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W. W. WILLIAMS

1,817,051

ELECTRICALLY OPERATED AND CONTROLLED OIL BURNING MECHANISM

Filed June 11, 1928

6 Sheets-Sheet 1

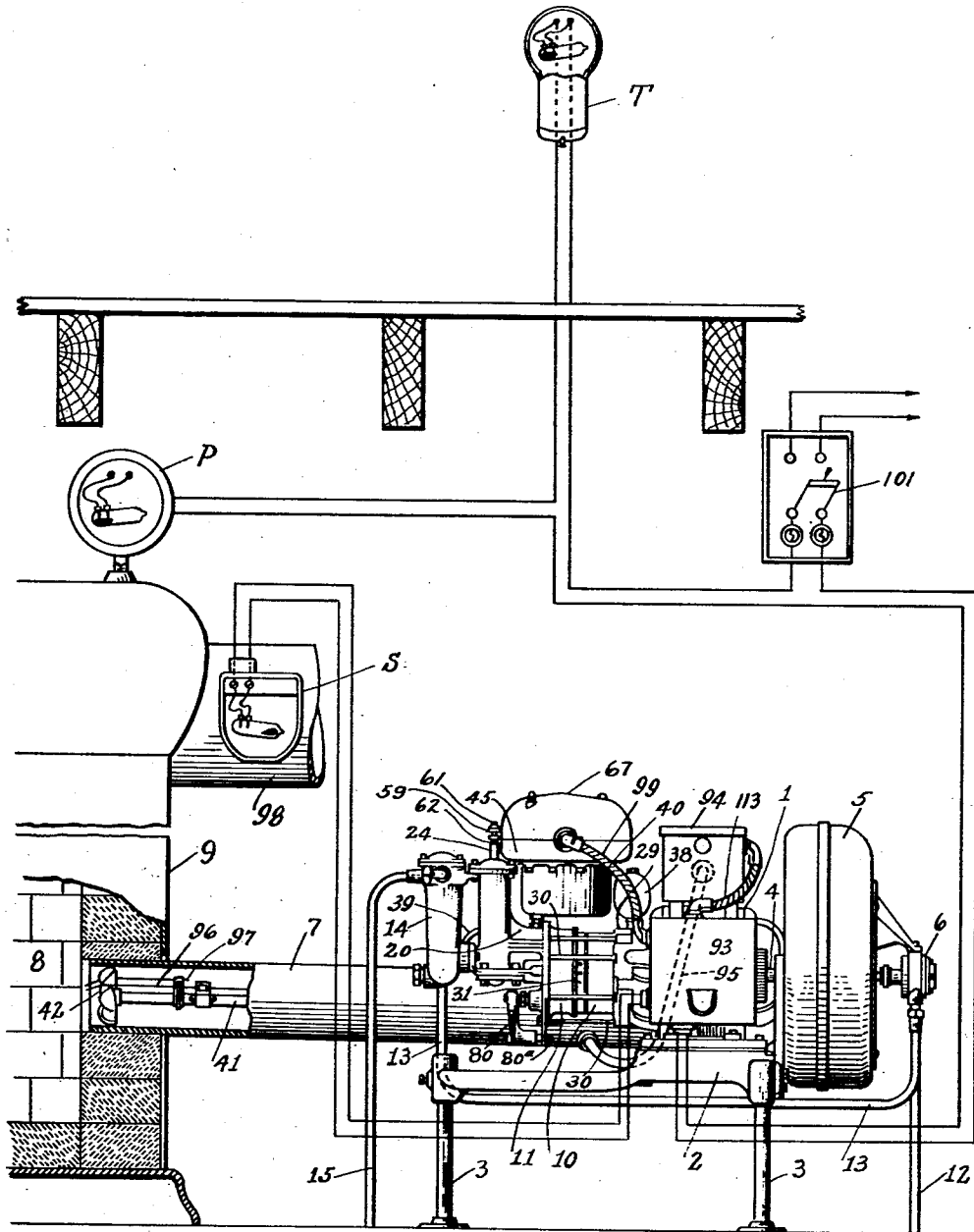


FIG. 1.

