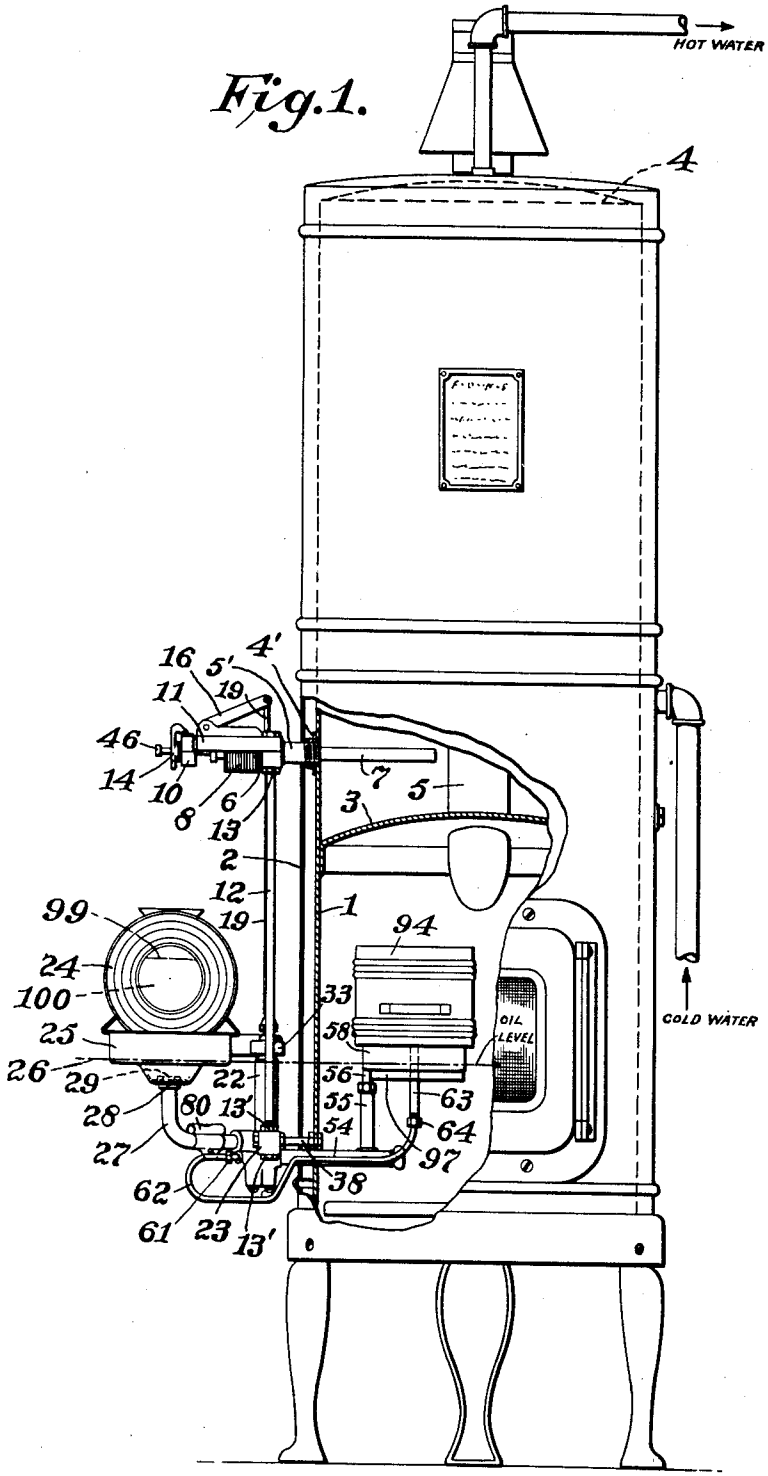
Dec. 20, 1932. F. E. WHITE ET AL 1,891,855

AUTOMATIC HEATER FOR WATER AND OTHER PURPOSES

Filed May 6, 1930 4 Sheets-Sheet 1

Fig. 1.



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AUTOMATIC HEATER FOR WATER AND OTHER PURPOSES

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Fig.2.

open

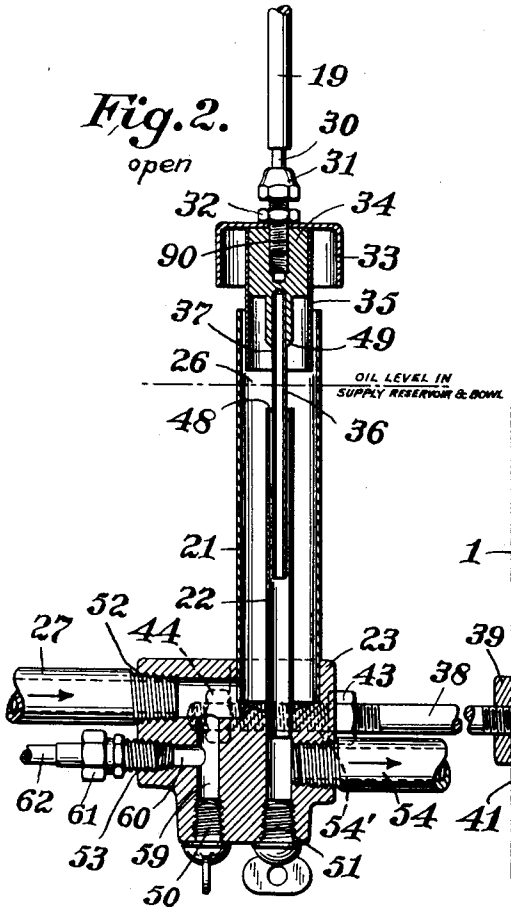


Fig.3.

