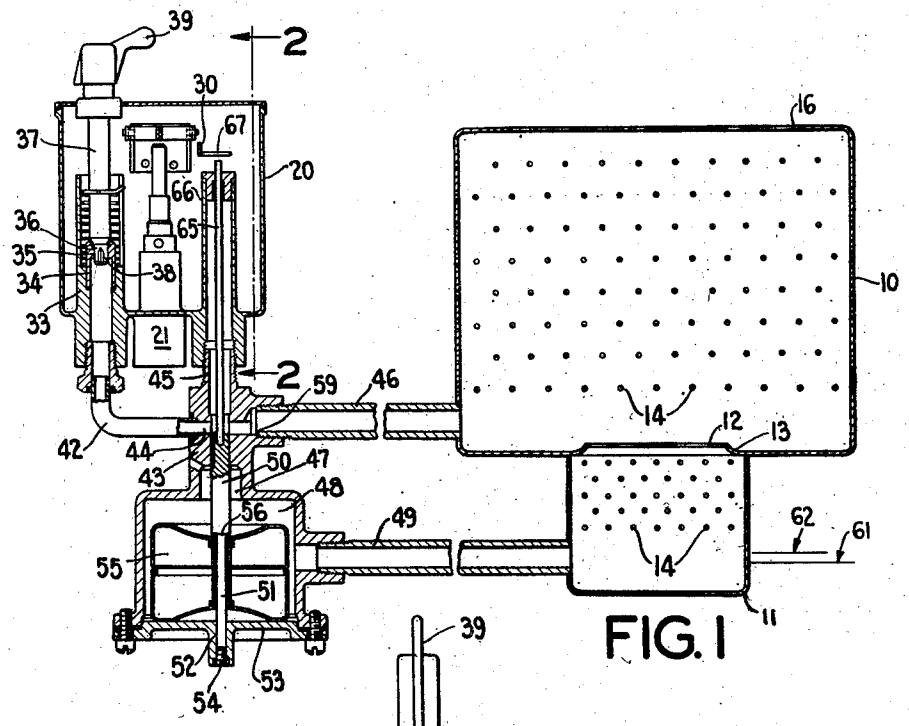


FIG. 1

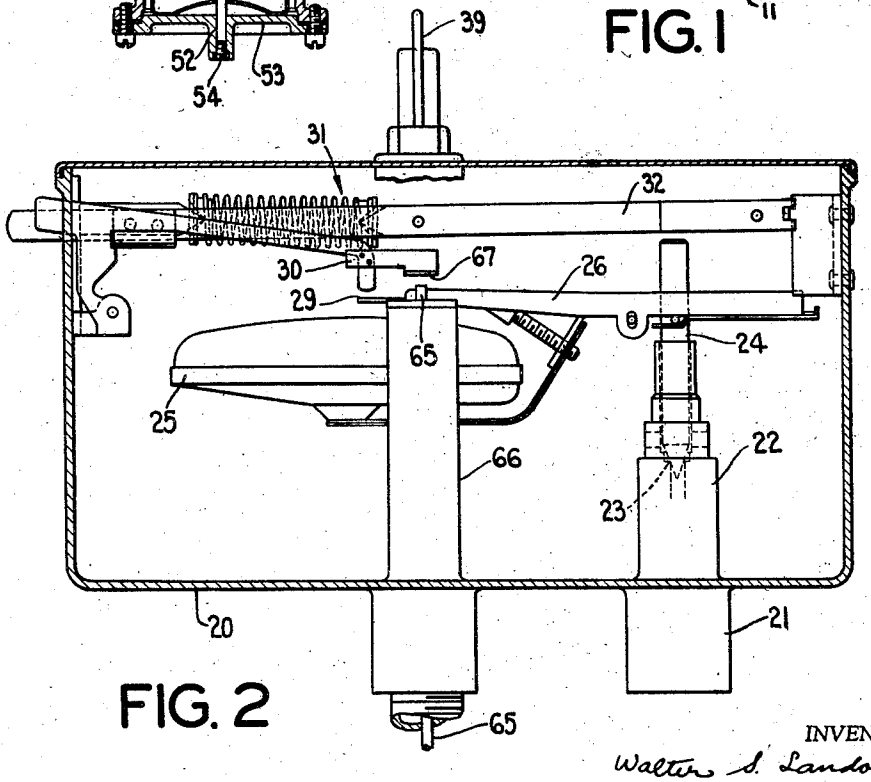


FIG. 2

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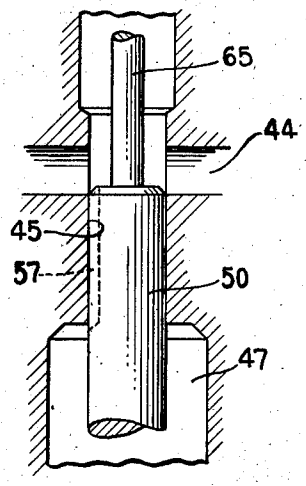


FIG. 3

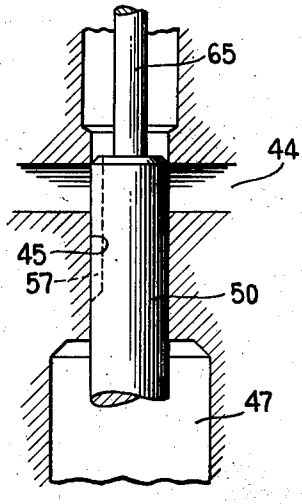


FIG. 4

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FLUID CONTROL FOR OIL BURNERS

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4 Claims. (Cl. 158—38)

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The invention relates to fuel burning apparatus, and it has particular relation to devices for controlling the flow of oil in oil burning equipment.

While the invention is adapted for use in connection with different types of oil burning equipment, one form is particularly applicable in a pot type oil burner of the multiple level type. In this design of burner using two levels, a larger pot is supplied with a larger supply of oil for high fire operation, while a smaller pot below the larger one is supplied with a smaller quantity of oil for low fire operation. In connection with this type burner, the flow of fuel to the larger and smaller pots has been controlled by valve devices, which, during normal operation of the burner, permitted a larger quantity of oil to flow to the larger pot and a smaller quantity to the smaller pot during high fire operation and only the smaller quantity of oil to continue flowing to the smaller pot during low fire operation. One objection to this manner of operation has been that the fuel did not burn satisfactorily in the smaller pot during the high fire stage. Furthermore, considerable difficulty was encountered in initially starting the burner in the event the operator failed to ignite it rather promptly when oil appeared in the pot. If ignition dit not occur promptly the burner became undesirably flooded with oil and the operator had to watch the burner and work with it for a substantial period of time before good and regular combustion occurred. It was practically impossible to ignite the burner after too much flooding occurred and then leave it immediately.

