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OIL BURNER

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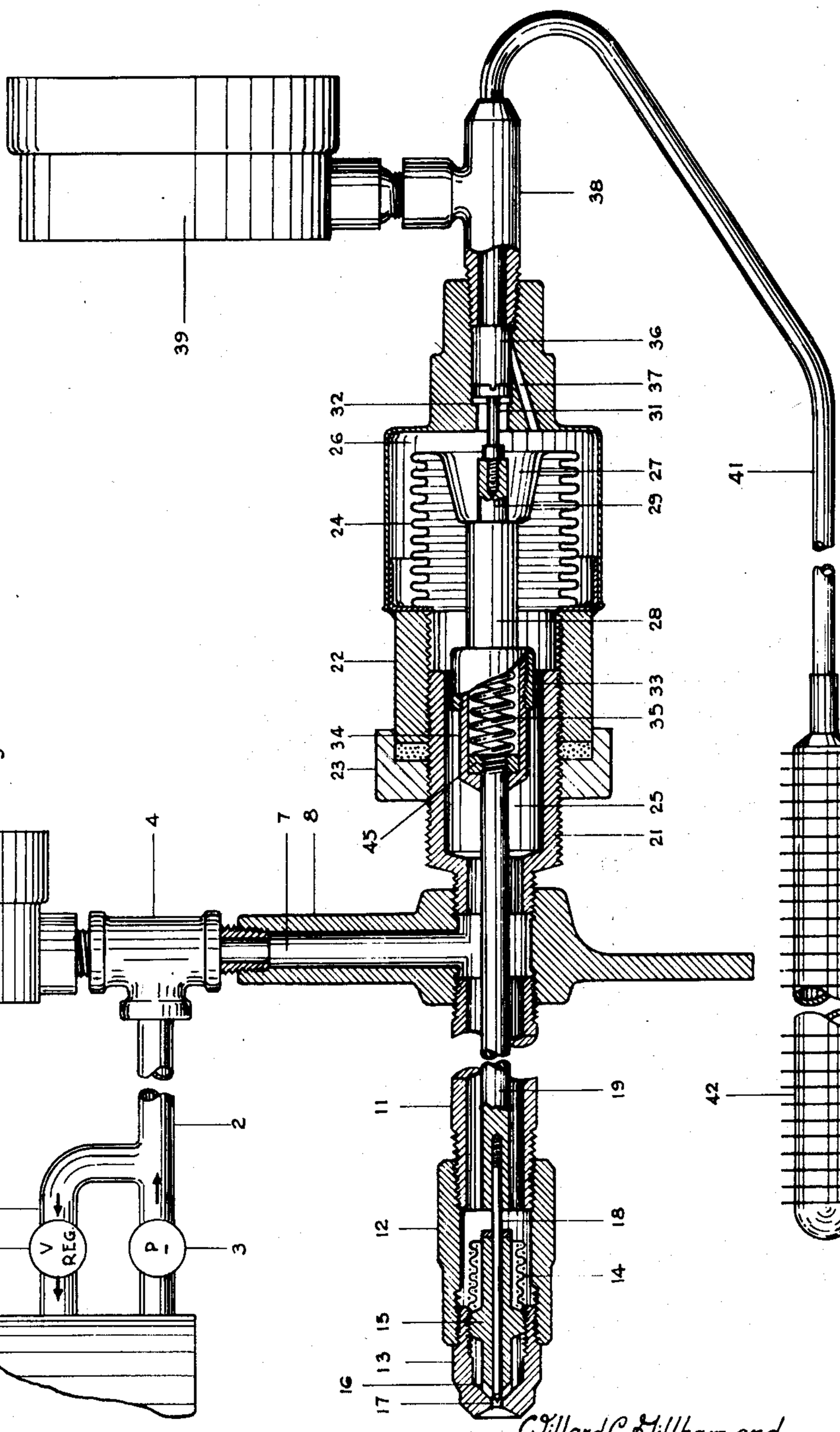

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OIL BURNER

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The invention herein described may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty therefor.

This invention relates to improvements in burners for liquid fuel and includes a mechanism for controlling the size of flame produced by such burners.

Oil burners are widely used for heating air or other atmospheres in driers, tobacco barns, buildings, and in many other applications. Such burners usually operate upon an on-and-off principle, i. e., the burner is constructed to emit an atomized spray of fuel oil into a combustion chamber where it is ignited and burned until an atmosphere undergoing heating reaches a predetermined temperature. The burner is then shut off by a suitable thermostat or other control means, and the flame is extinguished. When the temperature falls, fuel is again ignited by operation of a thermostatic or other system and heating is resumed. This type of operation has many disadvantages in certain applications. In tobacco barns and driers, for example, it is often desirable to maintain a uniform temperature for a prolonged period of time. Since a gaseous atmosphere has little heat-storage capacity, such on-and-off type of operation results in considerable fluctuation of temperature. A burner that is capable of producing more uniform heat would be a great improvement in many applications.