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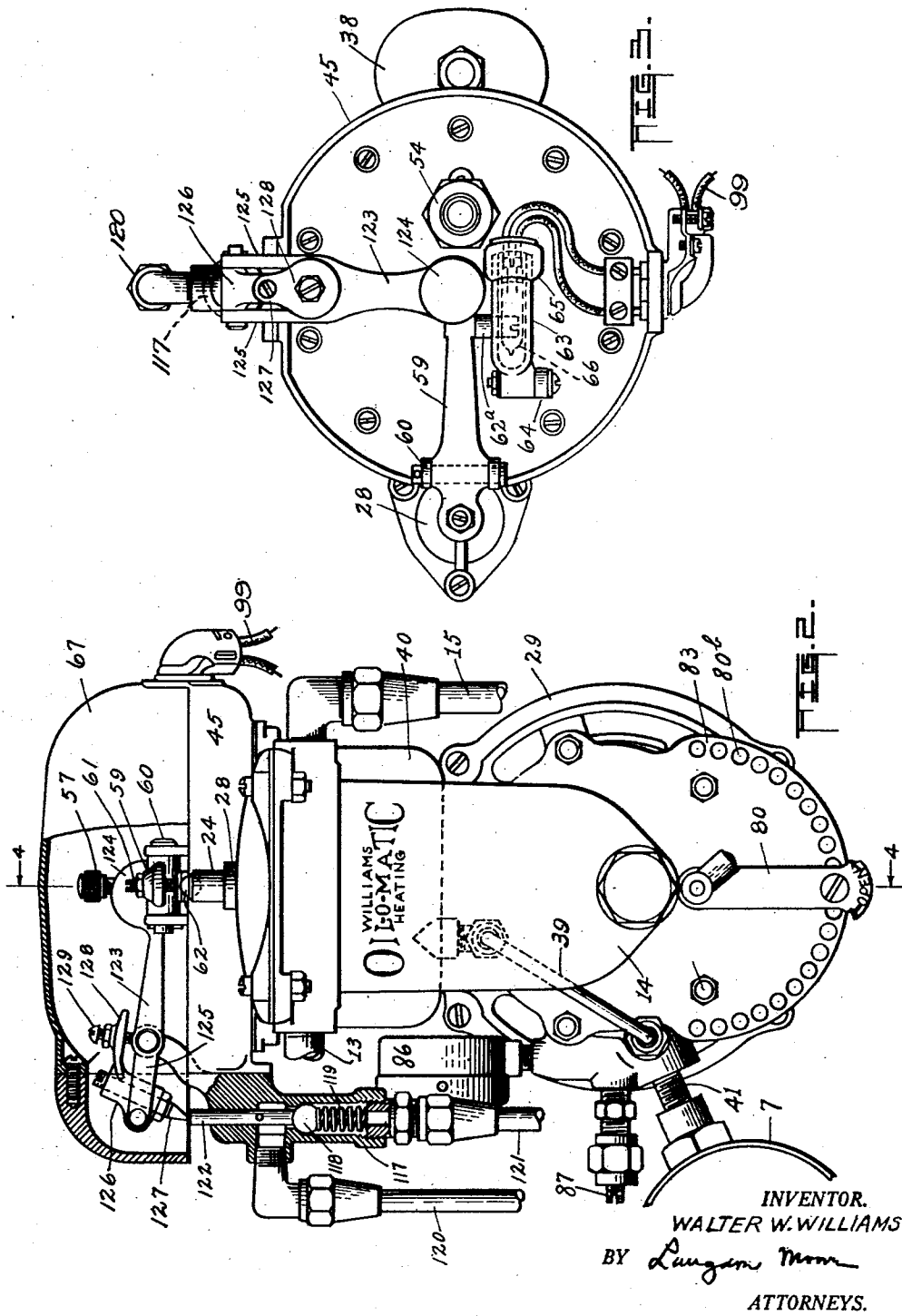
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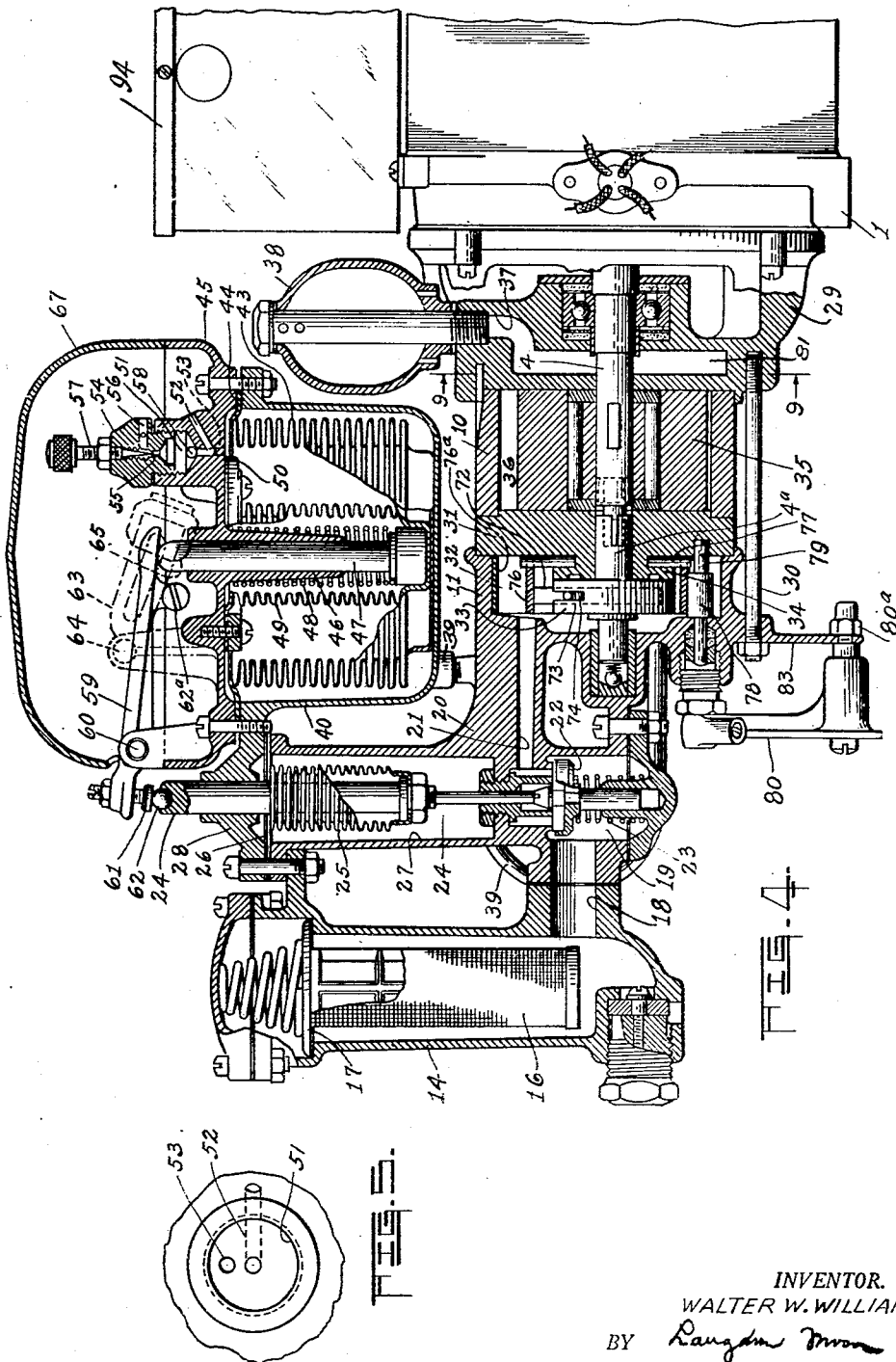
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ELECTRICALLY OPERATED AND CONTROLLED OIL BURNING MECHANISM

