This invention relates to oil burning systems and has particular reference to the range-type of oil burner.

A range-type oil burner usually comprises a base having an open top fuel channel with perforated outer and inner tubes surrounding the open top of the channel and standing thereabove and providing between them a combustion space in which the vapors of the fuel in the fuel channel are adapted to burn. The fuel channel is supplied with fuel, usually oil, from a supply reservoir or pool, the level of fuel in which is maintained constant; and the fuel channel of the burner is so positioned with respect to the level of oil in the fuel reservoir that oil can not rise in the fuel channel above the top of the reservoir and above the oil level in the reservoir. Oil is supplied to the burner by a pipe extended between the reservoir and the burner, the pipe being below the fuel level and opening into the burner through the bottom thereof, or, more commonly, the pipe opens into the lower part of a short vertical pipe, or "carbon leg", the upper end of which opens into the fuel channel of the burner. A control valve is interposed in the pipe, usually at the lowest point thereof, for the purpose of regulating the amount of oil supplied to the burner. I have found, however, that the control valve has very little effect in regulating the amount of oil and that the rate of flow of oil is almost the same when the valve is nearly closed as when it is fully open, when the burner is hot and in steady operation. Hence the operation of the burner can not be regulated as closely as is desired. I have found that the reason for the poor regulation is due to the manner in which the oil is vaporized in the burner. When the burner is first started in operation the oil stands in the fuel channel to the level of oil in the supply reservoir. This oil, however, is burned away shortly after it is ignited so that when the burner is in steady operation and thus is hot the incoming oil is vaporized in the oil duct, or carbon leg, before it gets into the fuel channel. The rate of flow of oil, for any valve setting, depends upon the difference in elevation between the free surface of the oil in the supply reservoir and the free surface of oil at the burner. If now the oil valve is partly closed so as to reduce the rate of flow of oil, the oil is vaporized farther down the tube, it being understood that ample heat is conducted into the tube from the burner base to vaporize the oil. This lowered position of the vaporizing surface of the oil increases the effective head of oil that causes the flow of oil through the valve so that, although the area of the valve opening is decreased the increase in head is such that the quantity of oil that passes through the valve in a unit of time is not changed much. A further closing of the valve causes the level of the vaporizing oil standing in the carbon leg to drop thereby further increasing the difference in the level of oil in the carbon leg and the reservoir and further increases the head of oil that causes the oil to flow through the valve. The vapor passage above the oil is freely open so that there is little if any back pressure of vapor on the vaporizing oil. Hence the manipulation of the valve has little effect in regulating the rate of flow of oil and consequently the oil consumption of the burner so that the burner in practice operates at about the same capacity for any open position of the valve.

It is an object of the present invention to provide an oil burner system and particularly an oil supply system for range-type burners wherein the rate of flow of oil into the burner can be regulated closely at will and wherein the temperature of the burner or the position of the level of the vaporizing oil does not influence the rate of flow of oil through the control valve to the burner.

A further object of the present invention consists in maintaining a constant difference in the level of oil on both sides of the control valve at all times regardless of the condition of operation of the burner.

Another object of the invention is in providing an oil duct from the constant level oil supply reservoir to the burner, said duct having a part that is freely vented to the atmosphere and is lower than the oil level of the supply reservoir and above the normal position of the free vaporizing surface of the oil at the operating burner, and in positioning the regulating valve in said duct below said elevated part and between it and the supply reservoir, whereby the head of oil on opposite sides of the valve must be constant regardless of a variable elevation of the vaporizing surface of the oil at the burner.

In carrying out my invention I feed the oil from a constant level pool or reservoir through the control valve and into another reservoir where the pool of oil is at a constant level that is below that of the supply pool. Oil is arranged to overflow from the second pool into an overflow or collecting chamber and thence run freely into the burner. With this arrangement the head of oil on the valve is constant regardless of the operation of the burner as the levels of the
two pools are maintained constant by structural members. Hence the rate of flow of oil through the valve and to the burner can be closely regulated by the valve. Such a manner of feeding oil comprises an object of the present invention. A yet further object of the present invention is the provision of improved means for priming the oil burner so that it can be supplied instantly with the full amount of oil necessary to heat the burner up to an operating temperature.

