May 4, 1926. 1,582,913

W. B. EWING

BURNER SYSTEM AND CONTROL THEREFOR

Filed March 2, 1922 4 Sheets-Sheet 1

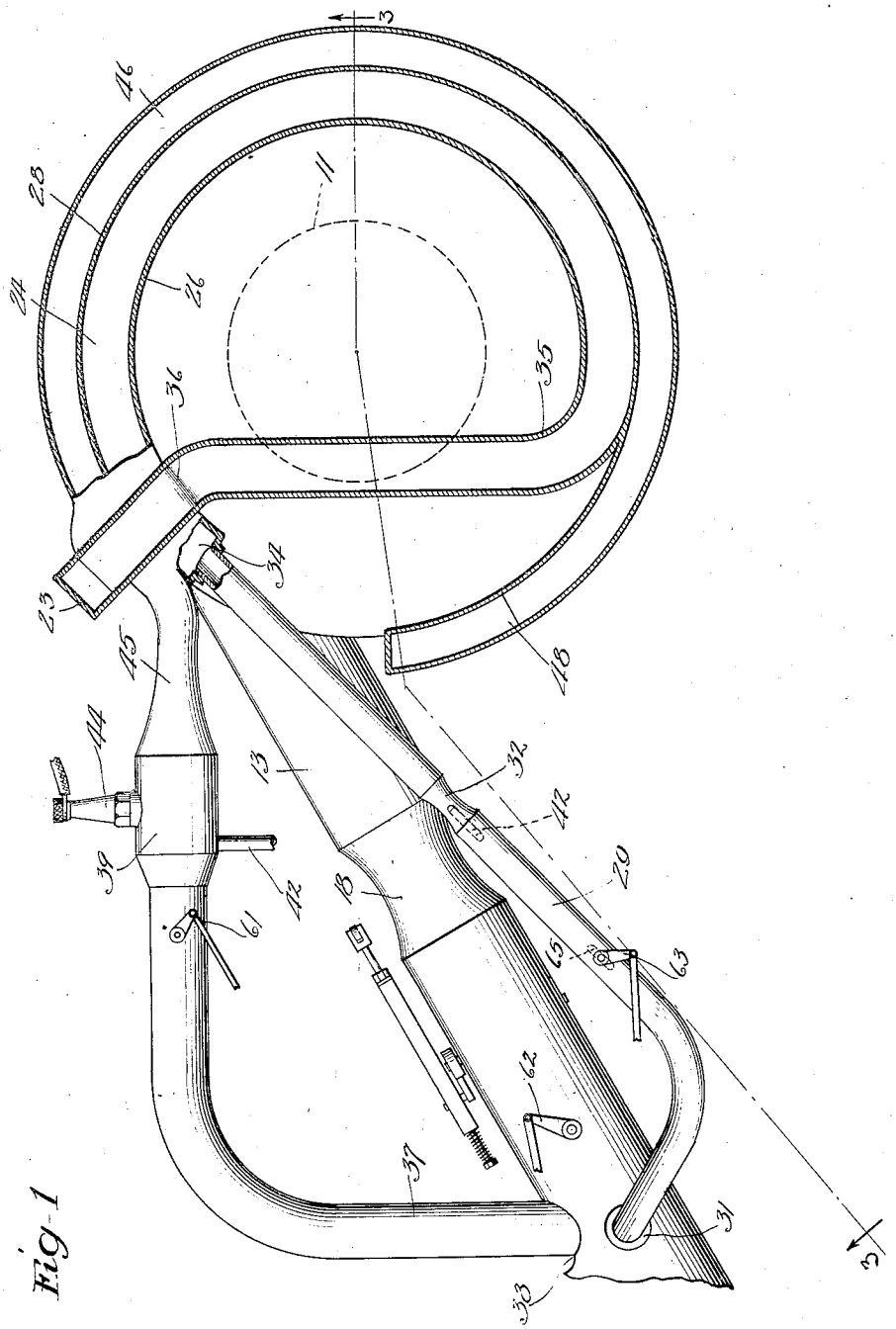


Fig. 1

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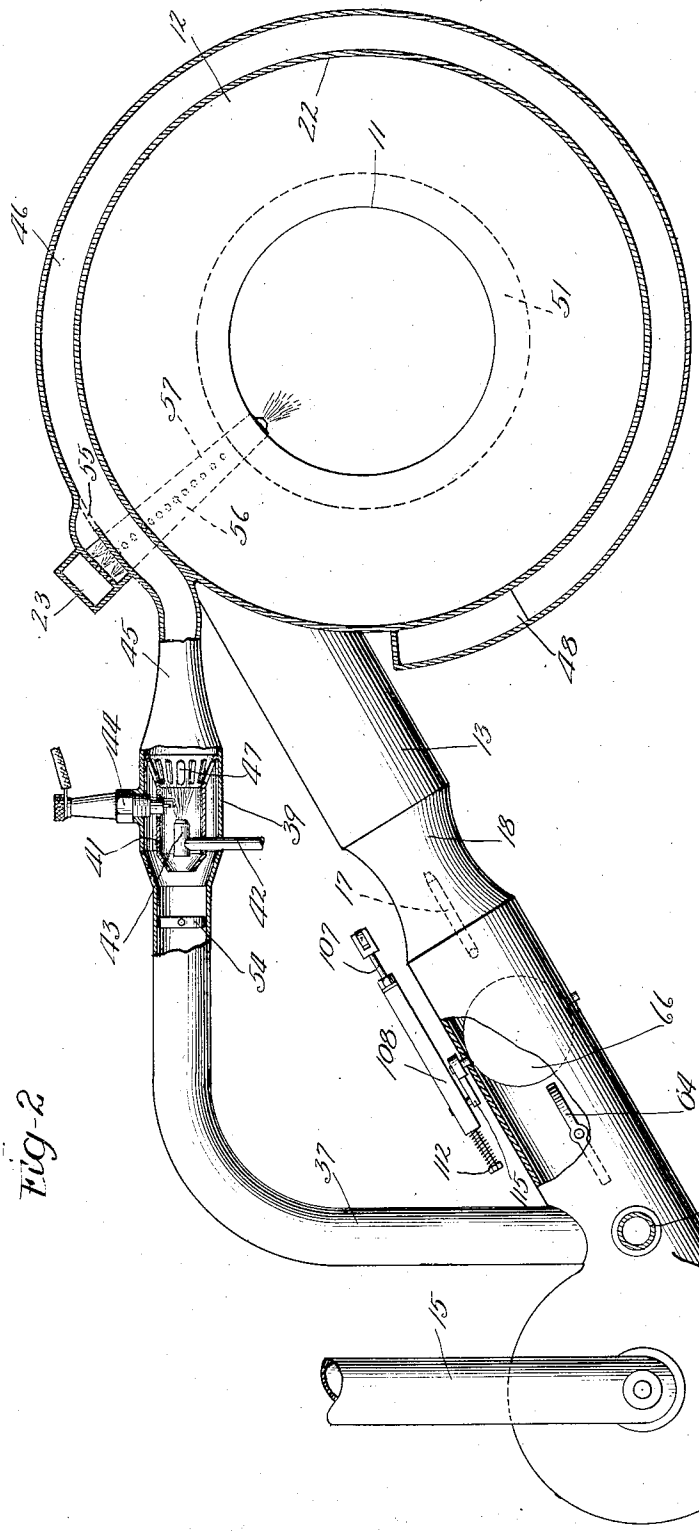