In applicant's copending application for patent, Serial No. 505,744, filed October 11, 1943, fuel burning equipment is provided which eliminates the first objection of unsatisfactory burning in the smaller pot during the high fire stage, and this objection is overcome by supplying a smaller and proper quantity of oil to the smaller pot during low fire and then automatically increasing this supply to the smaller pot in the high fire stage. It was found that by increasing the supply to the smaller pot in the high fire stage, a generally constant vaporization of the oil in the lower pot and satisfactory combustion thereof in the upper pot would occur.

The present invention obtains the advantages of the copending application and also avoids the other objection by increasing the supply to the smaller pot during high fire operation and allowing a longer period of time in which the operator may ignite the burner. In other words, with the

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present invention the burner may be ignited relatively late after the oil is fully turned on, and the operator can leave at once without any requirement of further observation. The present invention further contemplates obtaining these advantages in a single pot or receptacle type of burner. Additionally, the invention contemplates a safety control for completely cutting off the supply of oil in the event the operator does not ignite the burner within a reasonable time.

One object of the present invention therefore is to provide means for controlling the supply of fuel oil to a burner so as to permit initial ignition of the burner at any time during a reasonable period after the fuel oil is fully turned on, with the assurance that proper combustion will automatically occur without further attention on the part of the operator.

