

May 17, 1932.

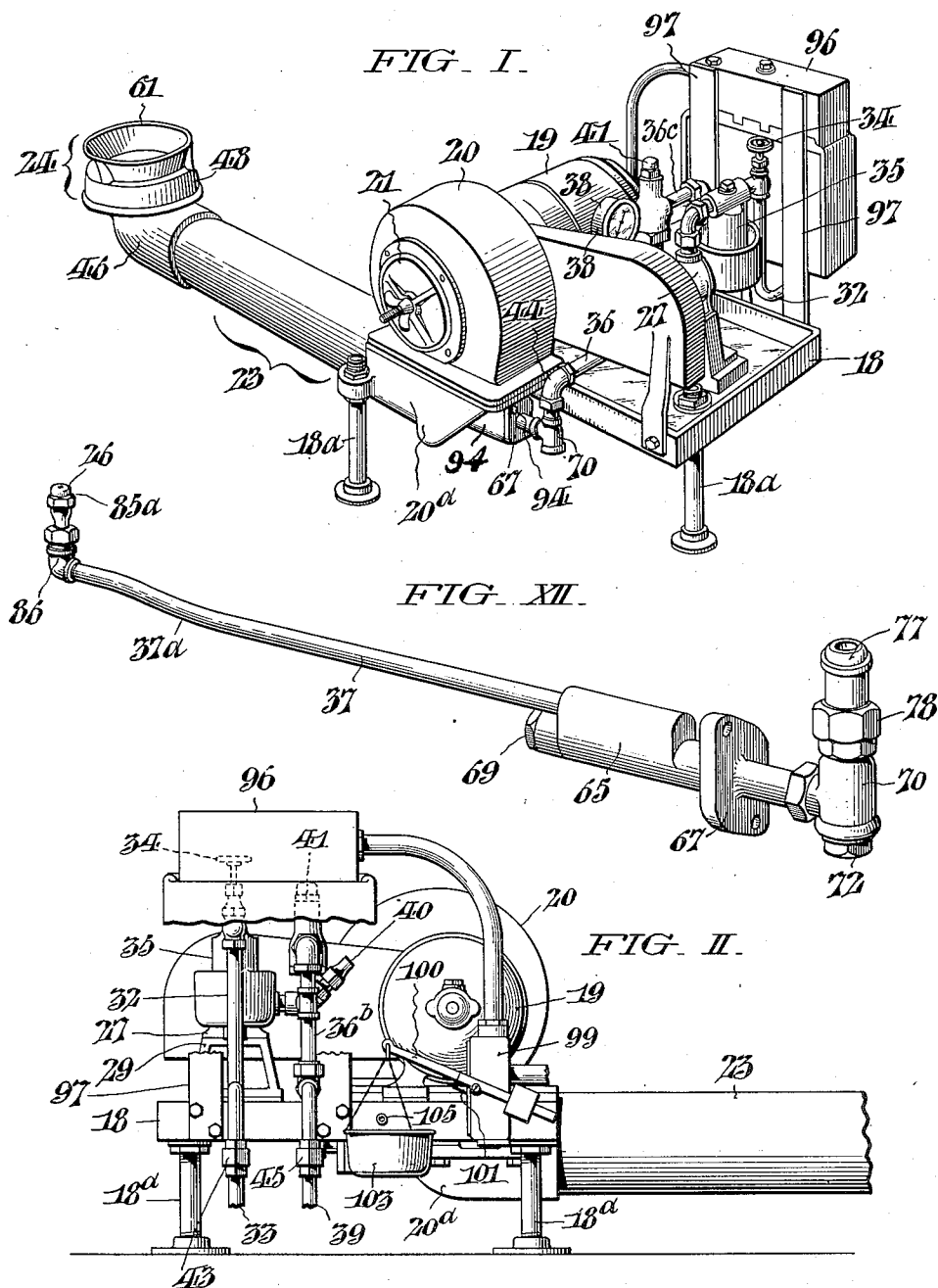
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1,858,302

OIL BURNING APPARATUS.