A further object of the invention is the provision of oil supply apparatus having a constant level oil reservoir, a priming chamber fed through a valve from the reservoir and in which oil is maintained at a constant level that is lower than that of the supply reservoir and which overflows into the burner, and priming apparatus including a displacement member that is adapted to displace oil in the priming chamber and to cause the displaced oil to overflow into the burner so as to charge the burner instantly with the starting amount of oil.

A range oil burner usually is provided with two independently operable burner units and accordingly I provide a fuel supply apparatus including two separate valves and two separate priming members with interlocking mechanism so arranged that a priming member can not be operated when the valve associated therewith is open. Since the two burner units usually are in close proximity in the same fire box, if one burner is in operation and the other is not, the unoperating burner may be hot and above the vaporizing point of the oil, due to the heat received by it from the operating burner and, under such condition, it may be dangerous to prime the idle burner. Hence a further object of the invention is the provision of locking mechanism between the valves and the priming members so arranged that no priming member can be operated to prime its burner when any valve is in open position.

A further object is generally to improve the construction and operation of oil burners and fuel supply systems and apparatus therefor.

Fig. 1 is a side elevation of an oil burning system embodying the present invention.

Fig. 2 is a plan view of the oil supply apparatus of Fig. 1.

Fig. 3 is a sectional elevation taken along line 3–3 of Fig. 2.

Fig. 4 is a sectional detail taken along line 4–4 of Fig. 3.

Fig. 5 is a sectional detail taken along line 5–5 of Fig. 3.

Fig. 6 is a sectional detail taken along line 6–6 of Fig. 3.

Fig. 7 is a detail taken generally along line 3–3 of Fig. 2 and illustrating particularly the interlock between the regulating valve and the priming plunger.

The oil burner comprising a part of the present invention is herein illustrated as of the range type comprising two separate and identical burners 10 and 12. Each burner includes a base 14 having an open top fuel chamber, usually in the form of an annular open top fuel channel 15, and spaced inner and outer perforated combustion tubest 16 and 20 which surround the open top of the fuel channel and extend thereabove and provide between them a combustion space in which the fuel vapor in the fuel channel burns. A liquid fuel, usually oil, is supplied to each burner through separate pipes 21 and 22, each pipe being freely in communication with the bottom of the fuel channel and being connected thereto usually by a vertical pipe or the equivalent 24, the upper end of which is screw-threaded into the bottom wall of the burner base and is connected at its lower end with one of the fuel pipes. The vertical passage in the pipe 24 is usually closed at its lower end by a removable plug 26 which is adapted to be removed for the purpose of cleaning out the carbon deposit that forms from time to time in said pipe. Said plug is usually termed a "carbon leg" and it is in this pipe or the equivalent thereof that the free surface of the oil stands and where vaporization of the oil usually takes place when the burner is in steady operation. Oil is supplied to the burner from a constant level oil reservoir 30 which is supported by a standard 32 at such a height that the shown the oil therein is always below the top and above the bottom of the fuel channel 16 in the burner. The constant level oil supply reservoir here shown is generally rectangular and is opened at the top and has a cylindrical side extension 32 located above the standard 32 and in which the neck of an inverted tank or oil bottle 34 is received, the lip of the neck being supported on the top faces of ledges 35. Oil from the bottle automatically flows into the oil reservoir 28 in the usual manner to constantly maintain the level of oil at the level of the top faces of the ribs 35 or at the line 36, Fig. 3.

Heretofore the oil has been conducted from the oil reservoir 28 through a control valve to the oil burner. In accordance with the present invention, however, the oil passes from the oil reservoir through head-controlling and priming apparatus and thence to the burner. Said apparatus comprises a generally rectangular casing 38 open at the top and carried by the oil supply reservoir 28. For some purposes the casing and the oil reservoir may be integral but as here shown the casing is a separate structure attached removably to the oil reservoir by a bracket plate 40 that is fixed to the rear vertical wall 42 of the casing and has at its upper end and spaced therefrom depending fingers 44 between which and the bracket the vertical side wall 46 of the oil reservoir is received. The fingers 44 can have one or more set screws 48 screw-threaded therein and bearing against the reservoir wall 46 whereby to clamp the casing securely yet removably thereto. The construction of the oil reservoir 28 is symmetrical so far as its opposite end walls are concerned and the casing 38 can be secured in the manner described to either end wall, which is sometimes an advantage. The bracket 40 has a plate 50 hinged thereto which overlies and rests upon the open top of and constitutes a cover for the oil reservoir.