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6 Sheets-Sheet 3



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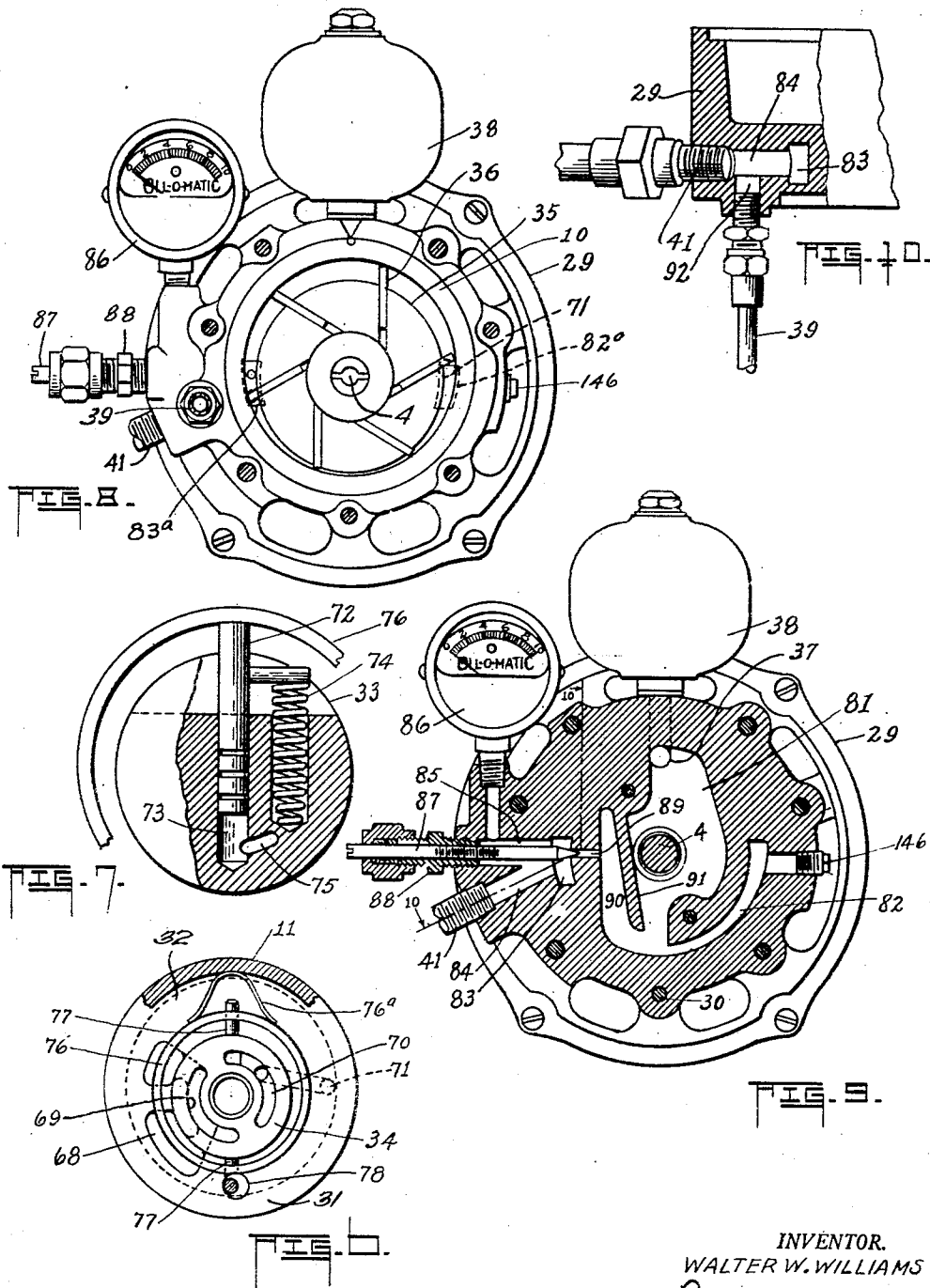
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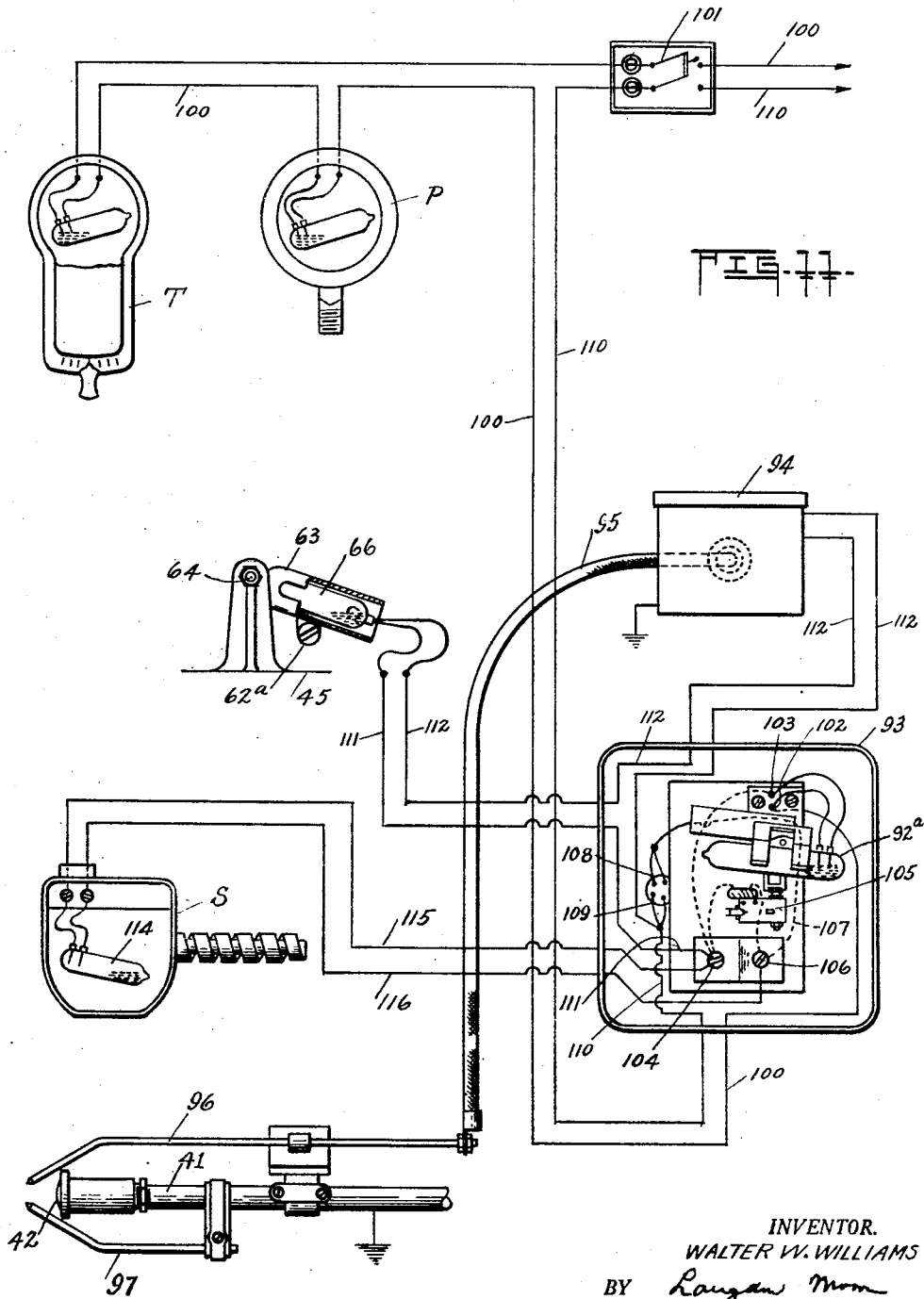
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ELECTRICALLY OPERATED AND CONTROLLED OIL BURNING MECHANISM