Filed April 23, 1928

4 Sheets-Sheet 1



WITNESSES
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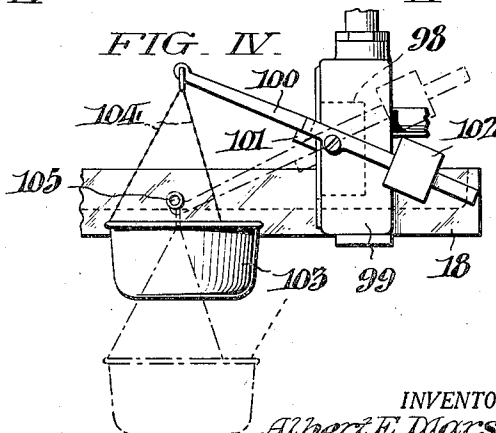
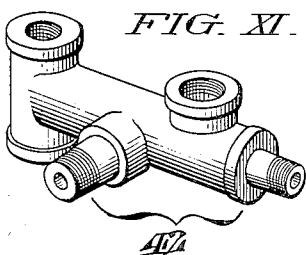
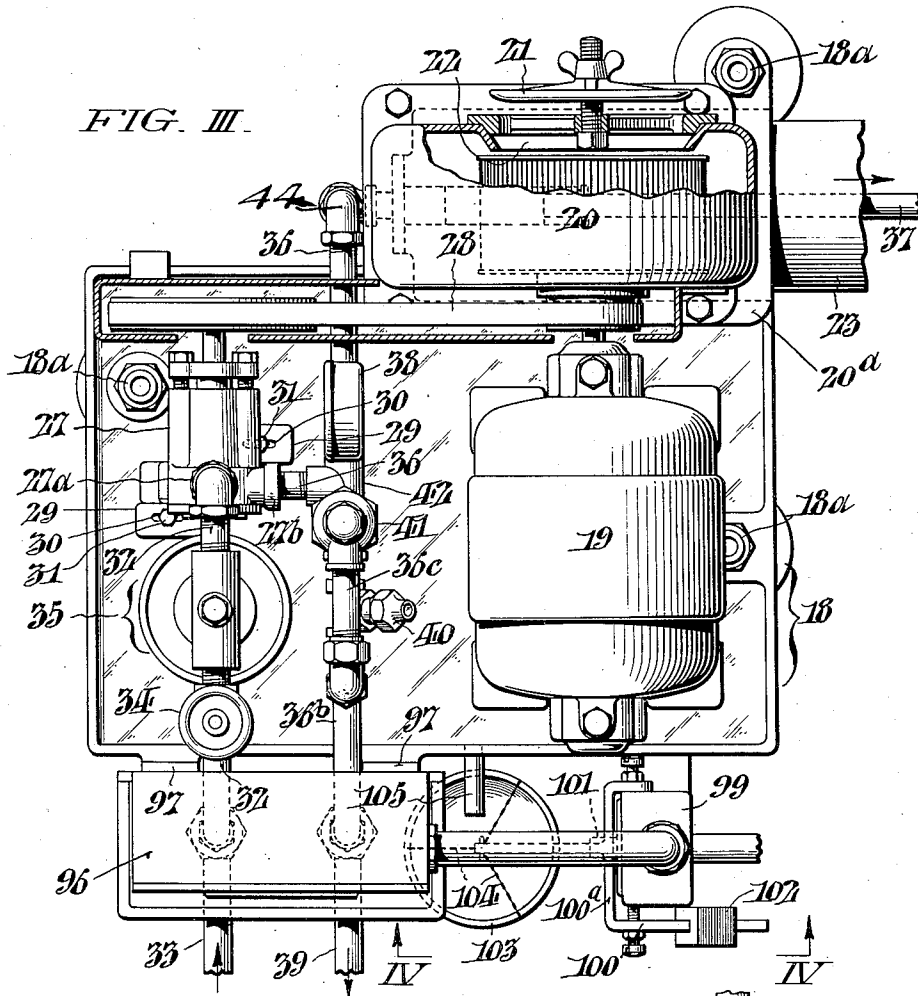
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4 Sheets-Sheet 2