Another object of the invention is to provide an arrangement and control which will at first reduce the flow of fuel to the burner after it is ignited so as to match the combustion rate, which will then increase the flow after ignition until full and proper combustion is occurring and which will stop the flow altogether if the burner is not ignited within a predetermined period of time.

Another object of the invention is to provide equipment of this character which includes means for completely cutting off the supply of oil in the event the burner becomes flooded for any reason and especially if the operator does not ignite the burner within the reasonable period mentioned.

Another object of the invention is to provide improved control means for allowing a small quantity of oil to flow to a smaller pot in a multiple level burner in the low fire stage and for increasing the supply to the smaller pot during the high fire stage.

Another object of the invention is to provide a simple and compact arrangement for accomplishing the aforementioned results.

Other objects of the invention will become apparent from the following specification, from the drawings forming a part thereof, and from the claims hereinafter set forth.

For a better understanding of the invention reference may be had to the accompanying drawings wherein:

Figure 1 is a vertical, sectional view of a fuel burning arrangement and control apparatus constructed according to one form of the invention;

Figure 2 is a cross-sectional view taken substantially along the line 2—2 of Figure 1 with certain parts broken away for the purpose of clarity;

Figure 3 is a detail view on a large scale showing the valve position when the burner is being supplied with fuel at a full flow rate; and

Figure 4 is a view on the order of Figure 3, but showing the valve in a position where only a small quantity of fuel is supplied as in the event the burner is not ignited soon after full flow is initiated.

Referring to the Figures 1 to 4, the burner comprises a larger pot 10 and a smaller pot 11 below the larger pot and opening thereinto. The bottom wall of the larger pot has an opening 12 overlying the open upper end of the smaller pot, and such bottom wall around the opening is flared upwardly, as indicated at 13, so as to permit proper combustion, guidance of vaporized fuel, and also to provide a small dam for holding a slight level of oil in the larger pot before it can overflow into the smaller pot. Openings 14 are provided in the side walls of both pots to allow air to enter for combustion purposes. The larger pot is open at its upper end, as indicated at 16, to allow the burned gasses to escape to a flue or other connection. Air will be supplied through the openings 14 by means of suitable draft equipment.

For supplying fuel oil to the burner, a float valve casing 20 is provided having an inlet 21 which is adapted to be connected to a fuel line so that fuel oil may flow into the casing. The casing above the connection 21 has a projection 22 formed with a valve seat 23 which is adapted to cooperate with a vertically movable valve stem 24. Flow of fuel oil into the casing is controlled by vertical movement of the stem 24, and such movement is in turn controlled by a float 25 connected to a lever 26 which in turn is connected to the valve stem. The lever 26 of the float has an extension 29 disposed under a trip arm 30 forming part of a tripping device indicated generally at 31 and which includes a tripping lever 32 overlying the valve stem 24. If the float rises too high, the trip operates to strike the valve stem 24 and forcefully close it. The detailed construction of the float control and tripping device shown need not be described here, as it is substantially the same as that shown in Russel Patent No. 2,317,556.

For allowing oil to flow from the casing 20 to the burner, the casing has a tubular projection 33 extending upwardly from its bottom wall, and this projection substantially above the bottom wall has a tubular valve seat 34 provided with a cylindrical valve opening 35. The cylindrical part of the valve opening cooperates with the lower, generally cylindrical end 36 of a valve stem 37 which is adapted to be moved vertically, and for metering the flow of oil through the opening, such cylindrical part 36 has a slot 38 tapering to a V form at its upper end. When the stem 37 is in the position shown, a metered and small quantity of fuel oil is allowed to flow downwardly through the valve opening, and as an example, the quantity allowed to flow may be 2 c. c. per minute. When the valve stem 37 is raised to expose the straight part of the slot, the amount of oil allowed to flow may, as an example, be 40 c. c. per minute. No means is shown for raising and lowering the valve stem 37, but as is well understood in the art, a cam arrangement may be used, including a handle 39 on the upper end of the stem 37 for raising and lowering the stem upon turning of the handle between two limiting positions.