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6 Sheets-Sheet 5



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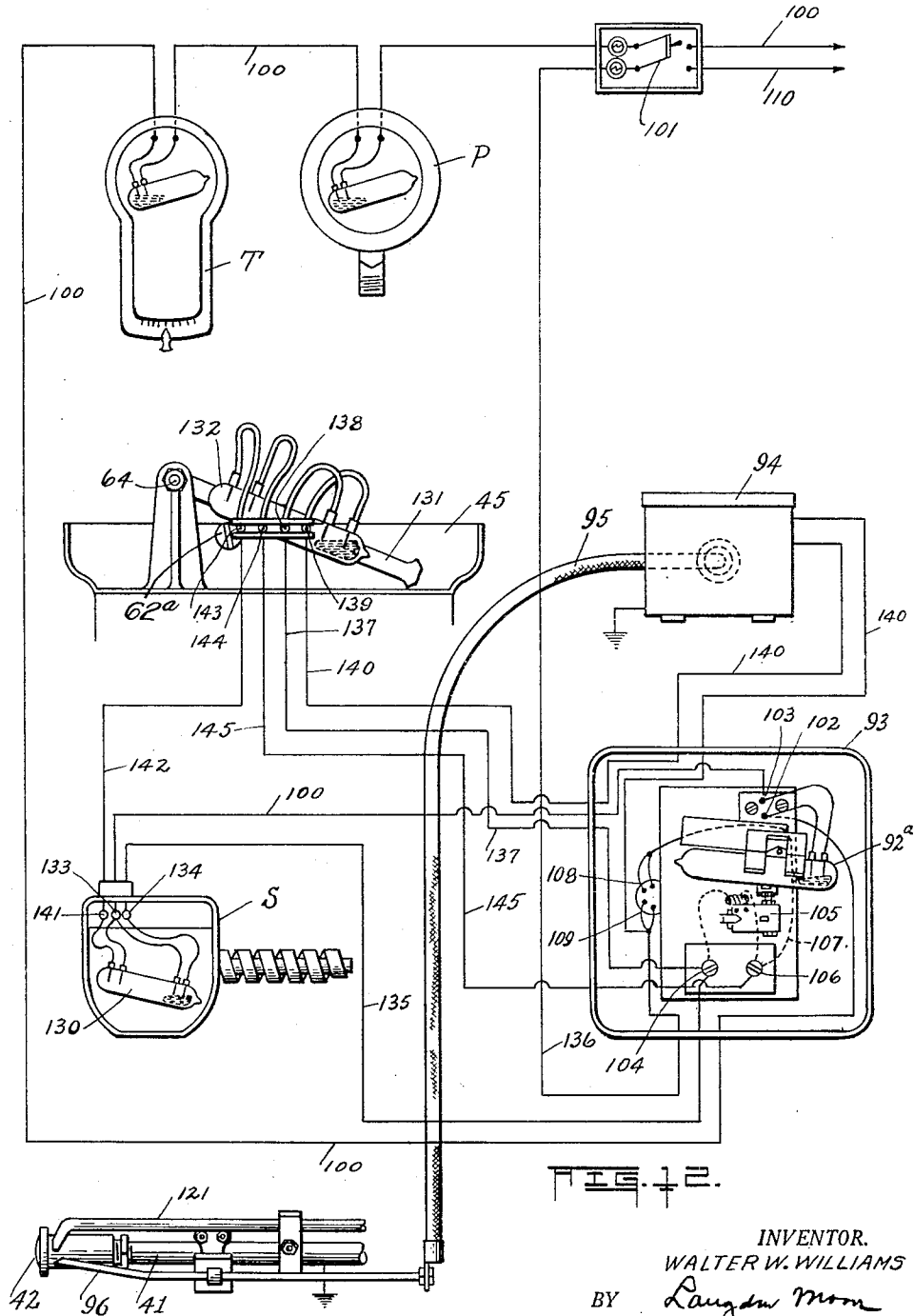
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ELECTRICALLY OPERATED AND CONTROLLED OIL BURNING MECHANISM

Filed June 11, 1928

6 Sheets-Sheet 6



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ELECTRICALLY OPERATED AND CONTROLLED OIL BURNING MECHANISM

Application filed June 11, 1928. Serial No. 284,545.

This invention relates to improvements in liquid fuel burners for domestic heating purposes and more particularly to an electrically operated and controlled oil burning mechanism.

It is an object of this invention to provide a device of this character which is of substantial yet simple construction and adapted to modern production methods with the various parts interchangeable and readily adjustable.

With these and other objects in view reference is made to the accompanying drawings which illustrate a preferred form of this invention with the understanding that minor detail changes may be made without departing from the scope thereof.

In the drawings:

Figure 1 is a view in side elevation of this improved device, as installed in connection with a commercial type of domestic furnace, with parts broken away, and illustrating the electrical controls in diagram.

Figure 2 is an enlarged fragmentary detail view in front elevation, of Figure 1, with parts broken away, and partly in section.

Figure 3 is a top plan view of the control mechanism of Figure 2 with the cap removed.

Figure 4 is a view in central vertical longitudinal section taken on the line 4—4, Figure 2, looking in the direction of the arrows.

Figure 5 is an enlarged detail plan view of dash pot intake trap, with needle valve cap removed.

Figure 6 is a view in end elevation of the metering pump with the housing and rotor removed.

Figure 7 is an enlarged detail view partly in section of the rotor and control ring removed.

Figure 8 is a view in end elevation of the atomizing pump with the metering pump end removed.

Figure 9 is a view in vertical transverse section of the end bell, taken on the line 9—9, Figure 4.

Figure 10 is a sectional view taken on the line 10—10, Figure 9, showing connection leading from atomizing pump to dash pot.

Figure 11 is a wiring diagram of the electrical control system shown in Figure 1.

Figure 12 is a wiring diagram of another electrical control system applied to this improved device.

Figure 1 of the drawings shows an embodiment of this improved electrically-operated and controlled oil burner mechanism as installed in connection with a domestic heater or furnace of any desired type. The oil burner is illustrated in side elevation and comprises an electric motor mounted within the casing 1 resting and secured upon the support 2 having adjustable legs 3, the motor shaft 4 extends to the right of the motor casing through a fan blower housing 5 to an oil pump 6. A fan blower, not shown, is mounted upon the motor shaft within the housing and the fan blower housing opens into a draft pipe 7 which extends along one side of the burner mechanism and enters the combustion chamber 8 of the commercial heater or furnace 9. The motor shaft is extended in the opposite direction to pass through an atomizing pump housing 10 and metering pump housing 11 and is adapted to operate simultaneously the oil pump 6, the fan blower within the housing 5, the atomizing pump within the housing 10, and the metering pump within the housing 11.

Oil, or other desirable liquid fuel, is drawn from a tank, not shown, through the pipe 12 by the oil pump 6 from which it is delivered by the way of pipe 13 to an oil strainer housing 14 having an overflow pipe 15 by which excess oil is returned to the tank.

The oil strainer housing is shown in end elevation and in section in Figures 2 and 4, respectively. The oil supply pipe 13 is shown in Figure 2 as entering the upper left-hand side of the housing and the overflow pipe 15 is shown leaving the upper right-hand side of the housing.

Figure 4 shows an oil strainer in the form of a fine wire mesh cylinder 16 carried upon a centrally perforated plate 17 held seated upon a shoulder within the housing below the opening of the supply pipe 13. The bottom of the housing is provided with an outlet orifice 18 opening into an oil valve chamber

19, whereby it is seen that all oil entering the oil valve chamber must first pass through the cylindrical strainer 16 and if excess oil is supplied to the oil strainer housing it will pass out therefrom through the overflow pipe 15 back to the tank.

The oil valve and oil valve chamber 19 is arranged within a housing 20 which also forms a part of the metering pump housing 11 and the oil valve chamber 19 is provided with a passage 21 leading from the upper portion thereof to the upper portion of the interior of the metering pump housing 11. The oil valve chamber supports an oil valve 22 normally held seated in its uppermost position by a spring 23 and is caused to open upon the depression of a rod 24 mounted thereabove in the housing 20. As shown in Figure 4, the rod 24 is provided with a bellows stuffing box 25 attached at its upper end to a plate 26 over the well 27, in which the piston operates, by a cap 28 which also acts as a bearing or guide for the upper end of the piston. When the piston is depressed by the fuel pressure, as hereinafter described, it depresses the oil valve 22 allowing the passage of oil from the oil strainer housing through the conduit 18 and valve chamber 19 to enter conduit 21 and be discharged within the metering pump housing 11. As shown in Figure 1, this oil valve and metering pump housing 20 is secured to the atomizing pump housing and the atomizing pump housing is secured in turn to the end bell 29 of the motor casing 1 by means of tie rods 30.