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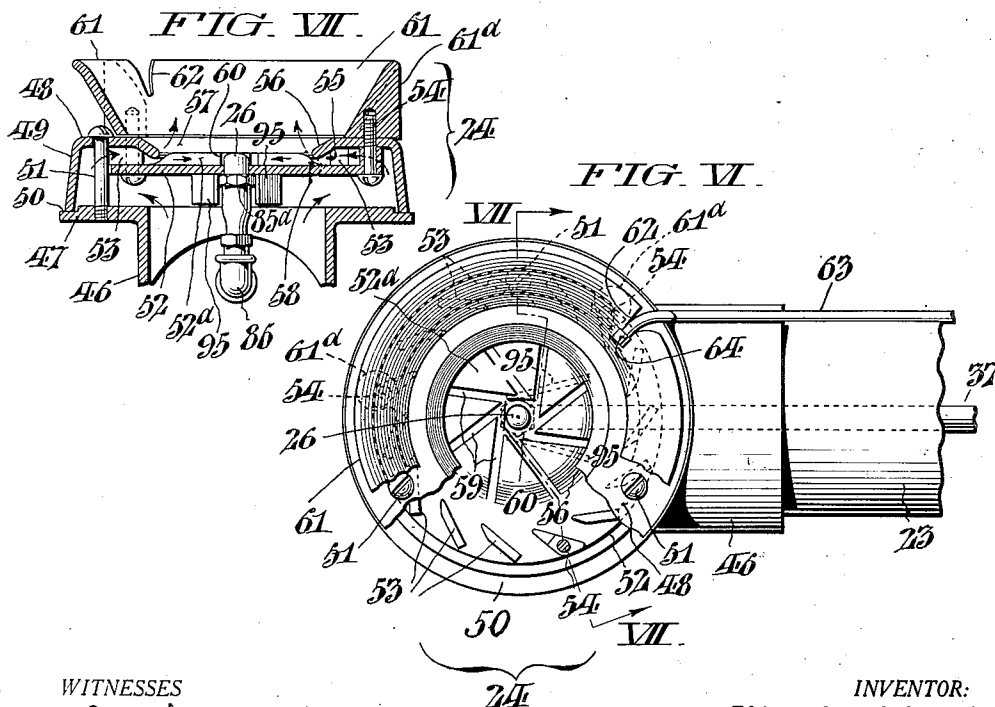
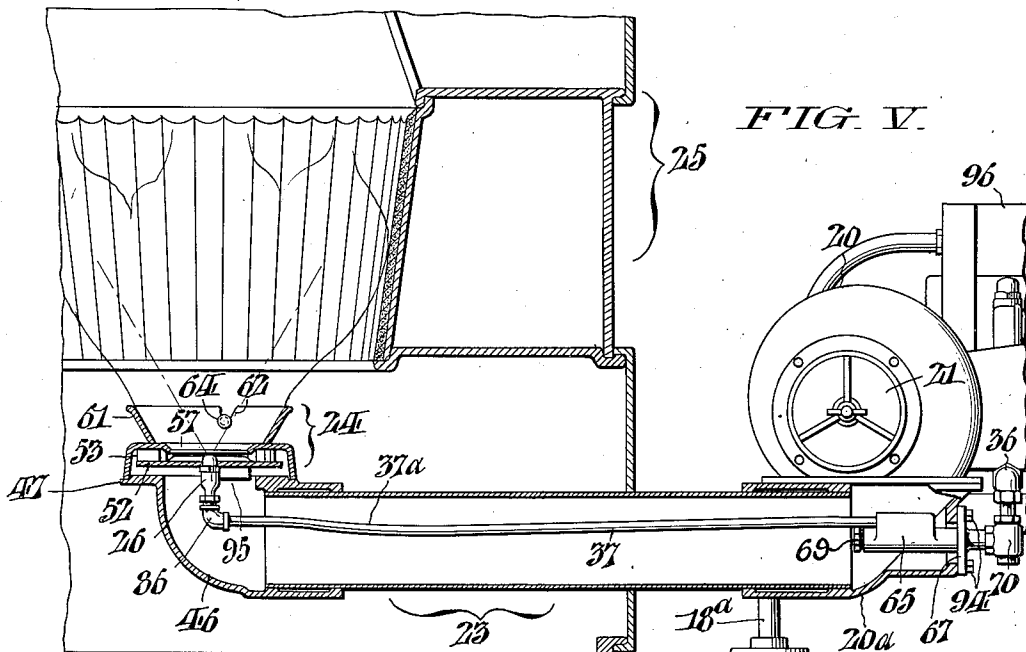
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OIL BURNING APPARATUS

Filed April 23, 1928

4 Sheets-Sheet 3



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OIL BURNING APPARATUS

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4 Sheets-Sheet 4

FIG. VIII.