Oil flows through the valve opening and downwardly into a pipe 42, and the end of this pipe joins a four-way connection or valve casing 43 having intersecting openings or passageways 44 and 45 with the passageway 44 horizontal and the passageway 45 vertical. The passageway 44 is connected to the pipe 42 at one side of the connection, while at the other side it is connected to a pipe 46 in turn connected to the larger pot 10.

At its lower end the vertical passageway 45 is enlarged as indicated at 47 and then communicates with a float chamber 48 which is part of the connection 43. Substantially midway between the top and the bottom of the float chamber, a pipe 49 is connected thereto and leads to the smaller pot 11 and the connection between the pipe and the smaller pot is slightly above the bottom of the latter.

For controlling the flow of fuel oil through the connection 43, a valve stem 50 is vertically reciprocatory in the vertical passageway 45 and extends downwardly through the float chamber 48 where it has a smaller end portion 51 slidable in a vertical opening 52 forming part of a cover 53 on the lower side of the float chamber. A screw 54 in the opening 52 serves as a means of adjusting the vertical position of the stem 50. Within the chamber 48, a hollow metal float 55 is slidable on the smaller portion 51 of the stem and when the float rises sufficiently it engages a shoulder 56 at the junction of the two stem portions so as to move the stem therewith.

The stem 50 fits closely but slidably in that part of passageway 45 above the enlarged part or space 47 as best seen in Figures 3 and 4, and has an axial groove or slot 57 extending from its upper end to a point which allows the slot to be in communication with the space 47 when the stem is in its lowermost position.

The lower part of the pipe 46 provides a dam or wall of slight height, as indicated at 59, in the opening 44, so that oil flowing through the passageway 44 cannot enter the pipe 46 until the oil level or rate of flow is high enough to flow over the pipe end. Thi relationship is effected by having the center of the pipe 46 above the center of the passageway 44.

With the valve stem 37 in its lower position so that a small quantity of fuel such as 2 c. c. is flowing downwardly, the fuel will flow through the pipe 42 and passageway 44 until it reaches the vertical passageway 45, and then it will flow downwardly through the slot 57 as seen in Figure 3 and into the float chamber 48. When the level in the float chamber 48 is high enough the fuel will then flow into the lower pot 11, and if the latter is ignited, the stated amount of fuel will be constantly supplied so as to maintain low fire. Under these conditions, no oil will flow through the pipe 46 primarily because the oil will flow downwardly through the slot 57 before it can flow into the pipe 46, and furthermore, because the oil would have to be high enough in the passageway 44 to flow over the lower pipe edge 59.

Now, if the operator wants the burner to operate at high fire, the valve stem 37 will be raised to allow, for instance, 40 c. c. to flow downwardly through the pipe 42. With this set of conditions, the oil will flow on through the passageway 44 and into the pipe 46 and then into the larger pot where it will ignite due to the flame in the lower pot. Some additional oil will flow downwardly through the slot 57 due to the greater flow and height of fuel in pipe 42. It may be desirable

to so arrange these conditions that twice as much fuel oil, that is 4 c. c., will flow downwardly through the slot 57, while the remainder, or 36 c. c., will flow into the larger pot. As stated earlier, this additional quantity of fuel oil in the lower pot during combustion in the upper pot is definitely desirable to provide for even combustion.

In the event the operator is starting the fire and he raises the valve stem 37 fully so as to allow full flow of oil into the burner and fails to ignite the burner promptly when oil flows into the pots, the level of the fuel will rise in the lower pot 11 and in the float chamber 48. When the level of the fuel oil in the pot 11 rises a small amount, the float 55 will pick up the valve stem 50 and raise it, and upon sufficient movement of the float the stem will move entirely across the passageway 44 and close it. During this movement, the upper end of the stem gradually closes off the oil flow to the pipe 46 leading to the upper pot 10.