The metering pump comprises a cylindrical base 31 which is held in place between the metering pump housing 11 and the atomizing pump housing 10 by the said tie rods 30. The metering pump housing provides a cylindrical chamber 32 which is concentric to the extension 4a of the motor shaft 4 which shaft passes through the center of the metering pump base 31 and is operatively attached to a rotor 33 adapted to rotate freely within the chamber 32 and bear on one side against a projection of similar size and shape 34 extending toward the center of the chamber from the fixed base 31. The operation of this metering pump will be described in detail in connection with Figure 6 of the drawings. At the present time it will suffice to say that the oil or liquid fuel entering from conduit 21 into the metering pump chamber 32 is delivered at a constant rate of supply to the interior of the atomizing pump housing 10 irrespective of the quality of the fuel.

The atomizing pump housing 10 is a cylindrical casing abutting the fixed metering pump base 31 and end bell 29 of the motor casing 1 which cylindrical casing is arranged eccentric to the motor shaft 4 and a cylindrical rotor 35 is axially mounted upon the motor shaft 4 to closely approach the interior walls of the atomizing chamber within the

housing 10 at the lower side thereof and said rotor is provided with a plurality of blades 36 slidably mounted within guides in the rotor 35 with their outer ends adapted to contact with and wipe over the entire inner surface of the atomizing pump cylinder as the rotor rotates, as will be hereinafter described more in detail in connection with Figure 8. It is to the general understanding of this device sufficient to say at this time that air is drawn into the atomizing chamber through ducts provided in the end bell 29.

The end bell 29 is secured to the motor casing 1 in fixed relation by any desired means. As heretofore stated the tie rods 30 secure the oil valve and metering pump housing and atomizing pump housing in fixed relation and securely in engagement with the end bell 29. The surface of the end bell adjacent the atomizing pump forms within the atomizing pump housing a closure for that end of the atomizing chamber. An intake air duct 37 is provided in the body of the end bell leading from an air intake muffler 38 upon the upper side thereof to a distributing duct 81 about the center of the end bell surrounding the motor shaft 4 and, to the general understanding, it is sufficient at this time to state that said distributing duct communicates with the interior of the atomizing pump chamber.

The atomizing pump communicates with a duct 83 in the end bell which is also in communication with a discharge pipe 41 to convey the atomized mixture of oil and air under pressure from the atomizing pump through the draft pipe 7 to the burner nozzle 42, as shown in Figure 1. Pressure is also conveyed by a pipe 39 from the atomizing pump to the under side of a dash pot bellows housing 40.

The dash pot bellows housing 40 is in the form of a cylindrical casing open at the top and is formed integral with the cap 28 secured upon the oil valve and metering pump housing 20 over the well 27. A metallic bellows 43 closed at the bottom and secured to an outwardly extending plate 44 is arranged within this housing with the plate 44 clamped about the upper edges of the housing by a closure 45 having a central opening with a depending cylindrical bearing 46, which closure also acts as a base or support for the control mechanism. A plunger 47 having an enlarged head in the lower end thereof is mounted in the central bearing 46 with the lower enlarged head resting upon the bottom of the bellows 43 and normally held in contact therewith by a compression spring 48 arranged about the plunger and bearing between the underside of the closure and upper side of the enlarged head. A stuffing box comprising a metallic bellows 49 is arranged about said plunger 47 and bearing 46, which bellows is closed at the lower end and is in-

terposed between the outer bellows 43 and underside of the enlarged head of the plunger 47 with the opposite end secured to an outstanding plate held in airtight position to the underside of the closure 45 by clamping member 50. It is, therefore, readily seen that when pressure created by the atomizing pump is conducted therefrom through pipe 39 to the underside of the bellows 43, the bellows 43 will be caused to contract, thereby imparting an upward movement to the plunger 47. The upward movement of the plunger 47 is employed to operate the oil valve plunger 24 and also the ignition switch, as hereinafter described, and it is desirable to impart a slow upward movement to said plunger 47 and allow it to have a quick return to its lowermost position. When the bellows 43 is caused to contract, the air contained between the inner walls of this bellows 43 and the outer walls of the bellows 49 must be allowed to escape to the atmosphere and by regulating the rate of escapement the upward movement of the plunger 47 can also be regulated. To this end a chamber 51 is provided integral with and extending above the upper side of the closure 45, which chamber is preferably provided with a depressed conical bottom having a small duct 52 leading from the apex thereof to the atmosphere and also a vertical duct 53 leading from the sloping surface thereof as shown in Fig. 5 to the interior of the dash pot bellows housing between the bellows 43 and 49, as shown in Figure 4. A cap 54 is secured above the chamber 51, as shown in Figure 4, which cap contains a central vertical passage 55 having a right angularly extending duct 56 extending therefrom and leading to the atmosphere with a bearing surface formed about the passage way 55 below the lower juncture of said duct, and a needle valve 57 is mounted in the cap 54 adapted to adjustably control the size of the opening between the passage 55 and duct 56. A check valve, preferably in the form of a ball 58, is provided upon the bottom of the chamber 51 which normally closes the duct 52. By the proper adjustment of the needle valve 57, the time required to contract the bellows 43 from its position resting upon the bottom of the housing 40 until the enlarged head of the plunger 47 engages the bottom of the bearing 46 can be accurately timed and when the pressure about the exterior of the bellows 43 is relieved, the spring 48 will expand it causing a suction through duct 53 to chamber 51 allowing the atmospheric pressure entering through duct 52 to pass the check valve 58, and, by this construction, an adjustable dash pot is provided controlling the time of movement of the plunger 47.

As heretofore said, the oil valve 22 is normally closed and is opened by a downward movement of the rod 24. The upward movement of the plunger 47 actuated by the bel-

lows 43 is imparted to a lever 59 pivotally mounted at 60 in line with the upper extremity of the rod 24, which lever 59 extends beyond its pivot and is provided with a downwardly extending adjustable contact 61 adapted to engage a ball 62 supported in the upper end of the rod 24 whereby upward movement of the plunger 47 causes a depression of the rod 24 to open the oil valve 22 and when pressure within the housing 40 is relieved, the depression of the plunger 47 by the spring 48 allows the upward tension of the spring 23 to return the rod 24 and lever 59 therewith. As seen in Figure 3, the lever 59 is provided with an angular extension 62^a adapted to engage the underside of a cylindrical housing 63 which is closed at its upper end and pivotally mounted upon a stud 64 mounted on an upward extension from the bottom of the closure 45 at one side and to a distance above said lever 59. The lower open end 65 of this housing is weighted to normally maintain its contact with the extension 62^a of the lever 59 and is adapted to receive therein a mercury tube switch 66 which will be in closed position when the open end of said housing 63 is in its lowermost position and which will be in the open position when said housing 63 has been rotated about its pivot to the upper end of its movement by the engagement of the projection 62^a of the arm lever 59 when the plunger 47 is fully extended. The purpose of this switch will be hereinafter described. A cover 67 is provided for the dash pot bellows housing which protects the controls and other parts mounted upon the upper surface of the closure 45.