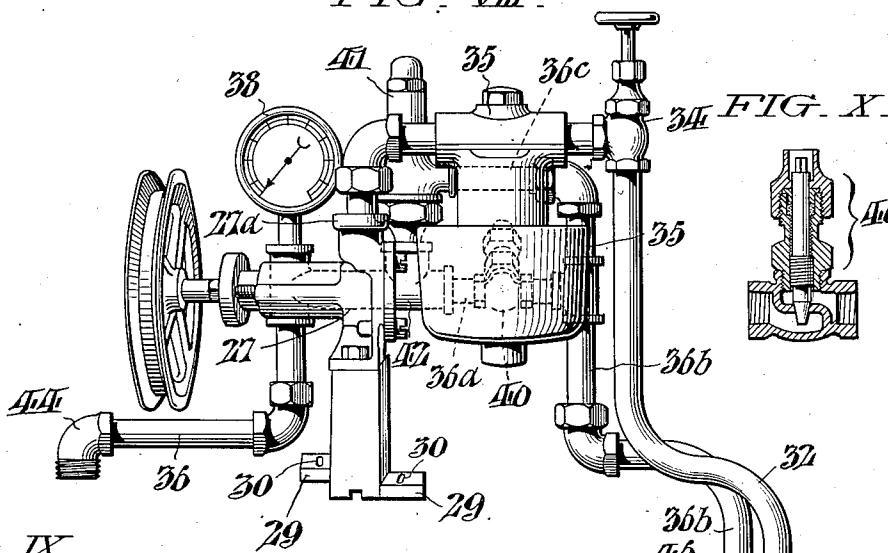


FIG. IX.

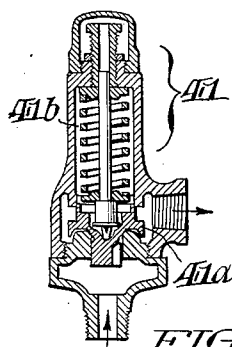


FIG. XVI.

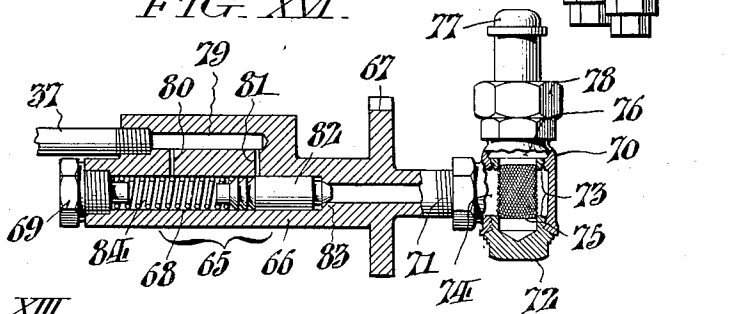


FIG. XIII.

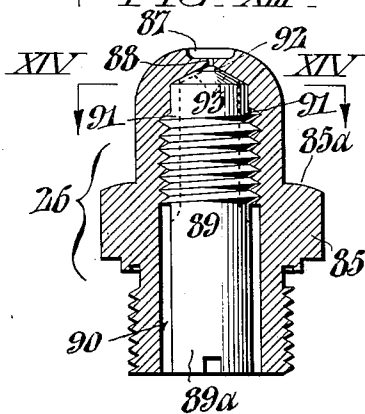


FIG. XV.

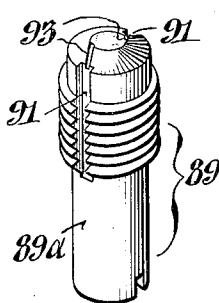
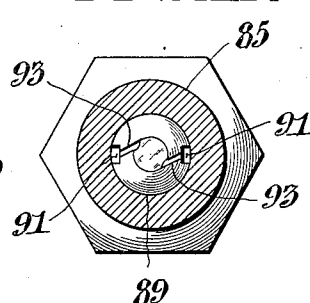


FIG. XIV.



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UNITED STATES PATENT OFFICE

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OIL BURNING APPARATUS

Application filed April 23, 1928. Serial No. 272,077.

This invention relates to oil burning apparatus useful in connection with house heaters or furnaces, more particularly to the thermostatically controlled automatic type of oil burning apparatus wherein a pump delivers oil under pressure for discharge as a finely atomized spray from a burner within the fire chamber of the heater or furnace, concurrently with combustion supporting air supplied by a blower.