closed

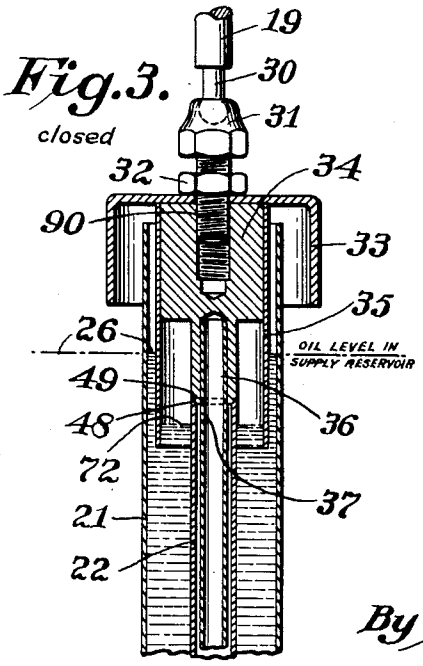


Fig.5.

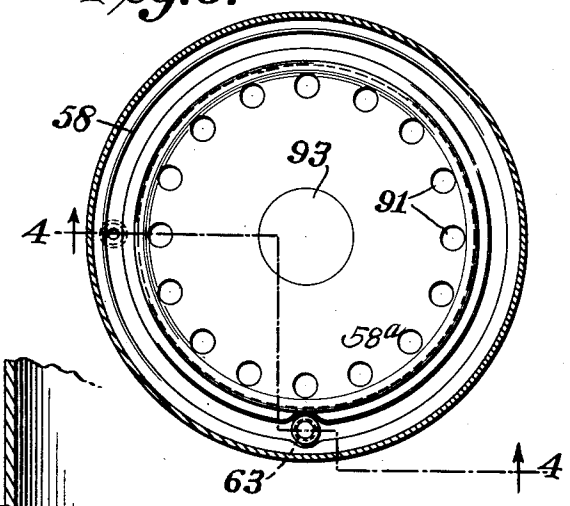
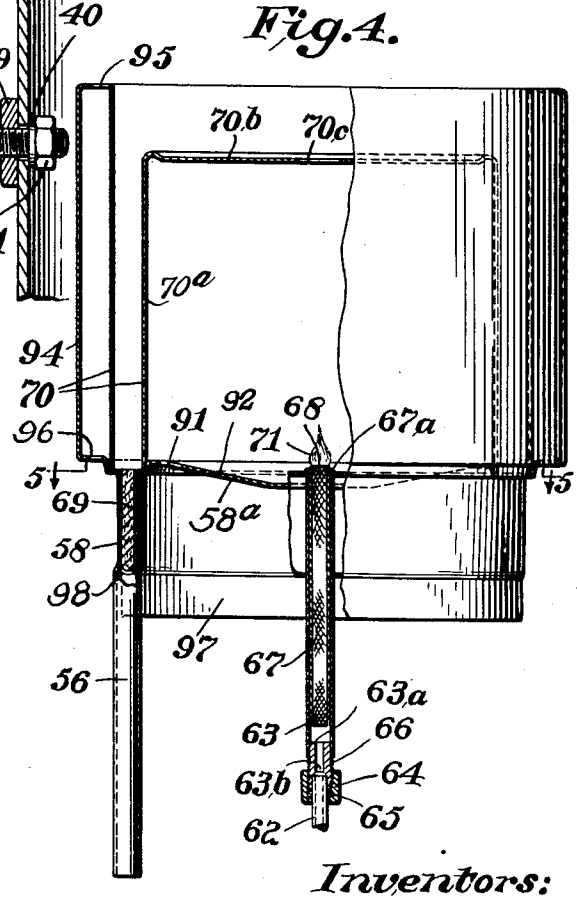


Fig.4.



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AUTOMATIC HEATER FOR WATER AND OTHER PURPOSES

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Fig. 8.

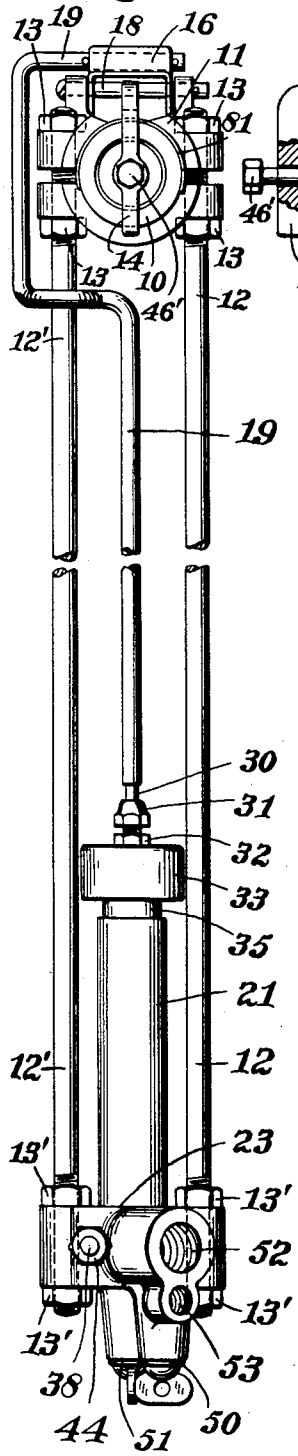


Fig. 7.