It is an object of this invention to provide a burner for liquid fuel which is adapted to maintain a constant flame of such size as may be required to maintain a selected constant temperature in an atmosphere to be heated.

Another object is to provide in such burner a mechanism for controlling the size of flame which is responsive to very small changes in atmospheric temperature.

Another object is to provide such burner which is simple, cheap in construction, rugged, and which has the particular advantageous arrangement of parts shown and described.

Other objects will become apparent as this disclosure proceeds.

We have found that these objects are attained in a burner for liquid fuel which comprises, in combination, a burner body having a passage for liquid fuel therethrough; means for continuously feeding liquid fuel into said passage at selected constant pressure; a nozzle adapted to atomize liquid fuel disposed upon said burner body in communication with said passage; a longitudinally movable control rod disposed in said nozzle

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to close the nozzle when advanced and to open the nozzle when retracted; a housing attached to said burner body in communication with said passage; a fluid-tight pressure-responsive reciprocating partition disposed within said housing to divide the housing into two chambers, namely a first chamber communicating with said passage and a second chamber; a bulb disposed in contact with an atmosphere to be maintained at a selected temperature partially filled with a liquid boiling at a temperature a few degrees below the temperature to be maintained; a conduit for vapor disposed in communication with an upper part of said bulb and with said second chamber; and mechanical means responsive to movement of such reciprocating partition for advancing and retracting said control rod through a distance proportional to movement of said partition.

In the attached drawing the single figure illustrates diagrammatically one particular apparatus embodying principles of our invention. The greater portion of this apparatus is shown in vertical section.

In this drawing the referenec numeral 1 indicates a tank suitable for holding liquid fuel. A conduit for liquid fuel 2 containing pump 3 is disposed to communicate with the interior of tank 1 and with the interior of a T-joint 4. A by-pass line 5, containing an adjustable pressure-responsive regulating valve 6 is disposed to communicate with the interior of tank 1 and with the interior of conduit 2. Conduit 2, pump 3, by-pass line 5, and regulating valve 6 cooperate to form a means for feeding fuel into T-joint 4 at uniform pressure which may be selected by suitably adjusting regulating valve 6.

The interior of T-joint 4 communicates via suitable nipples with a passage 7 for liquid fuel in the interior of a burner body and with a suitable gauge 9 if desired. This burner body preferably is made of several parts in order to assure ease of construction. In the embodiment shown, the burner body consists of a supporting member 8, an elongated hollow stem 11, a connecting member 12, and a tip member 13. The hollow stem 11 communicates with the passage 7 and with the interior of member 12. A screen 14, adapted to filter out any solid particles present in the liquid fuel used, is disposed in the interior of member 12.

A member 15 consisting of a threaded spider with an elongated central portion having a central bore therethrough is disposed within tip member 13. The interior of member 12 com-

municates with the interior of member 13 through spaces between the legs of this spider. Member 15 also contains slots 16 adapted to conduct liquid fuel from the interior of tip member 13 and discharge the same through an opening 17 in tip 13. Members 13 and 15 thus cooperate to form a nozzle adapted to atomize liquid fuel and to spray the same into a suitable combustion space.

A control rod 18 is longitudinally movably disposed in the central bore of member 15 in alinement with opening 17. Control rod 18 has a diameter at least as great as that of opening 17 and is adapted to be advanced toward opening 17 to substantially close the same, and to close slots 16 or to be retracted to open slots 16 to varying widths. The end of rod 18 opposite to opening 17 is threaded and is screwed into a central opening in a longitudinally movable elongated member 19 which may preferably be a solid rod. The spider 15 thus supports both control rod 18 and, through rod 18, the forward end of member 19. The effective length of rod 18 may be adjusted by screwing this rod a greater or lesser distance into member 19. Member 19 is centrally disposed in hollow stem 11 and projects through member 8. A housing, preferably comprising male and female threaded members 21 and 22 as shown, is attached to member 8 and communicates with passage 7. That portion of member 19 projecting through member 8 is disposed substantially centrally within this housing. The housing is adjustable for length by turning female member 22. A lock nut 23 and suitable packing are provided to prevent leakage of liquid fuel. A fluid-tight pressure-responsive reciprocating partition, illustrated as compressible corrugated diaphragm 24, is disposed within this housing to divide the housing into two chambers; namely, into a chamber 25 communicating with the interior of passage 7 in member 8 and therefore filled with liquid fuel under pressure in operation, and into chamber 26. The compressible diaphragm 24 has a central depressed section 27 which serves to permit attachment of other members without unduly increasing the length of chamber 26.