In the operation of apparatus of the above character as ordinarily designed heretofore, considerable difficulty was experienced with clogging of the oil spray nozzles due to carbonization of oil discharge or "flooding" attendant upon over-running of the pump as the power was shut off incidental to intermittent operation of the apparatus under thermostatic control. Therefore, to maintain the apparatus in proper working condition, frequent cleaning of the burners was required, this operation entailing dismantling of a considerable part of the apparatus to afford access to the oil spray nozzles for removal of the carbon deposit from their minute discharge orifices.

My invention is in part directed toward overcoming the difficulties pointed out, which I accomplish by trapping all excess, or after delivery, of oil immediately upon stoppage of the apparatus under the conditions noted.

A further object of my invention is to insure against fire hazards through provision in oil burning apparatus of means to automatically shut off the power in the event of leakage and accumulation of oil from connections exterior to the heater or furnace.

In general, I aim to provide an automatic oil burning apparatus, which is highly efficient in operation; which embodies a minimum number of parts; which is extremely compact so as to require but very little space for its accommodation exteriorly of the heater; and in which the elements involved in oil delivery, as well as those concerned in feeding the oil to the burners, are embodied in unitary assemblages capable of ready and rapid removal for cleaning, repairs or replacements, without necessity for disturbing or disaligning other parts of the apparatus,

more particularly the driving and power connections.

With reference to the drawings, Fig. I is a perspective illustration of an oil burning apparatus conveniently embodying my invention, as viewed from one side thereof.

Fig. II is an elevation of the apparatus, as viewed from the opposite side or from the right of Fig. I.

Fig. III is a plan view of the organization with certain parts in section to expose underlying details.

Fig. IV is a fragmentary detail elevation, viewed as indicated by the arrows IV—IV in Fig. III.

Fig. V is a fragmentary sectional view showing my oil burning apparatus in association with a typical hot-air house heater.

Fig. VI is a plan view of the burner head which occupies the fire chamber of the heater.

Fig. VII is a sectional view of the burner, taken approximately as indicated by the arrows VII—VII in Fig. VI.

Fig. VIII is a perspective view of an assembly of parts constituting the oil delivery unit.

Figs. IX and X are sectional views of pressure-relief and flow-control valves embodied in the oil-delivery unit of Fig. VIII.

Fig. XI is a perspective view of a special manifold fitting forming a part of the oil-delivery unit.

Fig. XII is a perspective view of an assembly of parts constituting the feed unit to conduct the oil from the supply unit to the burner head in the furnace.

Fig. XIII is an axial sectional view of the spray nozzle embodied in the oil feed unit of the immediately preceding illustration.

Fig. XIV is a plan sectional view of the oil spray nozzle, taken as indicated by the arrows XIV—XIV of Fig. XIII.

Fig. XV is a perspective view of the plug member of the spray nozzle; and,

Fig. XVI is a sectional view of an automatic drain valve associated with the oil feed unit of Fig. XII.

As herein delineated, the oil burning apparatus of my invention comprises a bed plate 18 which is supported at an elevation from

the floor by vertically-adjustable legs 18a. On the bed plate 18 is mounted a constant speed electric motor 19 whereof the shaft is direct connected to a rotary blower 20 having a disk 21 (Figs. I, III and V) positionally adjustable to control flow into its side intake opening 22. This rotary blower 20 delivers combustion supporting air through a horizontal duct 23 to a vertically-discharging burner head 24 adapted to occupy the fire chamber of a typical house heating furnace, such as partly shown in section at 25 in Fig. V. The fuel oil is supplied under pressure to a spray nozzle 26, centrally within the burner head 24, by means of a conventional rotary pump 27 that is mounted on the bed plate 18 with the motor 19, and driven through a belt connection 28 from the shaft of said motor. In order to enable taking up of the slack in the driving belt 28, the pump 27 is made positionally adjustable relative to the motor 19, through provision in its feet 29 of slots 30 for passage of the securing bolts 31, see Fig. III, and fitment of appropriate connections in the pipe of the oil system to enable such adjustments being effected, as will be obvious to those conversant with such matters.