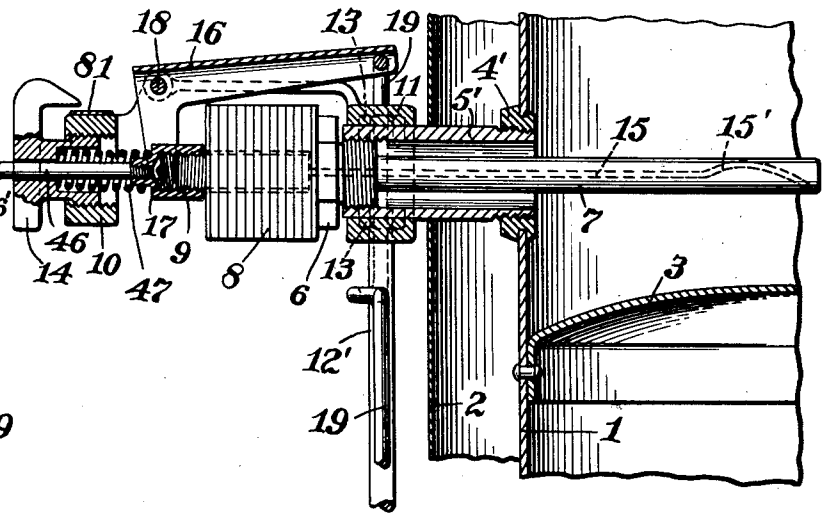
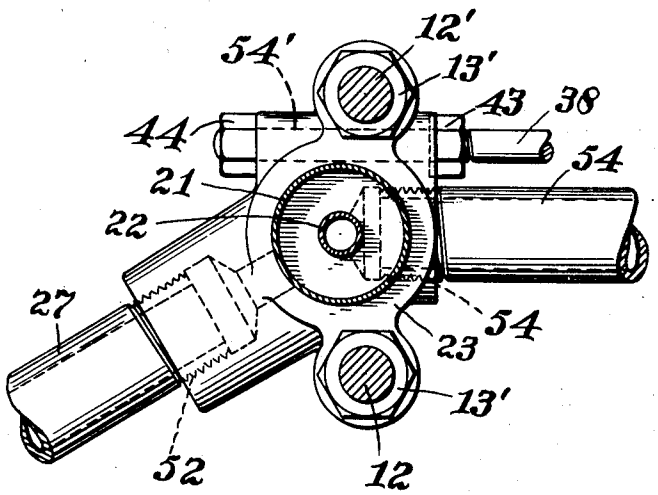


Fig. 6.



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AUTOMATIC HEATER FOR WATER AND OTHER PURPOSES

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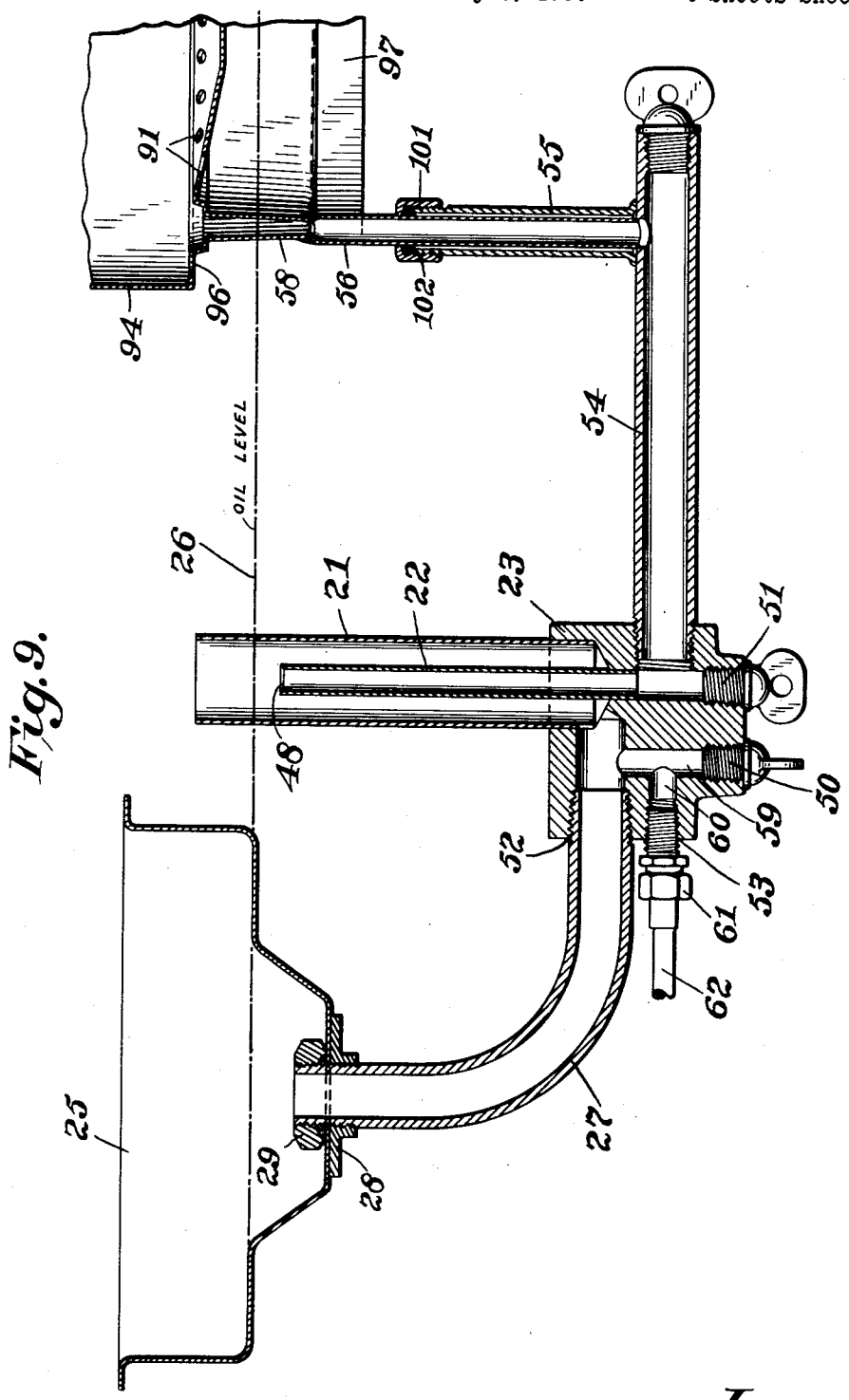