Fig-2

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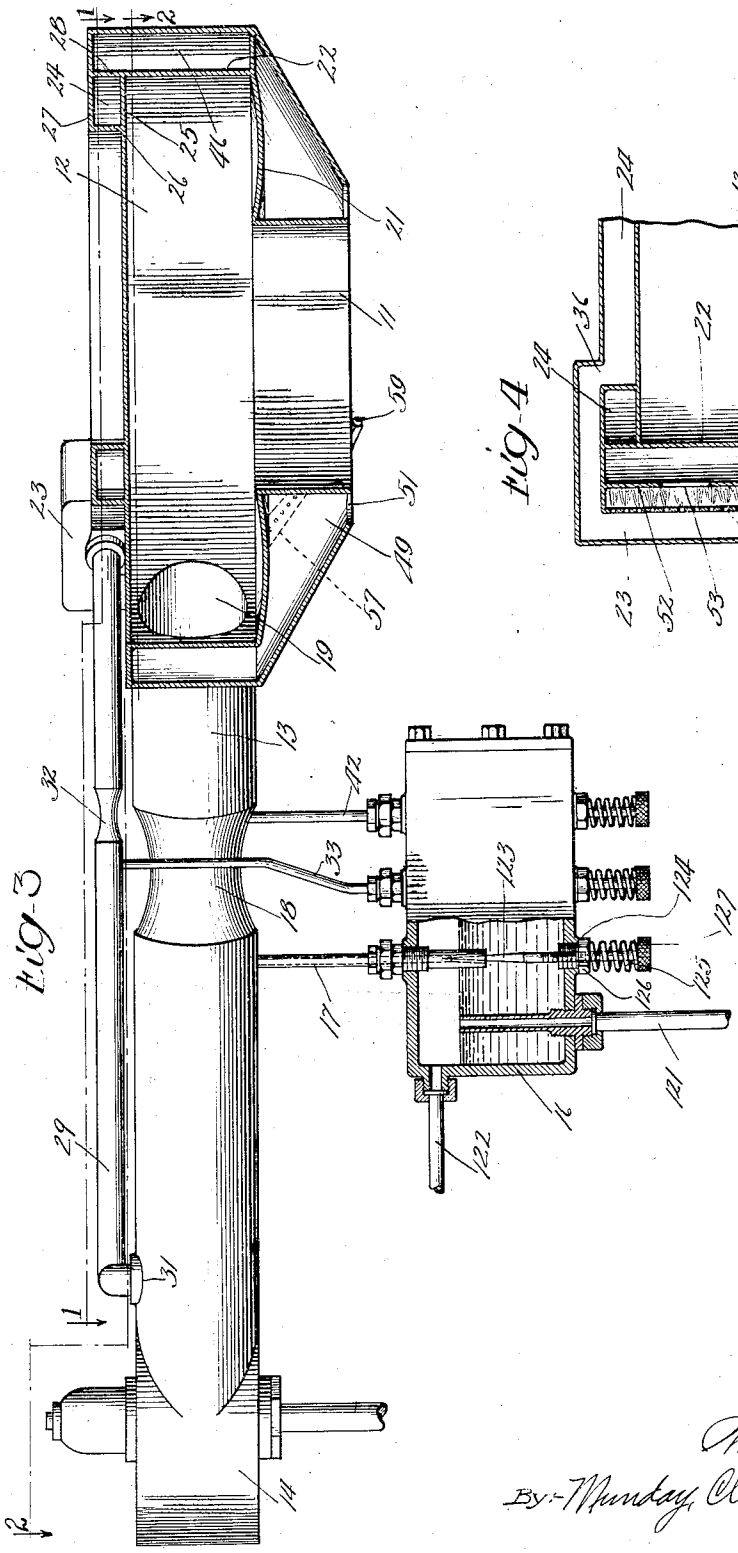