The casing 38 is provided with two separate constant level overflow primary and timing reservoirs or wells 51 and 52 by walls which include the vertical side walls 54 and 56 and the intermediate vertical wall 58 which separates said reservoirs into compartments. The front wall of the casing is provided with a forwardly directed valve housing 60 having end walls 62 and 64, see especially Fig. 4, which are in effect continuations of the side walls 54 and 56 and an intermediate wall 58 which is a continuation of the intermediate partition wall 58. Said walls 62, 64 and 66 are provided with aligned bosses 68, 70 and 72 which have aligned cylindrical openings therein. A cylindrical valve casing 74 is forced into the openings in the bosses 68 and 70 which is an oil tight fit therein. A similar cylindrical valve casing 76
is forced into the openings in the bosses 72 and 76 and is an oil tight fit therein. The confronting ends of the valve casings 74 and 76 are spaced apart to provide an oil entrance chamber 78 therebetween. Each valve is provided with a valve stem 80 which has an enlarged intermediate screw-threaded portion 92 that is screw-threaded in the valve casing and, when the valve stem is rotated a predetermined amount in an opening direction, abuts against the end of a ring 84 that is screw-threaded in the casing and thereby prevents further opening of the valve. Said ring can be held in various axially displaced positions whereby to adjust the valve stem for any selected extent of opening movement thereof. The inner end of the valve casing is provided with an entrance 86 for the oil and the inner end of the valve stem is provided with a conical seat and a V-shaped metering gate 88 which accurately determines the area of the oil passage through the valve for any setting of the valve stem. Each valve casing has a lateral outlet passage 90 from which the oil passing through the valve from the central chamber 78 flows into a separate one of the chambers 51 and 52. Oil is conducted from the constant level supply reservoir 28 to the oil entrance chamber 78 of the valves through a pipe 92. Each valve stem is provided with a knob 94 by which the valve can be manually opened and the knob has a drum 96 provided with a series of numbers or marks that register with the end of a name plate or other suitable witness means 98 by which the extent of opening of the valve can be readily adjusted and inspected.

The constant level reservoirs 51 and 52 are provided with rear end walls 100 and 102 that constitute dams over the horizontal tops of which the oil in the reservoirs is adapted to flow and fall freely into separate overflow reservoirs or chambers 104 and 106 located behind said dams 100 and 102 and in front of the end wall 42 of the casing. The pipes 21 and 22 connected with the burners 10 and 12 are in communication with said reservoirs 104, 106 through outlet passages 108 in the bottom walls thereof, and the oil in said reservoirs is adapted to flow freely through said pipes and into the burner pipe being free from valves or other restrictions.

The tops of the dams 100 and 102 are above the center line of the valves and the bottoms of the fuel chambers 16 in the burners and are lower than the level of oil in the constant level reservoir 28. Hence when the valves are open oil can flow from the constant level reservoir 28 through the valves and into the chambers 51 and 52 and thence over the dams and to the burners. The level of oil in the chambers 51 and 52 is constant at the level 109 and the level of oil in the constant level reservoir is constant at the level 36. Oil can run down the pipes 21 and 22 faster than oil can pass through the valves in their maximum open condition, which is determined by the maximum amount of oil that the burner can burn safely. Hence oil cannot flow in the overflow reservoirs except in the case of the upper ends of the bosses 108 and 109, or the difference between the levels 36 and 109. This head is independent of any setting of the valves and hence the head of oil that causes a flow of oil through the valves is constant regardless of any setting of the valves and regardless of any condition of operation of the burners and the elevation of the free vaporizing surface of the oil at the burners. Thus the flow of oil to the burners varies only with variations in setting of the valves and is constant for any valve setting under all conditions of operation of the burner. Thus the amount of oil consumed by the burner in any given time, and the heat generated by the burner, can be accurately adjusted throughout the entire range of fuel consumption within the capabilities of the burner. The valve can be set for a certain rate of fuel consumption when the burner is first started in operation, and the valves do not have to be reset after the burner becomes hot, since the rate of flow of oil through the valves is in no way influenced by the temperature of the burner.