Fig. 9.

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UNITED STATES PATENT OFFICE

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AUTOMATIC HEATER FOR WATER AND OTHER PURPOSES

Application filed May 6, 1930. Serial No. 450,177.

This invention relates to improvements in constant level oil burners and has special relation to an automatic regulation between maximum fire and pilot light according to the heat demand and is especially adapted for water heaters, brooders, oil burning refrigerators, and the like.

Heretofore, in regulating blue flame types of oil burners, it has been the custom to cut down the flame of the main burner to as low a flame as possible by lowering the burner bowl, or to construct the burner bowl in such a way that either full or part of the section was burning. Such regulation always entailed rather poor combustion efficiency at low fire.

The present invention provides a pilot light entirely separated from the main burner, but in proximity to the main burner to light the same if oil is present, and a novel valve mechanism controlling the main burner. This valve involves a triple safety feature of an air cushion, capillary action, and mechanical valve seat which is designed to provide definite shut-off with small power effort derived from the regulating device which may be by hand or by a thermostat, pressurestat, float, or any other device.

The following drawings illustrate one design incorporating these ideas but it is not desired to limit the invention to the exact embodiment shown in connection with water heaters as the invention may be applied to other devices.

Fig. 1 is a view of the entire assembly embodying the invention as applied to an automatic water heater.

Fig. 2 is a vertical cross-section of the valve mechanism and oil distributing pipes, with the valve shown in open position.

Fig. 3 shows the valve closed.

Fig. 4 is an elevation of the bowl assembly showing the pilot oil tube and wick in section, substantially on line 4—4 of Fig. 5.

Fig. 5 is a sectional plan view of the same, substantially on line 5—5 of Fig. 4, with chimney members removed.

Fig. 6 is a plan view of the valve bracket.

Fig. 7 is a vertical sectional view of the thermostat sylphon regulator device.

Fig. 8 is an end view of said device and of its connections to the valve bracket.

Fig. 9 is a cross section through the lower reservoir, valve, and bowl showing oil level in the three parts.

Referring to the drawings, the tank water heater 1, shell 2, tank bottom 3, tank top 4, and flue 5, illustrate a common form of tank water heater. On the tank 1 the welded boss 4′ is mounted and threaded to receive take up extension nipple 5′ which at the outer end is pipe threaded and into which diaphragm unit 6 is screwed up tight with tube 15, 15′ located in a vertical plane. The sylphon bracket or thermostat bracket 11 with its end cap 10 is clamped on the outside of nipple 5′ by means of rods 12, 12′ and nuts 13. The sylphon bracket carries temperature regulating nut or dial bushing 14 which acts as a guiding device for plunger screw 46 of sylphon 6 and as a seat for spring 47 which in its turn exerts regulatable counter pressure on plunger screw 46. Plunger screw 46 is adjustably connected by means of head nut 9 to sylphon motor 8. The sylphon 6 carries the stem 7 filled with the temperature active liquid in the usual manner. The small tube 15 prevents the active vapor from escaping into sylphon motor 8. The curved portion 15′ of tube 15 lies in a vertical plane.

Screw 46 is fastened tightly in thermostat head nut 9. The head 46′ of screw 46 allows unhindered movement of the bellows for the setting shown or any other setting of the nut farther in towards the right. That means that the spring 47 can be tightened at will and the temperature of the water or other heat carrying liquid changed to suit. If nut 14 is screwed to the left as far as it will go, head 46′ is moved outward by it and thereby the link 16 and valve rod 19 are moved, and part 49 of valve 34 Figs. 2 and 3 is pressed tight against valve seat 48 of standpipe 22, thereby shutting off the flow of oil to the burner. Dial plate 81 is secured to the peripheral surface of the thermostat bracket.

The plunger 46 which is actuated by the temperature of the tank connects to sylphon lever 16 by a pin 17. The lever is movably

hinged to sylphon bracket 11 by pin 18. This lever on its longer extension carries push rod 19. This push rod 19 by means of ball joint 31 carries the adjustable valve body 34 guided by tubes 21 and 22. The guide tubes are supported by distributing block 23, which in turn is held in definite relation to sylphon bracket 11 by means of rod 12, 12′ and nuts 13, 13′.