Fig. 3

Fig. 4

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Fig-6

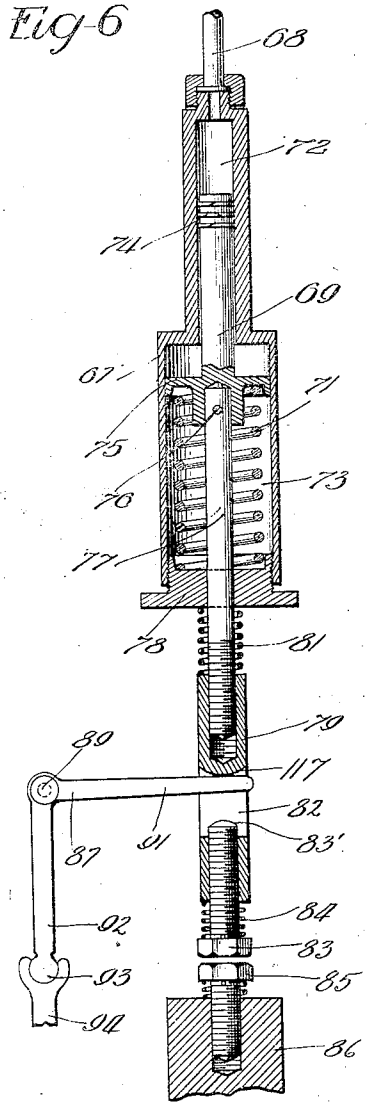
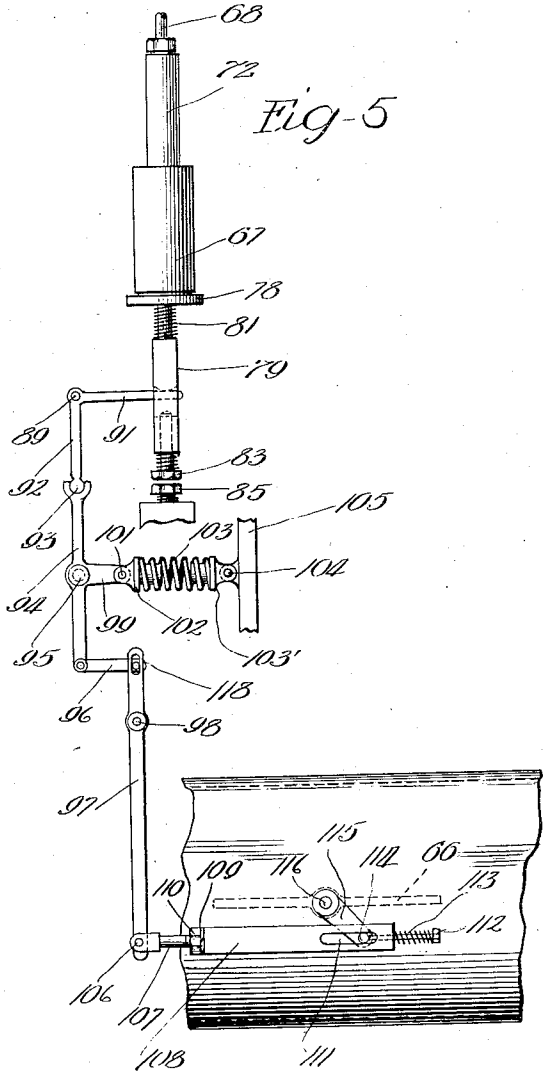


Fig-5



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Patented May 4, 1926. 1,582,913

UNITED STATES PATENT OFFICE.

WILLIAM B. EWING, OF CHICAGO, ILLINOIS.

BURNER SYSTEM AND CONTROL THEREFOR.

Application filed March 2, 1922. Serial No. 540,490.

To all whom it may concern:

Be it known that I, WILLIAM B. EWING, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Burner Systems and Controls Therefor, of which the following is a specification.

This invention relates in general to a burner system for automotive steam generators, and has more particular reference to improvements in such a system which result in greatly diminishing the length of time required to preheat the vaporizers associated with the burners and in increasing the general efficiency and effectiveness of a system of this general character.

In order that the objects of my invention may be clearly understood, it may be stated that a burner system of the type contemplated includes a main burner to which liquid fuel is to be fed in vaporized or combustible form, and in order to attain this result it is necessary to provide means for heating a vaporizer connected with said main burner. I accomplish this by the use of an auxiliary or sub-burner, having a separate vaporizer associated therewith, and in addition I provide special, quick acting means for preheating both said vaporizers and igniting the sub-burner, which operations of necessity must be accomplished in some manner before the system can start its normal functioning.