For a more complete understanding of the detail operations of the metering pump and atomizing pump, reference is made to the detail views of these features shown in Figures 6, 7, 8 and 9 of the drawings.

Figure 6 is an end view of the metering pump with the rotor and casing removed, which illustrates the base 31 and the outer surface of the extension 34. The metering pump operates in the same manner as that disclosed in the applicant's prior patent No. 1,492,186. The oil entering the metering pump chamber 32 through the passage 21 then enters the depressed port 68 in the flat surface of the base 31, shown at one side of the extension 34, which depressed port communicates with the transverse port 69 extending upward to the outer surface of the extension 34 and which forms an elongated opening parallel to the outer walls of said extension and arranged intermediate therebetween and the motor shaft extension 4a. The opposite side of the upper surface of the base extension 34 is provided with a similarly shaped port 70 which extends transversely of the base 31 and terminates in a connection with a radial duct 71 in said base,

which duct leads through the opposite side of said base and opens into the atomizing chamber adjacent the interior of the housing 10. The rotor 33, as shown in Figure 7, is provided with a reciprocating piston 72 closely received within a piston chamber 73 arranged at one side and parallel to a plane passing through the center of said rotor which piston is normally held in its outermost position by a piston spring 74. The bottom of the piston chamber is provided with a port 75 so located as to successfully wipe over the ports 69 and 70 opening on the upper surface of the base extension 34. The piston 72 is caused to rotate with the rotor with its outer end wiping over the interior surface of a control ring 76 which is held against rotation by oppositely disposed pins 77 engaging in notches in the edges of said ring. The eccentricity of the control ring 76 is controlled by a cam 78, acting upon the outer surface of said ring in line with the fixed pins 77, mounted on a shaft 79 which extends through a stuffing box in the metering pump housing and having an operating lever 80 rigidly secured at the outer end thereof. By the rotation of this cam, the control ring is moved against the spring 76a to bring the inner surface thereof toward or away from the outer surface of the rotor. The ports 69 and 70 are so arranged that as the spring 74 forces the piston away from the bottom of the piston chamber, the piston chamber port 75 passes over the port 69 in the extension 34 communicating with the depressed port 68 whereby the liquid in the chamber 32 is drawn through these ports into the piston chamber 73 and as the piston begins to descend the piston chamber port 75 wipes over the port 70 in the extension 34 whereby the contents in the piston chamber is discharged through the piston chamber port into the port 70 and into the radial duct 71 into the atomizing chamber. As seen in Figures 2 and 4, the control ring cam shaft lever 80 is provided with a right angular detachable locking member 80a adapted to engage in one of a series of holes 80b arranged concentric with the shaft 79 upon a depending extension 83 of the metering pump housing 11, whereby the position of the control rings 76 may be adjusted and when adjusted held securely in that position.

Figure 8 is an end view of the atomizing pump with the metering pump base 31 removed. From this view taken in connection with the sectional view shown on Figure 4, it is seen that the housing 10 is arranged eccentric to the motor shaft 4 and the rotor 35 slidably supports the blades 36 which are preferably arranged at one side of and parallel to the plane passing through the center of the rotor, as shown in Figure 8. These blades 36 wipe over the flat surfaces of the metering pump base 31 and end bell 29 at their opposite edges and their outer edge is adapted to wipe over the inner surface of the eccentrically arranged housing 10 by centrifugal force when the motor shaft rotates. The surface of the end bell 29 engaged by the adjacent side of the rotor 35 and adjacent edges of the blades 36 is flat, as shown in Figure 4. The air duct 37 leading from the intake air muffler 38 upon the upper surface of the end bell opens into a distributing duct 81 of the shape shown in Figure 9, and which extends about the motor shaft 4 and opens into an atomizing pump intake duct 82 at a point diametrically opposite the entrance of the duct 37. The atomizing pump duct 82 is arranged concentric with the motor shaft and of such shape as to allow the rotation of the blades 36 to suck or draw air from the opening 82a at the end of this duct into the atomizing chamber. The flat surface of the end bell 29 is provided with a depression 83 concentric with and diametrically opposed to and communicates with the duct 82a which may be called the discharge port of the atomizing pump inasmuch as this duct 83 opens into the pipe 41 leading to the burner nozzle and is so arranged that the air drawn in through duct 82 will be compressed by the blades 36 and discharged through duct 83. The radial duct 71 in the base 31 of the metering pump which opens into the atomizing chamber discharges oil thereinto approximately in line with the air inlet duct 82a whereby the air and oil are atomized or mixed to form a froth or emulsion which are both discharged from the atomizing pump through duct 83 into the pipe 41 to the burner nozzle to produce heat within the combustion chamber of the furnace. Under various conditions it may be desirable or found necessary to adjust the pressure of this mixture which is forced through the burner nozzle. As shown in Figure 9, the duct 83 not only opens into a passage way 84 leading to the pipe 41 but also opens into a contiguous passage 85 which leads to a pressure gauge 86. This passage way 85 also receives an adjustable needle valve stem 87 mounted in a cap 88 secured in the exterior end of said passage 85. The wall of the duct 83 opposite passage 85 is provided with a port 89 forming a means of communication from duct 83 to a duct 90 in the end bell opening into duct 82 which is separated from the duct 81 in the end bell by a partition 91 which provides at its lower end an opening from the duct 90 opposite the opening of the duct 82 of the atomizing pump intake duct 82a, the lower walls of the duct 90 being a continuation of the concentric outer wall of the duct 82. By means of varying the size of the opening into the passage way 89, the pressure of the mixture passing into pipe 41 may be varied as the excess pressure will be drawn through the passage way

89 upon the opening of the needle valve into the duct 90 and thence through the duct 82 by the suction of the atomizing pump when in operation. The partition 91 is necessary to this successful operation. It is by this means that the mixture of air and oil from duct 83 under pressure strikes against the partition 91 when it issues from the passage 89 and is directed downwardly so that it will be opposite the opening of duct 82 whereby it will be drawn directly into said duct without entering the duct 81.

The pipe 39 communicating with the underside of the dash pot bellows housing 40 is shown in Figure 2 as being connected with the end bell 29 at one side of the atomizing pump housing, as shown in Figure 10. The sectional view illustrated in Figure 10 shows the pipe 39 communicating with a passage 92 in the end bell which opens into the passage 84 therein so that upon initial operation of the atomizing pump, the pressure created therein will be communicated through the discharge duct 83, passage 84 and passage 92 leading therefrom to the pipe 39.