The upper and lower reservoirs 24 and 25 provide a constant level of oil 26. The oil flows by means of pipe connection 27 secured to reservoir 25 by means of counternut 28, and tank nut 29, through the pipe 27 to distributing block 23 and moves up in the receptacle or guide tube 21, flows over into tube 22 which connects to tube 54, nipple 55, into bowl tube 56 and bowl 58. The tube 21 of itself forms a reservoir and chamber and together with the tube 21 constitutes a continuous conduit for the flow of oil. Another branch on distributing block 23 allows oil from the supply pipe 27 to flow by way of passages 59, 60, connection 61 and oil tube 62 into pilot light burner casing 63 by means of parts 64, 65, and 66. The lower end of the pilot burner casing 63 is provided with a bored plug 63*a* having a screw threaded end portion 66. The nut 64 is mounted upon the end of oil tube 62 by swivel connection 65 so that the end of oil tube 62 may be pressed into firm communicating engagement with the bore 63*b* of plug 63*a*, when the nut 64 is screwed upon the threads 66 on the plug. The cartridge 67 containing the wick is removably received in the casing 63 with its overturned flange 67*a* resting on the upper edge of the casing. The plug 63*a* may be brazed in connection with the end of casing 63. A removable connection at each end of the pilot burner casing is thus provided which facilitates cleaning and replacement if necessary. The pilot tube 67 or removable cartridge preferably contains a cylindrical wick 68 to supply the oil by capillary attraction to the upper surface of pilot tube 67 where it is ignited and burns with a small bluish-red flame and very small oil consumption. The oil in the burner bowl 58 by means of kindler 69 and chimney 70 is burned in the usual well-known manner of blue flame burners. The main burner is ignited by kindler 69 by means of pilot flame 71 and extinguished by cutting off the flow of oil through tube 22 by valve 34. The heat supply can, therefore, be regulated by either burning at pilot flame or at full capacity, which allows very close temperature regulation at high burner efficiency. The pilot light is arranged at the top of the annular bowl 58, see Fig. 4 and also the position of the pilot burner case 63, Fig. 5 relative to said annular bowl 58. The pilot tube 67 forms a carrier for the cylindrical wick which allows ready adjustment and removal of the wick from the pilot burner casing 63.

The means including valve body 34 and guide tubes 21 and 22 for positive opening and closing of the fuel supply passage, will now be described.

The valve rod 19 is screwed tightly onto ball joint 30 which in turn makes connection with socket link 31. The threaded end of 31 fastens protection cup 33 to part 34 by the tightened nut 32. The valve body 34 carries air-tight skirt 35 and guide tube 36. This tube 36 moving in tube 22 guides valve body 34 perpendicularly up and down and thereby insures perfect seating and shutting off at the upper end of tube 22 and also insures a slower flow of oil through tube 22 for less sensitive burning.

This means that the flame is more even. When the passages are too liberal, the oil moving into a hot bowl vaporizes too rapidly, causing a high and sooty flame for a minute or two. The restriction of the passages prevents the oil from moving so rapidly into the hot bowl and the flame is not apt to surge up and down, and the burning is less sensitive and more even.

The cover or protection cap 33 prevents entrance of foreign matter to the valve and guards it against injury.

In the position of the valve shown in Fig. 2 the oil can flow unimpeded from feed tube 21 into the passage between the guide tube 36 and the outlet tube 22 and thence to the main burner bowl 58. In Fig. 3 the valve body 34 has a certain amount of air entrapped and effectively pushes the oil to a lower level 72 in the tube 21. Due to the rather close fitting diameter of pilot or guide tube 36 in tube 22, the capillary action of the oil strongly resists the entrance of the entrapped air into tube 22.

In the event that this capillary action is overcome and the air tends to break through the film of oil between 36 and 22, the mechanical valve 48, 49 provides a further means of safety in insuring a positive cut-off.

The cross-sectional area between air-tight skirt 35 and outlet tube 36 is preferably chosen large in comparison to the cross-sectional area of tube 22. A very small raise in the oil level 72 in skirt 35 will chase the liquid down in the tube 22 to such a relatively great extent that equilibrium will be reached before the oil could raise enough to flow into tube 22. Thus the air-bubble formed by the air-tight skirt constitutes in itself an effective shut-off, although it is supplemented in its positive action by the capillary action of the oil film between 36 and 22, and by the mechanical valve extension or pilot 49 engaging the frusto conical seat 48 in the top of tube 22.

In order to insure the never failing air bubble, valve body 34 under normal burning conditions is lifted entirely out of the oil and

assures a full size air bubble when the valve is pushed down by the regulator.

For baking ovens, brooders, and the like, it is advisable to have no abrupt shut-off, but to regulate gradually between high, low fire, and pilot. To accomplish this end, we may choose the cross-section of tube 22 as large or larger than the cross-sectional area between tube 22 and inverted cup 35, or decrease the diameter of the guide or pilot tube 36 much below the diameter of tube 22 or move the mechanical seat 49 on pilot tube 36 higher up. If the area in tube 22 is large in comparison to the inverted cup 35 and the latter moves downwards and say has reached a position $\frac{1}{32}''$ below the top of tube 22, the oil film on the edge of 22 is temporarily interrupted until a corresponding amount of oil has been burned out in the bowl. The decrease of level in the bowl causes a similar level difference between the level of oil inside of inverted cup 35 and that in guide tube 22. Since the air entrapped in the inverted cup is of a constant cubical area, the oil level 72 between 35 and 22 will rise a similar cubical amount as the amount displaced in tube 22. If tube area 22 is comparatively large, the oil very quickly moves up to rim of 22 and seeps down into 22. Lowering the inverted cup 35 further causes correspondingly lower level in the bowl and finally shuts off the oil supply entirely. However, there is a large range of regulation between high and low fire and for certain applications such as brooders, baking ovens, and the like, we prefer this closer regulation.