The above described system cannot become air bound, a trouble that has been common heretofore. The tops of the overflow reservoirs and chambers are freely vented to the atmosphere, as will be apparent hereinafter, and the ends of the oil pipes 22 and 24 are at all times freely open both at the casing 36 and at the burners and are free from intermediate obstructions so that there are no small passages or pockets in which air can collect and be retained to obstruct the flow of oil. Thus air in the pipes can readily escape. The valves are always under oil even though the level of oil in the constant supply reservoir 28 should drop below its normal level due to the exhaustion of oil in the bottle 34 and hence once the valves have been filled with oil, no air can enter and collect in the valves. The oil passages through the valves can be made larger than has been customary heretofore and the oil level on both sides of the valves is constant and the head is lower than usual so that there is little possibility of dirt or other obstructions lodging in the oil passages of the valves.

The overflow reservoirs 51 and 52 also constitute priming and timing reservoirs for the burners and are provided with separate displacement members 110 and 112 which are adapted to be moved into the oil in said reservoirs to displace oil therein and to cause the displaced oil to overflow the dams and to run into the burners. The displacement members comprise shells of rectangular cross-section loosely disposed in the reservoirs 51 and 52 between the walls 54, 58, and 66, and being parallel and close to said walls so that their freedom for angular movement is restricted. Said members are provided with vertical stems 114, 116 which are freely slideable through bosses 118, 120 in a cover plate 122 for the casing and at their upper ends are terminated in knobs 124 and 126. Said members are hollow and are open at the bottoms but are otherwise tight and are provided with internal bosses 128 and 130 which are located within the upper ends of helical springs 132, 134, the bottom ends of which bear upon the bottom walls of the chambers 51, 52 and serve to hold the displacement members yielidngly in elevated position in the upper ends of said reservoirs and against the cover plate. The lower ends of the displacement members are herein illustrated as being disposed normally just under the level of oil in said chambers 51, 52, although the precise elevated position of the displacement members is of no particular importance. The volume of oil displaced by a displacement member is adapted to be sufficient to supply the burner with enough oil.
to heat the burner to normal operating temperature and to burn long enough for a priming reservoir to be refilled with oil and oil to overflow and run into the burner.

5 The manner of starting a burner in operation is essentially as follows: The priming reservoir normally is filled with oil as the result of a previous operation of the burner and the valve associated with the priming reservoir is closed. The displacement member is moved downwardly into the oil in the priming reservoir and causes the displaced oil to run over the dam and into the burner. The displacement member is then returned to the oil level in the priming reservoir and then drops below the dam to a level dependent upon the amount of oil displaced. The oil in the burner is then ignited and begins to heat up the burner. The oil valve is then opened to whatever extent is desired and oil flows from the supply reservoir into the partially empty priming reservoir and refills it completely to overflowing before the priming charge of oil in the burner has been entirely consumed. It will be noted that the level of oil in the partially empty priming reservoir is considerably below its normal level immediately after the displacement member has been elevated out of the oil following the priming operation and hence the head of oil effective in passing oil through the valve is considerably greater than the normal head. This increase in head following the priming operation causes the priming reservoir to be refilled and oil to overflow into the burner before the priming charge therein is consumed, thereby to maintain a continuous combustion.

Due to the fact that the location of the valve is fixed with respect to the oil level in the supply reservoir, the dimensions of the overflow or priming reservoir and the oil passage through the valve can be and are such that the priming chamber is refilled with oil and oil is passed into the burner soon enough to prevent the burner from going out but not, even with the valve open to its maximum operating setting, in such quantity as to have in the operating burner more oil than the burner can burn safely. Hence, the burner can be primed, ignited and the valve opened to any desired setting, and thereafter ignored with safety.

50 Interlocking mechanism is provided between a valve and its associated priming mechanism so that the burner cannot be primed when the valve is open as the burner then might be accidentally primed when it was in operation and thus supplied with a relatively large amount of oil which it could not consume in a normal manner and hence a dangerous condition might result. The interlocking mechanism is also so arranged that no priming apparatus can be operated when any oil valve is open since otherwise an idle burner might be primed when it was hot as the result of the operation of the adjacent burner and when the adjacent burner was in operation so that the priming oil would be too rapidly vaporized and the vapors ignited from the operating burner and burn under dangerous conditions. The interlocking mechanism includes a generally vertically disposed interlocking plate 136 which is disposed just in front of the rear wall 42 of the casing 38 and has downwardly extending ears 138 that are pivoted to ears 140 integral with and depending from the cover plate 122. The stems 114, 116 of the displacement members are provided with locking recesses which in the normal or elevated position of the displacement members are aligned with locking pins 146, 148, that are movable horizontally into and out of said recesses and are urged by springs 150 out of said recesses and into abutting engagement with the interlocking plate 136.