A principal object of the invention, therefore, is the provision of an oil burner system, in which the fuel is effectively vaporized before reaching the combustion chamber of the main burner and automatically ignited, and this with exceptional speed and without the employment of delicate or complicated control parts.

Another important object of the invention is the provision of a burner system of the foregoing type which is adapted to automatically continue combustion after initial ignition in accordance with requirements, and in which the sub-burner which heats the vaporizer of the main burner serves, after being once started, to heat the vaporizer for its own fuel, with consequent simplification of the burner structure and reduction in the burner units required.

It is also an object to provide a series of vaporizers serving different burners and superimposed one upon the other so that the top of one forms the bottom of another and they have a common outer wall which may be heated from a common flue passage.

A further object of the invention is the provision of a burner construction in which a simple and effective form of low pressure fuel supply may be employed during normal operation after ignition is originally accomplished.

A still further object of the invention is the provision of a special burner and fuel feeding means therefor adapted to ignite fuel when cold to initially heat the vaporizers and start combustion in the burner system.

Other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings,

Figure 1 is a part plan and part sectional view of the burner and vaporizer system taken substantially on the line 1—1 of Fig. 3;

Fig. 2 is a similar view taken substantially on the line 2—2 of Fig. 3;

Fig. 3 is a vertical section taken through the main burners and vaporizers and showing in part the fuel feeding mechanism;

Fig. 4 is a sectional detail showing the sub-burner and pilot light arm extending therefrom;

Fig. 5 is a side elevation of the mechanism employed for automatically controlling the main fuel supply; and

Fig. 6 is an enlarged vertical section taken through the actuating portion thereof.

Upon the drawings I have shown a burner

system in which, generally stated, the induction method of feeding fuel is employed. The main burner is indicated by the reference character 11, it being understood that a suitable grating is provided at the bottom of the central opening thus indicated. Fuel is fed to this burner through a vaporizer 12 and an air duct or tube 13. Air under slight pressure is fed into said air duct from a blower 14 having a suitable intake pipe 15, and fuel is introduced from a small fuel tank 16 by means of a fuel pipe 17 which is inserted in a Venturi tube 18 which is positioned at a suitable point in the air duct 13. It will be apparent that the air moving at high velocity through the Venturi tube acquires a pressure lower than that in the fuel tank and the fuel is consequently drawn into the air duct 13, from which it is directed through an aperture 19 tangentially into the vaporizer 12. This method of induction causes the heavier fuel particles to be thrown against the cylindrical heated wall of the vaporizer, thereby causing immediate vaporization. The bottom 21 of the vaporizer 12 is depressed or dished in such manner that any unvaporized fuel will be collected and subsequently vaporized. The mixture whirls about the vaporizer and down through the center opening of the burner 11 and onto the grating in the bottom thereof which may consist of metal gauze or screen or any other suitable material.

It will be apparent that the vaporizer 12 must have its wall 22 heated continually during the introduction of fuel as above described, and for the accomplishment of this purpose I provide an auxiliary or sub-burner generally indicated by the numeral 23. Fuel is supplied to this burner through an auxiliary or sub-vaporizer 24 which is superimposed upon the vaporizer 12, being, however, entirely separate therefrom. Said sub-vaporizer 24 has a bottom 25 which is the same part forming the top of the vaporizer 12, and is provided with an inner wall 26, a top 27 and an outer wall 28 which is a mere continuation of the outer wall 22 of the main vaporizer. Fuel for the sub-burner is supplied through a relatively small sub-air duct 29 taking off at 31 from the main air duct 13, and the fuel feeding mechanism is in all respects similar to that provided for the main burner, the duct 29 being provided with a small Venturi tube 32 into which fuel is introduced through a fuel pipe 33 extending from the fuel tank 16. By reference to Figs. 1 and 3 it will be observed that the fuel and air mixture enters the sub-vaporizer 24 at the point 34 and passes around the major portion of the circumference of the main vaporizer, being then directed across the latter as indicated at 35 in Fig. 1, the vaporizer passage being elevated at 36 to carry the fuel over the entrance portion of the passage and into the sub-burner 23.