The guide tube 36, beside retarding any sudden rush of oil into the burner bowl, also helps maintain the air bubble between skirt 35 and valve pilot 49. If the valve is in lower or shut-off position and the oil in the bowl is burned up, it would have the effect of lowering the oil in standpipe 22; but due to the fact that the tubes 36 and 22 displace most of the bore, very little air from the air bubble within skirt 35 penetrates down these tubes and consequently the bubble within skirt 35 which presses the oil away from space surrounding standpipe 22, maintains its lower level practically unchanged when the oil level in the bowl is lowered. Also any reasonable change of oil level in oil reservoir has very little influence in disturbing the air bubble seal due to the reason above stated. The length of tube 36 and the space between it and the standpipe 22 are so proportioned that sudden surges are prevented and capillarity is increased.

The air bubble valve has and successfully performs at least three functions:

1. Shut off.
2. Regulation of burner.
3. By proper dimensioning the valve can hold back any predetermined head of oil from supply reservoir.

If tube 36 of the air bubble valve is fairly close fitting in tube 22, there exists an oil film. This oil film between a reasonably close fitting tube 22 and tube 36 may be capable of holding back 1″ to 2″ of oil pressure difference, much more than ever can be reached by burning the bowl dry. The capillarity alone constitutes a successful shut off but we do not depend on this capillarity at all as a shut off as indicated in the following:

Should, through some reason or another, the film break or no oil film be present, due to designing the pipe 36 of very small diameter, the burning off of the oil in the bowl will lower the oil level in tube 22 but cannot possibly lower it more than $\frac{5}{8}''$ because of the $\frac{5}{8}''$ normal oil level carried in the bowl. This is due to the fact that if the $\frac{5}{8}''$ oil layer in the bowl is burned up, the fire must go out if no further oil gets into the bowl. The displacement of air in tube 22, being about $\frac{1}{4}$ dia. $\times$ $\frac{5}{8}$ as a maximum, is very small, and will raise the level 72 only a slight amount, say about $\frac{1}{16}''$ to $\frac{1}{8}''$, depending on the ratio of tube 22 to cup 35. Even should there be no capillarity between tubes 22 and 36, the air would move down in tube 22 a maximum depth of $\frac{5}{8}''$. This air displacement in tube 22 is far too small to raise oil level 72 so that oil could pass over the rim 48 of tube 22. If the thermostat has lowered the cup more than this amount, $\frac{1}{16}''$ to $\frac{1}{8}''$ below the tube 22, no oil can flow into tube 22 even in case the bowl has burned empty.

A close study of the oil levels when burning the oil in the bowl will show that the level difference between tank and bowl will always show a similar or smaller difference of oil level in tube 22 and cup space, according to whether there is little or much capillarity between 22 and 36. This is true as long as cup 35 is below tube 22 and this is independent of further movement of cup.

In order to assure absolute shut off, we provide mechanical seat 49 and cupped end 48 on tube 22. There are, therefore, three independent forces, each one in itself capable of shutting off the oil supply.

If cup 35 is only slightly below the top end of the tube 22, say $\frac{1}{16}''$ to $\frac{1}{8}''$, a lowering of oil level in the bowl causing a similar or proportionate oil level lowering in tube 22, will cause the oil level 72 to rise sufficiently to flow over the edge of tube 22. It is therefore possible by varying the lowering of cup 35 within $\frac{1}{16}''$ to $\frac{1}{8}''$—or any amount according to design—to regulate the oil level in the bowl. For any position of the bowl within $\frac{1}{16}''$ to $\frac{1}{8}''$ in our design there is a definite oil level in the bowl to which the oil is burned off and at which level any further burning will cause the oil to seep over top edge of tube 22.

It is understood that by varying the dimen-

sion, we can increase or decrease the regulating quality and the shut off safety.

By means of the air bubble valve of the present invention the oil supply may be regulated to a certain constant flow or entirely shut off.

There are three outstanding features of the valve construction as a whole:

1. Frictionless shut-off by air bubble.
2. Capillary action between tubes 36 and 22 to resist air entering down this space and to prevent the surge of oil towards the bowl.
3. Mechanical shut-off at valve seat 48 by valve pilot 49 of valve body 34.

The flexible links 31 and 30 assure free movement of valve 34 and valve stem 19. Nut 32 may be loosened and the valve 34 may be adjusted as to height relative to standpipe 22 by adjustable threaded stud 90. The hole 37 is provided in the hollow tube 36 to allow the air to move out of the way when the oil flows through the valve for the first time. Tube 36 being hollow air pockets in standpipe 22 are eliminated and false oil levels in the bowl are prevented. The hollow tube 36 having opening 37 in its upper end, the air can escape through this hole when the oil system is filled initially.

An adjusting bolt 38 is provided to adjust the valve bracket 23 relative to the boiler wall to change the relative positions of the tank and burner bowl. By operation of nuts secured to the bolt the valve bracket is swung out or in in an arc in a vertical plane and about the thermostat bracket as a turning point, which action slightly raises or lowers the bowl and adjusts the oil level within small limits.