The general operation of the burner may best be approached by considering two different conditions. In the first place, if the burner is operating normally it will be governed by the control 39. If the control 39 is in a position for low fire operation, oil will be flowing downwardly through pipe 42 at a low rate of about 2 c. c. per minute, through the slot 57 in the valve stem 50, into the float chamber 48, through pipe 49 and into the smaller pot 11. Oil will not flow through the pipe 46 into the larger pot 10 and hence after the oil in the larger pot has burned following the previous high fire operation the burning will be confined to the smaller pot 11 and a low fire will be obtained.

Now, if the operator moves the control 39 so as to allow full flow of oil through pipe 42, the oil will flow on through the passageway 44 into the larger pot and will be ignited from the smaller pot. At the same time, a slightly greater quantity of oil will flow through the slot 57 due to the greater supply in pipe 42 and greater head of oil. This increased quantity of oil flowing through the slot 57 will supply a larger quantity, for instance 4 c. c., as indicated previously, to the smaller pot 11. Good combustion will be obtained under these circumstances.

The foregoing concerns normal operation. If the operator, however, should turn the control 39 to high fire or full flow and then not ignite the burner promptly, the present invention would become operative to prevent an undesirable or flooded condition for a substantial period of time and allow the operator more time in which to ignite the burner without incurring any undesirable results. Assume then, that the operator does not ignite the burner promptly after turning the control for full flow. The oil would flow into the large pot 10 and soon overflow therein into the smaller pot 11 and raise the level of the oil in the smaller pot and in the chamber 48. As soon as the level in the float chamber 48 rises to the line 61, for instance, as seen in Figure 1, the float 55 will begin to move the valve stem 50 upwardly thereby gradually cutting off the supply of oil through the passage 44. The level of the oil in chamber 48 will continue to rise but progressively slower as the oil is gradually cut off by the moving valve stem and upon the level of the oil reaching the line 62, for instance, the valve stem 50 will have moved into the position shown by Figure 4. With the valve stem in this position, the supply of oil is cut off.

The existing condition now is that the lower pot 11 has oil up to the line 62, but this level is still not so high as to prevent ignition and proper combustion. It should be understood that the levels 61 and 62 may be varied and that the valve and float movements may be so arranged and related as to obtain a desired level 62 with the valve in the position as seen in Figure 4.

Up to the time that the valve reaches the position shown by Figure 4, and even thereafter, the burner is not so flooded as to prevent proper ignition and combustion. Hence, at any time during this period, the operator may throw in a lighted piece of paper, or the like, and then leave the burner alone with the assurance that combustion will occur and continue in the proper manner. After burning begins, the temperature will increase thereby resulting in better vaporization of fuel and as more and more oil is consumed, the float 55 will gradually drop and finally a full flow will occur with a part, as mentioned previously, going to the lower pot and a larger portion going to the upper pot.

If the operator should not ignite the burner within a reasonable period of time, a flooded condition might eventually occur in the event of leakage past the valve stem and in order to prevent this flooded condition, the upper end of the valve stem 50 is in engagement with a stem 65 extending on upwardly through a tubular projection 66 in the casing 12 where it is engageable with a projection 67 on the trip element 30. This trip element when pushed upwardly, will completely cut off the supply of oil entering the casing 20 and is of such character that it must be reset manually before the supply of fuel again is turned on.

In general, it will be apparent that if the burner is not ignited after the fuel is turned on or if combustion is poor or improper for any reason, the float valve will gradually cut off or decrease the supply of oil and finally cut it off altogether if the concentration of unconsumed oil reaches a certain amount or level. If consumption and vaporization should be poor, as it might be for a period of time after initial ignition, the supply would be gradually reduced until the oil supplied approximated that consumed and then as vaporization and consumption increased, the supply would increase and keep pace with the consumption until a predetermined rate of flow existed along with uniform and good vaporization and consumption. In the event the burner were not ignited, the oil would be finally shut off but after that if it were ignited, the rate of flow would gradually increase in accordance with vaporization and consumption until the predetermined rate of flow would occur.

Although the invention has been illustrated and described in detail, it will be apparent to those skilled in the art that various modifications may be made without departing from the scope of the appended claims.