In order that the vaporizer 24 may function, it is, of course, necessary that the wall 28 be preheated and I have provided means for initially heating this wall in very rapid manner, it being thereafter continuously heated by the action of the sub-burner itself. Inasmuch as it is desirable that the fuel for the initial heating of the wall 28 be ignited when cold, I employ a separate and different type of feeding mechanism for the fuel intended for this purpose, this mechanism being best illustrated in Fig. 2. A blast air duct 37 takes off from the main air duct at 38 and is provided with an enlarged portion 39 in which is positioned a cylindrical member 41 adapted to receive merely a limited portion of the air passing through said duct 37. A fuel pipe 42 extends through the walls of the duct 37 and the cylindrical member 41 and is provided at its end with a nozzle 43 by which the fuel is sprayed, as illustrated in Fig. 2. The fuel pipe 42 leads from the tank 16 and through a suitable pump (not shown) whereby the liquid is forced through the nozzle 43 under considerable pressure. A spark plug 44 is inserted through the enlarged portion 39 of the air duct 37 and the electrodes thereof extend into the cylindrical member 41 and in the path of the fuel spray from the nozzle 43, the fuel being thereby ignited and the flame being directed through a further portion 45 of the air duct and into an outer flue 46 extending about the vaporizers 12 and 24, the inner wall of said flue being the outer wall of the vaporizers. The air which does not pass through the cylindrical member 41 in the air duct 37 passes through apertures 47 and also into the sub-burner flue 46. The flue 46 does not complete a circle but extends downwardly at 48 to permit the gases to pass into an annular passage 49 beneath the vaporizer 12 and on out through an opening 51 into the boiler flue (not shown). The outer wall 52 of the flue 46 is provided opposite the sub-burner 23 with an aperture 53 through which the flame extends to ignite the fuel in the sub-burner when the latter is turned on after the vaporizers are sufficiently heated. I have found that with the apparatus just described this preheating may be accomplished in approximately 30 seconds, it being possible, therefore, to turn on the sub-burner and main burner in that length of time after the blast fuel burner is started in operation.

After ignition of the fuel in the sub-burner 23 the blast air duct may be closed by means of a valve 54, the pump being also stopped, and thereafter the heat from the sub-burner passes into the flue 46 through an aperture 55 and serves to heat the vaporizer walls 22 and 28. It will thus be seen

that the sub-burner heats its own vaporizer, and since the operation of the blower 14 is continuous, combustion will continue in said sub-burner so long as the system is in operation.

The sub-burner 23 is provided with a desired number of rows of apertures 56 and has an arm 57 extending downwardly and inwardly at 58 to a point beneath the main burner 11, said arm being preferably provided with a single row of apertures. Said arm at its extremity is provided with an aperture 59 through which the flame is projected to form a pilot light for igniting the main burner. It is, therefore, possible to turn on the main burner at practically the same time that the sub-burner is started, and in this manner the entire preheating operation is completed in approximately 30 seconds, the period required for the blast burner to originally heat the vaporizer walls.

Liquid fuel is pumped into the tank 16 through a supply pipe 122 from a main tank and excess flow is drained back by gravity through a pipe 121. The flow to the various burners is regulated by needle valves 123 which may be adjusted in seats 124 against the pressure of springs 125 held between nuts 126 and knurled heads 127.