5 The casing 38 is provided with side walls 152 and 154 which are spaced respectively from the walls 54 and 56, and on the upper ends of which the cover plate 122 is seated and is held removably therefrom by screws 156. The spaces within said plates 152, 154 are open at the upper end of the casing so that the interior of the casing is freely vented. The interlocking plate 136 has parts or extensions 158 that depend into said spaces and at their lower ends abut against actuating pins 165 and 167 which are longitudinally slidable in bosses 164 and extend through the front wall of the casing 38 and confront cam rings 166, 168, carried by the valve knobs 94 of the valves. Said cam rings are each provided with a notch 170 which confronts its cooperating pin when the valve is closed, the outer face of the cam rings otherwise being cylindrical. The arrangement of the parts described is such that when both displacement members are in normal or elevated positions both valves can be opened and the opening of any valve causes the associated cam disc to move the associated actuating pin rearwardly to rotate the upper end of the interlocking plate forwardly to press both locking pins 146, 148 into the recesses of the stems of the displacement members thereby to hold them in elevated position against depression; and the cylindrical face of the cam disc holds the lever against the locking pins so that neither displacement member can be depressed. When both valves are closed either or both displacement members can be depressed. This arrangement provides assurance that the burners cannot be primed at improper times.

1. Oil burning apparatus comprising a plurality of burners, a constant level oil supply reservoir therefrom, means including regulating valves for controlling the admission of oil from said supply reservoir separately to each burner, separate priming apparatus for separately introducing a priming charge of oil to each burner, and means interlocking said valves and said priming apparatus arranged to lock all priming apparatus from operation except when all valves are closed.

2. Oil burning apparatus comprising two burners, means for supplying oil thereto for their normal operation, separate priming means for separately introducing a priming charge of oil into each burner for starting it in operation, and means for preventing the operation of both priming means when any burner is conditioned to receive a normal supply of oil.

3. Oil burning apparatus comprising two burners, means including regulating valves for supplying oil separately to each burner, separate priming means for separately introducing a priming charge of oil into each burner, and means preventing the operation of both priming means when any one of said valves is open.

4. Fuel supply apparatus for oil burners comprising a casing having two oil reservoirs therein each provided with a dam over which the oil is adapted to flow and an outlet behind the respective dams, separate valves controlling the entrance of oil to said reservoirs, separate displacement members in said reservoirs movable into the oil therein, locking members movable into locking engagement with said displacement members for holding them against operation, a

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locking plate engageable with both locking members for moving them in a locking direction, and means extended between said valves and said plate for holding said plate in the locking position of said locking members except when both valves are closed.

5. Fuel supply apparatus for oil burners comprising a casing having two oil reservoirs therein each provided with a dam over which the oil is adapted to flow and an outlet behind the respective dams, separate valves controlling the entrance of oil to said reservoirs, separate displacement members in said reservoirs movable into the oil therein, locking pins movable into locking engagement with said displacement members to hold them from operative movement, a locking plate engageable with both pins for moving them together into locking position, and rods slidably in said casing externally of said reservoirs between said valves and plate and each rod being separately movable to actuate said plate and both locking pins, and said valves having cam surfaces that hold said rods in a locking position except in the closed positions of the valves.

6. Fuel supply apparatus for oil burners comprising a casing having side walls and an intermediate wall defining between them two oil reservoirs having dams and outlets behind the dams, valves carried by said casing having rotatable valve members, displacement members located in the casings above the oil in said reservoir and movable downwardly thereinto, means including a locking plate movable into engagement with both displacement members conjointly for holding them against operative movement, said casing having outer walls spaced from said side walls and providing channels therebetween, said plate having parts located in said channels, and plate actuating rods located in said channels and interposed between said plate-parts and said valve members, and said valve members having cam members which hold said rods and plate in locking position except when both valve members are in closed position.

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