The adjusting bolt 38 is fastened by plate 39, lock-washer 40 and nut 41 to boiler wall. This bolt extends through casting 23 and can be set tight by nuts 43 and 44. With nuts 43 and 44 it is possible to move casting 23 from right to left and vice versa. Since casting 23 is more or less flexibly connected by rods 12 and 12′ with thermostat housing 10 and 11, it will swing in an arc, thereby raising the tank and lowering the bowl, or vice versa. The valve bracket or body 23 is provided with drain holes and plugs 50 and 51 and hole 54′ for receiving the adjusting screw 38 in addition to the oil inlet 52, outlets 53 and 54, hole for standpipe 22, hole for outside tube 21, and holes for receiving rods 12 and 12′.

A spirit level 80 is also attached to pipe 27, see Fig. 1 to facilitate the installation of the tank.

Referring to Figs. 4 and 5, the inner and outer chimney walls 70 are perforated as shown at 70*a*. An annular series of air holes 91 are provided in the burner bowl bottom 58*a* as well as a central depression 92 with central air hole 93. The top 70*b* of the inner chimney wall 70 is also perforated as shown at 70*c*. The outer chimney wall 70 is open at the top. A chimney housing 94 covers the entire chimney assembly and is provided with openings 95 and 96 at the top and bottom.

The burner bowl 58 is preferably provided with a depending skirt or stiffening strip 97 which serves as a reinforcement both for the bowl 58 and for the oil supply tube 56 to which it is integrally connected as shown at 98.

The oil level 99 in upper reservoir 24 may be seen through the glass wall 100 of the reservoir.

The connection between nipple 55 and burner bowl tube 56 is sealed by means of gland 102 and packing nut 101.

I claim:—

1. A thermally operated oil supply controlling apparatus comprising a chamber containing oil, a conduit communicating with said chamber for supplying oil to a consuming device, means for holding an air bubble within the chamber and in contact with the oil in said chamber, and thermally operated means for actuating said bubble holding means to cause the body of air forming said bubble to regulate, restrain or permit the flow of oil through the conduit.

2. A thermally operated oil supply controlling means comprising a receptacle to which oil is supplied, an egress pipe leading from the receptacle, said egress pipe having its upper end communicating with the upper part of the receptacle to receive oil therefrom, an air bubble valve having a skirt extending downwardly to enter the body of oil in the receptacle and to surround the upper end of the egress pipe whereby the air within said valve will press upon the oil when the valve is lowered, means for checking the escape of air through the egress pipe and means for moving the air bubble valve up and down relative to the receptacle and egress pipe according to the heat demand to regulate the supply of oil passing from the receptacle in to the egress pipe.

3. Oil supply controlling means according to claim 1 in which the air bubble holding means comprises an inverted cup, with means for guiding the same vertically.

4. Oil supply controlling means according to claim 1 in which the air bubble holding means comprises an inverted cup with a pilot guide member working within a part of the oil conduit.

5. Oil supply controlling means according to claim 1 in which the air bubble holding means has a pilot extension guided within a part of the oil conduit, and an operating rod for the means having a flexible connection therewith.

6. Oil supply controlling means according to claim 1 in which the bubble holding means has a pilot extension working within a part of the oil conduit, with a capillary space be-

tween said extension and the wall of the conduit to prevent surging of the oil.

7. Oil supply controlling means according to claim 1 in which the air bubble holding means has a pilot extension, working in a part of the oil conduit, said pilot extension being in the form of a tube having a vent opening at its upper end for the escape of air from said conduit, substantially as described.

8. Oil supply controlling means according to claim 1 in which the air bubble holding means has a pilot extension, working in a part of the oil conduit, said pilot extension being in the form of a tube having a vent opening at its upper end for the escape of air from said conduit into said air bubble valve.

9. Oil supply controlling means according to claim 1 in which the air bubble holding means is in the form of an inverted cup, and the oil conduit includes a receptacle for receiving oil from the reservoir and an egress or stand pipe projecting up within the receptacle to receive oil therefrom at its upper end, the skirt of said air bubble holding means moving in the oil and below the upper end of and spaced apart from the stand pipe when the holding means is lowered, to cause the air to press upon and restrain the passage of oil to said stand pipe, said air bubble holding means having a valve member, above the lower end of the skirt to seat upon the upper end of the stand pipe to mechanically close the oil connection, substantially as described.

10. Oil supply controlling means according to claim 1 in which the air bubble holding means is in the form of an inverted cup, and the oil conduit includes a receptacle for receiving oil from the reservoir and an egress or stand pipe projecting up within the receptacle to receive oil therefrom at its upper end, the skirt of said air bubble holding means moving in the oil and below the upper end of and spaced apart from the stand pipe when the holding means is lowered to cause the air to press upon and restrain the passage of oil to said stand pipe, said air bubble holding means having a valve member, above the lower end of the skirt to seat upon the upper end of the stand pipe to mechanically close the oil connection, said air bubble holding means having a pilot member extending from said valve member coaxially therewith to work in the egress pipe, substantially as described.

11. Controlling means for an oil supply of the constant level type comprising a receptacle for containing the oil and having its walls extending above the constant oil level, a stand pipe within the receptacle having its upper end below the constant oil level to receive the oil from the receptacle, and an air bubble containing chamber comprising an inverted cup shaped member having its depending skirt to move down into the body of oil in the receptacle and below the level of the upper end of stand pipe, to restrain the flow of oil into the upper end of said stand pipe, means for checking the escape of air through the stand pipe and means for moving the air bubble containing chamber vertically, substantially as described.

12. Controlling means for an oil supply according to claim 11 in which the air bubble chamber has movement upwardly to a point where it is above the constant oil level and downwardly to a point where its skirt is immersed in the oil.