Oil flow piping 32 connecting with a conduit 33 (Figs. II and III) in communication with the source of oil supply (not shown), conducts the oil to the intake 27a of the pump, said piping having interposed in it a hand shut-off valve 34, as well as a standard form of strainer 35 with an upwardly-removable screen to filter the oil enroute to the pump 27. From the outlet 27b of the pump 27, the oil is conducted through a pipe 36 to a feed tube 37 within the air duct 23, said feed tube leading to the spray nozzle 26, see Figs. V and XII. A pressure gage 38 enables direct reading of the delivery pressure of the oil at all times during operation of the apparatus. Joined with the pipe 36 is a short horizontal section 36a that leads to a vertical branch 36b via which oil in excess of that required by the burner is returned to the supply source by way of a connecting conduit 39 (Figs. II and III) under governance of a flow control valve 40. This control valve 40 is preferably of the needle type detailed in Fig. X to permit of very accurate regulation of the oil flow to the burner through "bleed" regulation. An upper branch pipe 36c constitutes a by-pass or shunt across the control valve 40; and flow therethrough is governed by a pressure relief valve 41. Such relief valve 41 may be of the construction shown in Fig. IX, i. e. with a closure member 41a which is subject to a spring 41b capable of adjustment to yield at the predetermined critical pressure. By placing the relief valve 41 on the high pressure side of the flow control valve 40, as herein shown, the oil can by-pass through the upper pipe branch 36c in

the event of clogging of said flow control valve. This provision obviously serves to protect the apparatus against possible injury. A specially designed manifold fitting 42 (detailed in Fig. XI) greatly facilitates connection of the various pipe sections 36, 36a and the several fittings associated with them. In practice, the elements directly involved in the delivery of the oil are assembled at the factory into the unit illustrated in Fig. VIII so as to be removable intact, for convenience of complete replacement in case trouble should at any time develop with regard to proper functioning of any of the component parts. To this end the terminals of the pipe branches 32, 36 and 36b, are fitted with quick release couplings 43, 44 and 45, where connection is made respectively with the oil feed tube 37 that leads to the spray nozzle 26 in the burner head 24, and to the supply and return conduits 33, 39. The described arrangement is particularly advantageous from a commercial standpoint in that a complete substitution of the oil delivery unit of Fig. VIII may be quickly made simply by unbolting the pump 27 from the bed plate 18 and undoing the couplings 43, 44 and 45, without necessity for disturbing any other parts of the apparatus, or requiring an extensive shut-down as might otherwise be the case. Furthermore, the cost of such substitution need not be prohibitive since the faulty unit may be easily repaired and conditioned for re-use in servicing.

As shown in Figs. I and V the blower 20 is provided with a supplemental base 20a which is secured to the bed plate 18 by concealed bolts. This supplemental base 20a is hollow and serves as a continuation of the outlet from the blower 20 into the air flow duct 23. To that end of the air duct 23 within the furnace 25 is attached an upturned elbow 46 with a flat horizontal flange 47 at the top to support the burner head 24 at the proper elevation in the fire chamber of said furnace.

From Figs. V, VI and VII, it will be observed that the burner head 24 is of hollow circular configuration, embodying a cover member 48 with a depending perimetric rim 49 to rest on a circumferential seat 50 in the horizontal top flange 47 of the elbow 46. The cover member 48 is secured to the elbow 46 by screws 51 taking into the flange 47. Horizontally within the burner head 24 at a level substantially mid-way between the top flange 47 of the elbow 46 and the top of the cover member 48, is a baffle in the form of a circular plate 52 with a central aperture to accommodate the oil spray nozzle 26. The baffle or deflector plate 52 does not quite reach the depending rim 49 of the cover member 48, so that the air may flow about its perimetric edge, as shown by the arrows in Fig. VII. Adjacent its periphery, the baffle plate 52 has a series of tangentially-disposed de-