The various air ducts may be controlled by suitable links and rods, indicated generally by the reference characters 61, 62 and 63 respectively, which are preferably connected to be manipulated by the operator of the vehicle by means of a lever and indicator on the dashboard. A butterfly valve 64 is positioned in the main air duct and is controlled in the manner just described, a similar valve 65 being positioned in the sub-air duct 29. The control parts 61, 62 and 63 are so related in their operative connection with the dashboard operating lever which I prefer to employ, that the desired operating conditions are controlled by manipulation of the single lever. These conditions may be either: (1) with the blower idle and the burners and vaporizers cold; (2) with the blower on the main and sub-air ducts closed by the valves 64 and 65 and with the blast air duct open, with the fuel pump and spark plug in operation, and the vaporizers being heated; (3) the same condition as just described, with the sub-air duct valve 65 open, in which condition combustion is started in the sub-burner from the blast flame; (4) with the blast air valve 54 closed, the fuel pump and spark plug inoperative, the valves 64 and 65 open, in which condition combustion is started in the main burner by the pilot light and the system is operating normally; or (5) with the main and blast burners off and only the sub-burner and pilot light on, this condition serving to keep the steam up and to keep the vaporizers hot so that the main burner may be ignited when necessary. The various conditions just referred to are indicated by positions on the indicator and may be controlled by simply moving the knob or lever from one position to another.

In addition to the foregoing controlling mechanism, I employ automatic means for turning the main burner off and on in accordance with variation of steam pressure, the construction relating to this part of the invention being illustrated in Figs. 5 and 6. A second butterfly valve 66 is positioned in the air duct 13 and is maintained in fully open or fully closed position by the automatic mechanism illustrated in said figures. A cylinder 67 is suitably mounted to receive steam through a connection 68 and contains a piston 69 operating against a coil spring 71. The upper portion 72 of the cylinder 67 is of smaller dimension than the lower portion 73 which contains the spring 71, and the upper part of the piston 69 is ground to dimension very little less than the diameter of said cylinder part 72 and carries at its upper end a suitable number of piston rings 74. The lower end of the piston is shouldered at 75 and has pinned thereto at 76 a piston rod 77 which extends through a cap 78 screwed into the lower end of the cylinder. On the lower end of the rod 77 is an adjustable cap 79 which is held against jolts by a lock spring 81. In the cap 79 is a slot 82, and a nut 83 extends through the lower part of the cap and into said aperture, said nut being held firmly in position by a lock spring 84 and being adjustable to vary the length of the slot 82. A nut 85 is secured into a fixed base 86 to limit the downward movement of the piston and associated parts.

The mechanism just described controls the valve 66 by means of a spring and lever system which will now be described. A bell crank 87 is pivoted at 89 and has an arm 91 extending into the slot 82, the lower arm 92 of said bell crank having a ball and socket connection at 93 with a straight lever 94 which is fulcrumed at 95 and has its lower end connected by a link 96 with another straight lever 97 fulcrumed at 98. Extending from the center of the lever 94 is an arm 99 which forms a part of a toggle joint, being pivotally connected at 101 with a spring supporting member 102 upon which is mounted a strong spring 103 having its opposite end fitted upon a second supporting member 103' pivotally connected at 104 with a fixed part 105. The lever 97 is connected at 106 with a rod 107 which has its opposite end screwed into a larger rod 108, a lock washer 109 and a lock nut 110 serving to hold these parts in assembled relation. The rod 108 is slotted at 111 and has a set screw 112 extending through an end thereof and into the slot 111, said set screw being held in place by a lock spring 113. Extending

into the slot 111 is a pin 114 which protrudes from an arm 115 fixed to the shaft 116 of the butterfly valve 66.