13. Controlling means for an oil supply according to claim 11 in which the air bubble chamber has movement upwardly to a point where it is above the constant oil level and downwardly to a point where its skirt is immersed in the oil, the upper end of said receptacle being open for access of air to within the skirt of the bubble containing chamber.

14. Means for regulating the supplying of oil to a point of use comprising a reservoir containing oil, an outlet standpipe in the reservoir and an air bubble valve which by its movement in one direction causes its contained air to press upon and restrain the body of oil from flowing to the said point, substantially as described.

15. Oil supplying means according to claim 1 in which the air bubble holding means is in the form of an inverted cup, having an axial extension, slidable within a part of the conduit to provide a capillary space between it and the wall of said conduit, the cross section area of said portion of the conduit being smaller than the cross sectional area of the space between the said conduit wall and the surrounding skirt of the inverted cup shaped air bubble holding means.

16. Controlling means for an oil supply of the constant oil level type including a receptacle containing the oil, a stand pipe open at its upper end to receive oil from said receptacle to direct it to the point of use, an inverted cup shaped valve member movable vertically of the receptacle so that its skirt will move in the body of oil around the upper end of the stand pipe and the air trapped in said inverted cup will control the passage of oil into the upper end of the stand pipe, said valve member having a portion to seat upon and close the upper end of the stand pipe, and having also a portion to extend into the stand pipe and provide a capillary crevice between the same and the wall of the stand pipe, substantially as described.

17. In combination, a conduit, a vessel extending vertically from a portion of said conduit having an inlet for the oil at its lower end, and a centrally disposed egress tube open at its upper end and communicating with the upper portion of said vessel, and an air bubble valve of inverted cup shape, the depending

skirt of which is adapted to surround and is spaced apart from said egress tube, and means for checking the free escape of air through the egress tube, said valve being vertically movable to enter the body of oil and subject it to pressure from the air bubble trapped in said valve, substantially as described.

18. Apparatus according to claim 17 in which the oil receiving vessel extends above a constant oil level and the upper end of the egress pipe is below the constant oil level, said vessel being open to the atmosphere at its upper end and said air bubble valve having a range of movement from a point above the constant oil level to a point below the upper end of the egress tube, substantially as described.

19. Apparatus according to claim 17 in which the wall of the vessel and the egress tube are mounted in a distributing block, a by-pass through said block and an oil conduit connected with said by-pass, substantially as described.

20. Apparatus according to claim 1 in which the air bubble holding means is in the form of an inverted cup shaped member, said member surrounding an egress tube, the cross sectional area of said tube being smaller than the cross sectional area of the space between said tube and the wall of the inverted cup.

21. In combination a conduit for oil, a vessel connected with said conduit to receive oil therefrom, an egress tube within the vessel, an air bubble valve of inverted cup shape located over the upper end of said egress tube, said valve being loose fitting and vertically movable with substantially no friction excepting that which it has with the liquid, means for checking the free escape of air through the egress tube and means for moving the valve to regulate, shut off, or turn on the flow of oil to the burner, substantially as described.

22. Apparatus according to claim 1 in which manually operable means are provided for adjusting the position of the air bubble holding means, substantially as described.

23. In combination a conduit, and means for controlling the flow of oil through said conduit comprising an inverted cup shaped member having air entrapped therein by the oil, and means cooperating with said conduit whereby said air bubble is caused to act upon the oil for its flow control.

24. In combination, a vessel through which oil passes, an egress tube, an air bubble valve cooperating with said egress tube and a protecting cap carried by the said valve, and reaching down over the upper open end portion of the said vessel, substantially as described.

25. In combination a conduit, a vessel and egress pipe interposed in said conduit, an air bubble valve comprising an inverted cup shaped member working over the said egress pipe and cooperating with said egress pipe, a connection for operating said valve, including a flexible joint, and an adjusting screw by which the valve may be varied in its relation to the egress pipe.

26. In combination, a conduit, valve means for regulating the flow of oil through said conduit, a thermally operated actuator for said valve, a spring opposing said actuator, a manually operable member for regulating the actuator and for operating the valve including a nut against which the opposite end of the spring engages, and a plunger connected with the actuator adapted to be operated by said nut for actuating the valve.

27. In combination a valve controlling a supply of oil, an actuator for the valve operating according to temperature changes, a bracket supporting said actuator, a lever supported on the bracket and operated by the actuator to transmit movement to the valve, a nut mounted in the bracket, a spring adjusted by the nut to operate the actuator by hand, and a dial to indicate the position to which the nut is adjusted, substantially as described.

28. Apparatus according to claim 26 in which the actuator has a plunger rod connected therewith passing through the manually operable member and having a head to be contacted by said member to shut the valve by hand operation, substantially as described.

29. In combination a block, a receptacle mounted on the block, a conduit pipe leading to said block which has a port communicating with the receptacle, a by pass passage, a conduit connecting with said by pass, an egress pipe from the said receptacle, said pipe being supported in the block, a conduit pipe leading from the block and communicating with the egress pipe, and drain openings in the block leading from the by pass and from said egress tube, and plugs closing said drain openings.

30. Means for regulating the supplying of oil to a point of use consisting of a conduit through which the oil is supplied and an air bubble valve which by its movement in one direction causes its contained air to press upon and restrain the oil in said conduit from flowing to the point of use, substantially as described.

In testimony whereof, we affix our signatures.

FRED E. WHITE.
ALFRED RUTTIMAN.