flector vanes 53 that extend up into contact with the cover member 48, certain of these vanes being pierced for passage of screws 54 whereby the baffle plate 52 is secured to the cover member 48. The air passing around the edge of the deflector plate 52 is caught by the vanes 53 and swirled into an annular space 55 behind a downturned lip 56 that extends about the central discharge opening 57 through the cover member 48, said lip terminating short of the deflector plate 52 to define a restricted annular outflow interval 58 for the air. As shown in Figs. V, VI and VII the medial portion 52a of the baffle plate is raised slightly within the area of the burner opening 57, and has a number of grooves 59 which are cotangential with respect to the deflecting vanes 53. A portion of the air discharged through the restricted annular interval 58 beneath the downturned lip 56, of the cover member 48, enters the grooves 59; and, as a consequence, is swirled still more for induction, at accelerated velocity, into an annular space 60 immediately around the oil spray nozzle 26. The burner head 24 is further fitted with an upwardly flared guard or "pot" ring 61 which has socketed lugs 61a to engage the ends of the screws 54 protruding above the cover member 48. The pot ring 61 is notched as at 62 for passage of a small caliber gas pipe 63 with a pilot tip 64. Any other type of ignition means may of course be substituted if desired. In the operation of the burner head 24, the vertical spray discharge of oil from the nozzle 26 is met by the swirl of air induced in the immediately surrounding space 60 as a consequence of having traversed the tangential grooves 59, of the deflector plate 52, to the end that vaporization of the spray is effectively promoted. At the same time, a proportionate quantity of the air gyrating at a lower velocity escapes around the edges of the lip 56 through the burner opening 57 and mixes with the vaporized oil within the confines of the pot ring 61. Through the described functioning of the various parts of the burner head 24 a radially-spreading tulip-shaped vertically-discharging flame is obtained, the same reaching outward and impinging against the side walls of the fire chamber within the heater 25, after the manner graphically indicated in Fig. V, with attainment of the maximum heating effect from the fuel. The characteristic construction of the burner head 24 facilitates ready removal of its parts separately from the heater 25, the procedure being as follows: The pot ring 61 is first lifted off, thereby rendering accessible the heads of the screws 51 securing the cover member 48. Upon removal of the screws 51, the cover member 48 can, in turn, be lifted out together with the attached deflector plate 52.

To avoid flooding of the burner 24 incidental to overrunning of the pump 27 when the motor 19 is stopped I provide the automatic drain valve 65 detailed in Fig. XVI. This drain valve 65 has an elongated casing 66 with an integrally formed flange 67 adapted to serve as a cover over an opening at the rear end of the conduit 23 through the blower base 20a. The axial bore 68 of the valve casing 66 is closed at one end by a removable screw plug 69, and, at the other end communicates with an auxiliary filter 70 which has a screw connection to said casing at 71. Threaded into the hollow of the auxiliary filter 70 is a removable plug 72 with an upward tubular extension 73 having ports in its side in line with the lateral outlet 74 and covered with screening material 75. The inlet 76 of the auxiliary filter 70 is fitted with an upstanding nipple 77 to match the quick release coupling 44 at the end of the pipe 36 previously referred to, the nut 78 associated with this coupling being engaged about the neck of the nipple. As shown in Fig. XVI, the oil feed tube 37 connects with an offset passage 79 in the top of the valve casing 66, said passage communicating with the bore 68 through ports 80, 81 which are well spaced apart in a longitudinal direction. The bore 68 is occupied by a piston 82 which is tapered at one end for capacity to function as a closure against a correspondingly ground seat 83 in shutting off flow of oil into the bore 68 as presently noted. The piston 82 is subject to the action of a spiral spring 84 tending to urge it toward the seat 83 against the pressure of the oil. As long as the normal working pressure is maintained the resistance of the spring 84 is overcome and the piston 82 held at the left hand end of the valve bore 68 with the port 81 uncovered to permit flow of oil into the feed tube 37 enroute to the spray nozzle 26 within the burner head 24. Immediately upon drop in the pressure of the oil incidental to stoppage of the motor 19, the piston 82 is released to the action of the spring 84 and forced to the opposite end of the bore 68, thereby covering the port 81 with prevention of further flow into the feed tube 37 to the nozzle 26 by closing against the seat 83. As a consequence of the movement of the piston 82 just explained oil in the feed tube 37 is concurrently sucked through the port 80 into the automatic drain bore 68 of the valve 65, thus avoiding after discharge from the nozzle 26 with attendant flooding of the burner head 24 and in this way preventing carbonization which would otherwise occur. At restarting of the apparatus, the resistance offered by the spring 84 is such as to predetermine building up of pressure in the oil line before movement of the piston 82 takes place to open the port 81 for passage of the supply into the feed tube 37. This insures starting with a full flame supported by the requisite supply of the oil and air at the burner 24. The spray