The strength of the spring 71 and the adjustment of the cap 78 provide for limited movement of the piston 69 controlled by the steam pressure in the cylinder 72. By reason of the toggle joint controlling the lever 94 and the slotted or lost motion connection of the rod 108 with the pin 114, the downward movement of the piston 69 may continue to nearly its limit before any movement is imparted to the valve 66. The upper face 117 of the slot 82 is rounded as shown to provide a rolling action upon the arm 91. When said arm has been depressed by the action of the steam until the latter has reached nearly the maximum pressure desired the spring 103 is under maximum tension, the parts being in the neutral position indicated in Fig. 5, and upon further steam pressure being added, the arm 99 and the toggle are thrown out of neutral position, and the force of the spring 103 moves the system of levers with a snap with resultant quick closing of the valve 66, it being understood that at the time of the toggle action just referred to the rod 108 has been moved to bring the inner end of the set screw 112 against the pin 114. It will be noted, also, that a loose pivotal connection is provided at 118 between the link 96 and the lever 97. Upon reduction of steam pressure the piston 69 is forced gradually upward by the spring 71 and the reverse action to that just described takes place, it being noted that the nut 83 has a beveled end 83′ allowing rolling action on the arm 91. There is no closing movement of the valve 66 until the parts have reached the position where the toggle moves past center and thereupon the valve is opened with a snap. It will thus be apparent that the valve 66 is maintained either in its fully open or closed position and that the opening and closing movement is practically instantaneous. Referring to Fig. 6, it will be observed that the stroke of the rod 77 and cap 79 is not only limited in downward direction by the bolt 85, but also in upward direction by the contact of the piston shoulder 75 with the top of the enlarged cylinder portion, this occurring when the steam pressure is 500 pounds or less.

It is obvious that the range of steam pressure by which the automatic control may be operated may vary, as desired, in accordance with the adjustment of the parts and the strength of the resisting spring 71. I have found that a maximum pressure of 600 pounds and a minimum of 500 pounds are suited to ordinary conditions, but it is manifest that this type of control is adaptable to any conditions of service of the burner system.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A burner system for liquid fuel comprising a main burner, a cylindrical vaporizer positioned above said main burner, an annular heating flue extending partially around the circumference of said vaporizer and thence downwardly, and means forming a flue space beneath the vaporizer and an outlet passage adjacent the burner, said flue space being adapted to receive the hot gases from said flue.

2. A burner system for liquid fuel comprising a main burner, a cylindrical vaporizer positioned above said main burner, an annular heating flue extending partially around the circumference of said vaporizer and thence downwardly, and means forming a flue space underneath the vaporizer and an outlet passage adjacent the burner, said means comprising an inclined outer wall forming with the burner wall and the bottom of the vaporizer a confining passage with the vaporizer bottom as a top whereby the latter is heated by the gases from said flue to vaporize any fuel particles which may have fallen thereon.

3. A burner system for liquid fuel, comprising a main burner, a vaporizer positioned above said burner, a heating flue extending around said vaporizer, and an auxiliary or sub-burner positioned outwardly with respect to said vaporizer and at one side of said flue, whereby the products of combustion are guided directly into the flue and about the vaporizer wall.

4. A burner system for liquid fuel, comprising a main burner, a vaporizer positioned above said burner, a heating flue extending around said vaporizer and an auxiliary or sub-burner positioned outside said vaporizer and having an arm extending downwardly and beneath said main burner, said arm being provided with flame holes and forming a pilot light for igniting the main burner.

5. A burner system for liquid fuel, comprising a main burner, a cylindrical vaporizer above said burner, an auxiliary or sub-burner positioned at one side of said vaporizer, and an auxiliary or sub-vaporizer for said last mentioned burner comprising an enclosed passageway above and extending partially around the outer part of said main vaporizer, thence across the latter and over the intake portion of said passageway and down into said sub-burner.

6. A burner system for liquid fuel, comprising a main burner, a cylindrical vaporizer above said burner, an auxiliary or sub-burner positioned at one side of said vaporizer, an auxiliary or sub-vaporizer for said last mentioned burner comprising an enclosed passageway above and extending partially around the outer part of said main vaporizer, thence across the latter and over the intake portion of said passageway and down into said sub-burner, and a flue passage about a wall of said sub-vaporizer communicably connected with said sub-burner whereby the latter heats its own fuel.

7. A burner system for liquid fuel, comprising a main burner, an air duct leading thereto, a plurality of auxiliary burners, auxiliary air ducts therefor, said auxiliary ducts taking off from said main duct, and manually controllable valves in each of said ducts adapted to be selectively controlled to regulate burning conditions.

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