Figure 1 illustrates a wiring diagram which is illustrated more in detail in Figure 11. Figure 1 shows the pipe 41 through which the fuel is delivered to the nozzle 42 and the broken away portion of the draft pipe 7 illustrates a direct spark ignition device also shown in Figure 11. In this type of ignition and control a safety switch 92^a having a counterweight which will normally hold the switch in open position and which is held in closed position by a releasable catch responsive to heat produced by an electric current passing there-through, which safety switch is of commercial construction, is mounted in a switch box 93 shown in Figure 1 as being supported upon the inner side of the motor casing. Upon the upper side of the motor casing an ignition device 94 is shown in Figure 1 which ignition device may be a spark coil or transformer, as desired, and in either case, one of the terminals of the induced current is grounded upon the motor casing. A cable 95 is shown for conveying the other passage of the induced current from the ignition box to the electrode 96 which is supported upon and insulated from the pipe 41 and extends to a point in advance of the burner nozzle and is then bent downward to form a spark gap with another electrode 97 so arranged that the spark will jump in the path of the discharged fuel for igniting the same, which latter electrode is supported upon and grounded to the pipe 41. The operation of the burner is controlled by a room thermostat T and the furnace is preferably provided with a pressurestat P in circuit with the room thermostat. The safety switch is prevented from breaking the motor circuit during normal running conditions by the stack safety switch

S mounted in the stack 98, or passage way which leads the gases of combustion from the combustion chamber to the smoke stack or chimney. Figure 1 also shows a cable 99 leading from between the cap 67 of the closure 45 of the dash pot bellows housing 40 to the switch box 93, the purpose of which will be hereinafter explained. Referring to the enlarged detail wiring diagram on Figure 11, the commercial current enters the building through the wire 100, passes through the knife-switch 101 to the room thermostat T and from thence through the pressurestat P to the binding post 102 in the switch box 93 and from thence through flexible leads to the mercury tube switch 92^a to the binding post 103 and from there to binding post 104 and here the current branches, one branch passing through a heating element 105 to the binding post 106 and from thence through a lead 107 to the motor connections 108, through the motor and motor connections 109 and thence through wire 110 back through the knife switch 101 to the main line. The other branch from binding post 104 passes through wire 111 to the mercury tube switch 66 in the pivoted cylinder 63 on the dash pot bellows housing closure 45 and thence through wire 112 through the ignition device 94 and back through the switch box to join the return wire 110 to the return of the main line. Wires 111 and 112 leading from the switch box to the mercury tube switch 63 pass through the cable 99, shown in Figure 1, and the wires 112 passing from the switch box to the ignition box 94 are shown passing through the cable 113, shown on Figure 1.

When the furnace is cold and the motor is idle, the circuit is normally broken through the room thermostat T, however, the circuit is closed through pressurestat P and the mercury switch 66 and closed through the safety switch 92^a. When the room thermostat closes to operate the burner to produce heat, the circuit is then completed, as above described, and the motor will begin to operate which will create pressure in the atomizing pump that will be transmitted through pipe 39 to the underside of the bellows 43 causing the same to contract and as the plunger 47 moves upward it will open the oil valve allowing oil to flow through the metering pump into the atomizing pump and be discharged at the burner nozzle. The mercury tube switch 66 being closed, the ignition device will also be energized causing a spark to jump from electrode 96 and 97 and ignite the liquid fuel and, after a predetermined time, as the plunger 47 reaches the uppermost end of its travel, the mercury tube switch will be tilted to break the circuit to the ignition device. If for any reason ignition should fail to take place, the motor circuit will continue to pass through the heating element 105 which will result in its releasing the safety switch 92^a and thereby

break the motor circuit. To allow continued normal operation of the burner after ignition has taken place, the stack safety switch is employed. As shown, this is a mercury tube switch 114 which is normally in open position and is connected by wire 115 leading from binding post 104 and by wire 116 leading from the mercury tube switch to the binding post 106. This stack safety device is a commercial article and is provided with a coil of thermostatic or bi-metallic metal which enters into the interior of the stack and is effected by the gases of combustion so that when it becomes heated it expands rotating the mercury tube switch 114 to closed position, so that after the fuel at the burner has become ignited and before the heat element 105 releases the heat switch 92^a, the motor circuit passes from binding post 104 through the mercury tube switch 114 to binding post 106 and therefrom to the motor shunting out the heating coil 105.

The type of ignition described in Figure 11 is termed "Direct spark ignition". There are times when it is desirable to employ the flame from the commercial gas supply to ignite the burner flame in the manner shown and described in the applicant's co-pending application Serial No. 578,618, filed December 31, 1922. This type of ignition is commercially known as the "Combined gas and spark ignition" and the control apparatus for admitting gas at the time spark occurs and allowing it to be ignited thereby and burn for a predetermined time and after the burner flame has been ignited to cut off the gas supply, is illustrated in Figures 2 and 3 of the drawing as well as on wiring diagram No. 12.

When it is desired to employ a combined gas and spark ignition a gas valve housing 117 is formed integral with the dash pot bellows housing closure 45, as shown in Figure 2. This housing contains a ball valve 118 normally held seated by a compression spring 119 closing a passage way into the housing from an independent source of gas supply entering therein through pipe 120 and lead therefrom by pipe 121 to a point adjacent the burner nozzle. In order to control the admission of gas at the time the spark ignition is energized, a stem 122 is mounted in the gas valve housing and adapted to slide therethrough and depress the ball valve 118. This movement is imparted to the stem by means of a lever 123 pivotally mounted upon a support extending above the upper surface of the closure 45. Said lever 123 is provided with a weighted extremity 124 which will normally maintain that end of the lever in contact with the end of the oil valve operating lever 59 so that when the plunger 47 causes lever 59 to rotate about its pivot, it will also cause lever 123 to rotate in an upward direction about its pivot. The lever 123 is provided with a forked extension 125, the arms

of which extend beyond the pivotal point. Pivotally mounted between the extremities of these extensions 125, is a gas valve stem engaging member 126 provided with a depending adjustable member 127 so arranged that when the weighted end 124 is in the depressed position this member 127 will engage the upper end of the stem 122 when the gas valve 118 is seated. The gas valve stem engaging member 126 is provided with an extension 128 provided with an adjusting screw 129 passing therethrough and adapted to contact the body of lever 123 above its pivotal point, as shown in Figure 2. Upon upward movement of the plunger 47, the lever 123 is rotated about its pivot causing the gas valve stem engaging member 126 to descend with the adjusting screw 129 in contact with the lever 123. This movement depresses the gas valve stem 122 and then, upon continued rotation in a downward direction of the member 126, the engaging member 127 wipes over and loses contact with the stem 122 and being carried out of its path allows the spring 119 through the ball 118 to impart an upward movement to the stem 122, allowing the gas valve to become seated and cut off the independent gas supply. The pivotal support of member 126 allows the same to wipe over the upper extremity of stem 122 in its raised position when the burner motor ceases to operate so that when the weighted extremity 124 is in its lowermost position, the gas valve stem engaging member 126 will again assume the position shown in Figure 2.

In Figure 12, the independent gas supply pipe 121 is shown terminating adjacent the pipe 41 a short distance to the rear of the nozzle 42 and the electrode 96 is shown supported upon and insulated from said pipe 41 with the extremity bent down in proximity to the open end of the independent gas supply pipe 121 so that when the ignition device 94 is energized a spark will jump from the electrode 96 to the extremity of pipe 121 and if gas is emitted therefrom it will be ignited thereby.