What is claimed is:

1. In a liquid fuel burning apparatus having a constant level device for supplying fuel to a main burner pot and to a low fire burner pot opening upwardly through the bottom wall of said main pot so that liquid fuel can overflow from said main pot into said low fire pot, safety means controlling the flow of liquid fuel from the constant level device to both of said pots and comprising a float chamber, a conduit connecting said float chamber to the low fire pot for flow from said float chamber to the low fire pot and for

flow from the low fire pot to said float chamber so that the liquid level in said float chamber will correspond to the level in the low fire pot, a valve casing mounted on said float chamber and having an inlet and a plurality of outlets, a conduit connecting said inlet to the outlet of the constant level device, one of said valve casing outlets discharging into said float chamber, a conduit connecting another of said valve casing outlets to said main pot, a valve controlling said one outlet, a valve controlling said other outlet, and a float in said float chamber and connected to said valves and operable at a predetermined liquid level in the low fire pot to close said first-named valve and at a higher liquid level in said low fire pot to close said second-named valve.

2. In a liquid fuel burning apparatus having a constant level device for supplying fuel to a main burner pot and to a low fire burner pot opening upwardly through the bottom wall of said main pot so that liquid fuel can overflow from said main pot into said low fire pot, safety means controlling the flow of liquid fuel from the constant level device to both of said pots and comprising a float chamber, a conduit connecting said float chamber to the low fire pot for flow from said float chamber to the low fire pot and for flow from the low fire pot to said float chamber so that the liquid level in said float chamber will correspond to the level in the low fire pot, a valve casing mounted on said float chamber and having an inlet and a laterally directed outlet and a downwardly directed outlet discharging into said float chamber, a conduit connecting said inlet to the outlet of the constant level device, a conduit connecting said lateral outlet to the main pot, a valve controlling said downwardly directed outlet, a valve controlling said lateral outlet, and a float in said float chamber and connected to said valves and operable at a predetermined liquid level in the low fire pot to close said first-named valve and at a higher liquid level in said low fire pot to close said second-named valve.

3. In a liquid fuel burning apparatus having a constant level device operable to supply liquid fuel to a main burner pot and to a low fire burner pot opening upwardly through the bottom of the main pot so that liquid fuel can overflow from the main pot into the low fire pot, safety means receiving liquid fuel from the constant level device and controlling flow of the liquid fuel to both of the burner pots and comprising a float chamber communicating with the low fire pot

such that increase of liquid level in the low fire pot above a predetermined level will correspondingly increase the level in said float chamber, a valve casing mounted on said float chamber and having intersecting passageways, a valve rod reciprocally fitting one of said passageways and operable on movement to interrupt flow through the other passageway, said other passageway having one end connected to the outlet of the constant level device and having its other end connected to the main pot, said rod having a slot for flow to said float chamber, said slot having an end wall movable into said one passageway to close off flow to said float chamber, and a float in said float chamber operable to move said valve rod to close first said slot and then said other passageway.

4. In a liquid fuel burning apparatus having a constant level device for supplying fuel to a main burner pot and to a low fire pot opening upwardly through the bottom of said main pot so that fuel can overflow from said main pot into said low fire pot, safety means for controlling fuel flow from said constant level device to said pots and comprising a float chamber, a conduit connecting said float chamber to said low fire pot, a valve casing mounted on top of said float chamber and having a horizontal passageway and an intersecting vertical passageway discharging downwardly into said float chamber, a valve rod reciprocally fitting said vertical passageway and extending downward into said float chamber, a float in said float chamber and engageable with said rod to move it upwardly, said rod having a longitudinal slot for flow through said vertical passageway into said float chamber, said slot having an end wall movable into said vertical passageway to close said slot, said rod having its upper end terminating adjacent the lower wall of said horizontal passageway and movable upwardly by said float to close said horizontal passageway, a conduit connecting one end of said horizontal passageway to the outlet of said constant level device, a conduit connecting the other end of said horizontal passageway to said main pot, said float chamber being positioned laterally of said low fire pot such that upon a predetermined level in said low fire pot said float will lift said rod to close said slot and at a higher level in said low fire pot will lift said rod to close said horizontal passageway.

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