nozzle 26 may be of the type detailed in Figs. XIII, XIV and XV, with a hollow body 85 threaded at the lower end to take into an elbow fitting 86 at the end of the feed tube 37. At the top, the nozzle body 85 has an axial recess 87 around its discharge orifice 88. The nozzle body 85 is constructed hollow to accommodate an insert screw plug 89 whereof the lower portion 89a is reduced in diameter with formation, within the nozzle, of an annular clearance 90 for flow of the oil. At opposite points, the upper portion of the plug 89 is longitudinally grooved as indicated at 91, and its top ground to frusto-conical configuration to seat snugly against a correspondingly coned seat within the nozzle body 85, as shown in Fig. XIII, with provision of a small interspace or chamber 92 in direct communication with the discharge orifice 88. The plug 89, furthermore, has tangential grooves 93 in its sloping top surface constituting flow ducts between the longitudinal grooves or passages 91 and the interspace 92. In operation, the oil fed under pressure through the tube 37, enters the annular clearance 90 around the lower end of the plug 89 within the nozzle body 85 and from thence is conducted upward via the vertical passages 91 to the tangential grooves 93 in the top of said plug. The two tangentially directed streams issuing from the grooves 93 meet within the interspace 92 in the top of the nozzle body 85 for expulsion through the orifice 88 as a finely-divided gyrating, divergent spray concurrently with the combustion-supporting air discharged through the opening 57 of the burner head 24 in the manner hereinbefore explained. For convenience of inspection and cleaning the spray nozzle 26 from time to time without necessity for reaching into the furnace 25, I assemble all the parts associated with the oil feed tube 37 to form the unit shown in perspective in Fig. XII, which may be withdrawn in its entirety from the outer end of the air conduit 23 simply by unscrewing the nut 78 of the pipe coupling 44 and removing the bolts 94 which secure the plate 67 of the valve 65 to the blower base 20a. The tube 37 is slightly bent as at 37a in Figs. V and XII to promote flexure in an upward direction and insure that the shoulder 85a of the spray nozzle 26 bears firmly against the bottom of the deflector plate 52, within the burner head 24, when the bolts 94 are drawn up tight. Entry of the nozzle 26 into the aperture therefor in the center of the deflector plate 52 incidental to introduction of the oil feed unit into the air conduit 23, is facilitated through provision on the bottom of the plate 52 of a pair of converging guide lugs 95 which lead directly to said aperture, see Figs. VI and VII.

For automatic control of the apparatus, any standard thermostatic system may be employed—for example one embodying a

relay switch for interposition in the circuit to the motor 19. For the sake of greater compactness of the apparatus as a whole, I make provisions for accommodation of such a relay switch in the form of a protective box 96 (Figs. I and III), the same being supported, through attached uprights 97, by the bed plate 18.

In addition to the relay switch I employ in the circuit of the motor 19 a snap switch 98 of conventional type, which is housed in a metallic casing 99 also suitably secured to the bed plate 18, see Figs. III and IV. To the casing 99 is pivoted a lever 100 with a cross bar 100a that normally rests on the trigger 101 of the snap switch 98. The lever 100 is counter-weighted at one end as at 102, and at the other end carries a cup 103 which is suspended by means of chains 104. The normal position of the lever 100 is shown in full lines in Fig. IV, with the cup 103 in position to receive drainage oil from a spout 105 that extends through the side flange of the bed plate 18. Thus if leakage develops in the pump 27 or any of the piping connections leading to and from it, the accumulation will find its way into the cup 103. When the cup 103 becomes full, the counterbalancing effect of the weight 102 is overcome, and the lever swung to the dotted position of Fig. IV to actuate the switch 98 and automatically interrupt current to the motor 19. The simple arrangement just described acts as a safe guard against fire hazards exterior to the furnace 25 through leakage of the oil in the manner indicated.

Having thus described my invention, I claim:

In oil burning apparatus including a burner feed tube and atomizing nozzle, a pump to deliver oil under pressure to the nozzle, and a motor to drive the pump; a drain valve in the feed tube embodying an elongated casing having an axial bore, means providing an integral offset paralleling passage communicating with the bore by well spaced apart ports, and a spring-influenced piston having a conical end coacting with a corresponding seat in said bore adapted to automatically shut-off the flow of oil from the pump, and to draw oil from the feed tube by suction through the offset passage into the axial bore aforesaid, thereby to prevent flooding of the burner.

In witness whereof, I have hereunto signed my name at Baltimore, Maryland, this 18th day of April, 1928.

ALBERT E. MARSHALL.