The control indicated in diagram in Figure 12 includes the house switch 101, pressurestat P, room thermostat T, stack safety S, switch box 93, and ignition device 94, all of commercial construction and corresponding to similar parts illustrated on Figure 11, with the exception that the mercury tube switch 130 in the stack safety S is a double switch, that is, is provided with pairs of electrodes entering adjacent each end whereby one circuit may be closed when depressed in one direction and another circuit closed when depressed in the opposite direction. The safety switch mechanism illustrated in Figure 12 within the switch box 93 is of the same commercial type as shown in Figure 11 including the mercury tube switch 92^a, heating element 105, binding posts 104 and 106 and motor connections 108 and 109. A lever 131 is

substituted for the sleeve 63 and is mounted in the same relation as said sleeve upon an extension 64 from the upper surface of the closure 45. This lever is engaged upon the underside by an extension 62^a from the lever 59 and is operated in the same manner as the sleeve 63. In place of having a single mercury tube switch, as shown in Figure 3, a double mercury tube switch 132 is supported upon said lever.

The operation of this control circuit, as diagrammatically illustrated in Figure 12, is as follows:

The current entering from the commercial line through wire 100 passes through the knife switch 101, pressurestat P, and room thermostat T to the binding post 102 within the casing 93 and from thence through flexible leads through the mercury tube switch 92a to the binding post 103 and from thence to the middle binding post 133 of the double stack safety switch 130. When the furnace is cold and the motor is idle, the stack safety switch 130 is in the position shown so that the current passes through the flexible lead to the right hand binding post 134 and thence by wire 135 to binding post 104 within the casing 93. Here the current divides, part passing through the heating element 105 to binding post 106 and thence by way of lead 107 to the motor connections 108, through the motor to motor connections 109, and from thence by way of wire 136 back to the knife switch 101 and commercial lead 110. When the furnace is cold and the motor is idle, the double mercury tube switch 132 on the dash pot bellows housing closure 45 is in the position shown and the other portion of the current branching the binding post 104 passes through lead 137 to binding post 138 and thence by flexible leads through the mercury in switch 132 back to the binding post 139 and then by way of wire 140 through the ignition device 94 and thence to the return wire 136. When the circuit just described is once closed, the motor will be energized and heat will be generated by a portion of the current passing through the heating element 105. If the burner flame is not ignited after a predetermined time sufficient heat will be created by the element 105 to release the safety switch 92a and break the motor circuit. On the other hand, if combustion is established the heat therefrom will actuate the stack safety S to rotate the switch tube 130 so as to close the electrodes at the opposite end and close the connection between binding posts 133 and 141 while breaking the connection between binding posts 133 and 134. The operation of the atomizing pump of the motor will cause the mercury tube switch 132 to be rotated in an upward direction breaking the contact shown and closing the contact between the two electrodes in the left hand end of the

switch closing the connections between binding posts 144 and 143. The circuit thus established is called the "running circuit of the motor" and the current follows the path above described to the middle binding post 133 of the stack safety. With the new position of the stack safety switch, the current then passes through flexible leads through the mercury in the switch back to the left hand binding post 141 and thence by way of lead 142 to the binding post 143 and by the way of flexible leads through the mercury in the switch 132 back to the binding post 144 and then by way of wire 145 to the binding post 106 and then follows the path through 107 to the motor and return lead, thereby cutting the heating element out of the running circuit entirely. Should combustion for any reason cease after the running circuit has been established, the stack safety will cool and assume the position illustrated in Figure 12, whereby the motor circuit is broken.

In certain localities natural gas is employed for heating purposes and the house will not be supplied with the usual commercial artificial gas. Natural gas does not act in the same manner in all localities as does artificial gas in a combined gas and spark ignition. In such cases where natural gas is desired, the natural gas is admitted from the gas valve into the interior of the atomizing chamber. For this purpose a plugged aperture 146 is shown on Figure 9, but the connecting pipe to the gas valve housing 117 is omitted. In this application of natural gas, the direct spark electrodes are employed and the natural gas is admitted first into the gas valve housing and from thence to the opening in the atomizing chamber. The control of the admission of the natural gas to the atomizing pump is the same as that employed in the combined gas and spark arrangement described for artificial gas. In the use of natural gas the direct spark electrodes are employed so that when the burner begins to operate for a predetermined time the natural gas will be allowed to enter the atomizing pump and will be forced through the pipe 41 to the nozzle 42 where it will be ignited and the flame therefrom will ignite the mixture of oil and air as it follows through.

What I claim is:

1. In a domestic liquid fuel burning mechanism, a motor for operating said mechanism including an end bell thereon a mixing pump mounted upon the end bell having means admitting liquid fuel and air thereto including a chamber within said end bell and means discharging the mixed liquid and air under pressure to the burner nozzle including a chamber in said end bell, said discharging means having an adjustable means communicating with said air admitting means, where-

by upon adjustment of said communicating means the pressure of the mixture between the pump and nozzle is regulated.

2. In a domestic liquid fuel burning mechanism including a motor having an end bell, a motor operated mixing pump mounted upon said end bell having separate intakes for liquid fuel and air, said air intake being within said end bell, and a mixture discharge connected to the burner nozzle within said end bell, said air intake including a chamber opening into the atmosphere and having a port leading into the pump chamber, said intake chamber also having a port leading therefrom to the mixture discharge of the pump with a baffle in said intake chamber opposite said mixture discharge port adapted to direct mixture passing through said mixture port towards the pump chamber port, and an adjustable needle valve controlling the size of said mixture port whereby mixture delivered at the nozzle above the desired pressure will be returned through the mixture port into the air intake chamber and therefrom through the air port into the pump chamber.

3. An electrically operated domestic liquid fuel burning mechanism comprising a motor having a shaft extending on both sides thereof adapted to operate a fan blower arranged at one side and having an end bell secured upon the other side providing one face for a rotary mixing and atomizing pump chamber, said end bell having an air intake chamber therein communicating to the atmosphere and to an air intake port leading into the pump chamber and a discharge chamber communicating through a discharge port to the pump chamber and through a port leading to the burner nozzle, a mixing and atomizing pump housing in engagement with the end bell, a pump rotor mounted upon the motor shaft within the housing, a metering pump base in engagement with the pump housing and forming the face for the pump chamber opposite the end bell, said base having a fuel intake port leading into the pump chamber, a metering pump rotor secured upon the motor shaft cooperating with ports provided in the opposite face of the base to deliver fuel through the fuel intake port, and a metering pump housing engaging the metering pump base providing a fuel chamber about the metering pump rotor, and having a passage from said chamber leading into an integral fuel inlet valve chamber and an integral oil inlet valve operating rod well, the mixing and atomizing pump housing metering pump base and metering pump housing all being detachably secured together and against the end bell in operative relation by tie rods engaging the metering pump housing and end bell.

4. In an electrically operated domestic liquid fuel burning mechanism, means for

supplying fuel to the burner nozzle including a motor having a shaft extending at one side thereof and an end bell secured upon that side providing one face for a rotary pump, a rotary pump and pump chamber mounted thereon, separate means for admitting air and liquid fuel to said pump including the provision of a chamber within the end bell having an intake leading to the atmosphere and a discharge leading into the suction side of the pump, the provision of a fluid fuel intake in the opposite face of the pump opening into the suction side, means for supplying fuel to said intake, and a single means for discharging both air and fuel including an additional chamber in the end bell with an intake from the compression side and a discharge leading to the burner nozzle.

Signed at Bloomington, Illinois, this 8th day of June, 1928.

WALTER W. WILLIAMS.