A member 28 having a smaller portion 29 is inserted through the depressed section 27 in fluid-tight relationship therewith and is supported and carried by diaphragm 24. An adjustable screw 31 is attached in a suitable threaded opening in the end of portion 29 and is limited in its forward movement by shoulder 32 of the housing. The end of rod 28 opposite to screw 31 is either made integral with or attached to a female portion 33 of a housing consisting of a male member 34 having an opening therethrough and member 33. Member 19 extends slideably through the opening in the end of member 34 and ends within the spring housing in a suitable head portion which may conveniently be a nut screwed upon suitable threads in the end of the rod, or may be any equivalent head member disposed to receive spring pressure from spring 35 enclosed within spring housing, when rod 29 is advanced, and to engage and be retracted by member 34 when rod 29 is retracted.

Chamber 26 in the control mechanism housing communicates with a passage 36 in the housing via the vapor passage 37. A T-joint 38 is attached to the housing so that it communicates with passage 36 and with a suitable gauge 39, if desired, and with a pipe 41 leading to and communicating with an upper part of a bulb 42 disposed in the atmosphere to be heated. Passages 36, 37, T-joint 38, and pipe 41 cooperate to form a conduit for vapors, communicating with an upper part of bulb 42 and with chamber 26. Bulb 42 is partially filled with a liquid which has a boiling point slightly lower than the temperature to be maintained in the atmosphere to be heated. Any noncorrosive liquid may be used in bulb 42, provided the liquid boils at a temperature sufficiently below that to be maintained in the surrounding atmosphere so that the pressure of vapor within bulb 42 is approximately equal to the pressure of liquid fuel. For instance, we have found that methyl chloride is an excellent liquid for use in the bulb when a burner of this type is used for warming air in driers for grass seeds and small grains, and fuel pressure of 60 to 120 pounds per square inch is used. For commerical tobacco barns a liquid having somewhat higher boiling point will be required.

In operation pump 3 is started, regulating valve 6 is set for an approximate desired pressure, and liquid fuel flows into passage 7 at uniform pressure via conduit 2 and T-joint 4. Through passage 7 fuel flows into the interior of stem 11, through the interior of member 12, through screen 14 into the interior of member 13, and on through slots 16 and opening 17 from which it is atomized and sprayed into any suitable combustion chamber, not shown, and is there ignited. Liquid fuel also flows from passage 7 into the interior of the control-mechanism housing, fills chamber 25, and exerts pressure on the diaphragm 24 so that rod 28 is fully retracted, thus opening slots 16 to their full width.

As the atmosphere containing bulb 42 is heated, liquid contained in the bulb boils and is partially converted into vapor under pressure. This vapor is conducted via pipe 41, T-joint 38, and passage 36 into chamber 26 where it exerts pressure on diaphragm 24 in the opposite direction to that exerted by the fuel in chamber 25. When this pressure becomes great enough to overcome the pressure of liquid fuel in chamber 25, rod 28 and spring housing carried thereby are moved toward the burner tip. Movement of the spring housing slightly compresses the spring 35, which in turn moves the control rod 19 and rod 18 toward the burner tip with the result of partially closing slots 16 and decreasing the amount of liquid fuel burned without extinguishing the flame.

After a few initial fluctuations in the size of the flame, the burner automatically adjusts itself to give a steady flame of the size required to maintain the atmosphere at any desired temperature. Temperature control is easily regulated by setting regulating valve 6 at any required pressure, and this pressure may be changed if desired without interrupting operation of the burner. Spring 35 serves as a cushion to prevent rod 18 from being driven too strongly against tip 13 and eliminates any difficulties due to rod 18 becoming stuck in opening 17.

Burners of the type described are desirable in many applications. They may be used for heating atmospheres directly where the products of combustion are not deleterious or may be used in any heat-exchange relationship desired. In either case they form a source of steady even heat which increases or diminishes in response to very small changes in atmospheric temperature.

A number of variations in the burner illustrated may be made without departing from the spirit and scope of our invention, which is lim-

ited only by the subtended claims. For instance, the reciprocating partition may be a piston or a diaphragm of other type than the corrugated diaphragm shown. The means for advancing and retracting the control rod 18 may be constructed in many forms, such as making rod 18 continuous to attachment with the partition, omitting intermediate parts, or substituting a system of pivoted levers and multiple rods for these intermediate parts. The latter might be desirable if the housing is not disposed in alinement with the burner nozzle.

We claim as our invention:

1. A burner of the class described which comprises in combination a burner body having a passage for liquid fuel therethrough; adjustable means for continuously feeding liquid fuel into said passage at selected constant pressure; a nozzle adapted to atomize liquid fuel disposed upon said burner body in communication with said passage; a longitudinally movable control rod disposed in said nozzle to close the nozzle when advanced and to open the nozzle when retracted; a housing attached to said burner body in communication with said passage; a fluid-tight pressure-responsive reciprocating diaphragm disposed within said housing to divide the housing into two chambers, namely, a first chamber communicating with said passage and a second chamber; a bulb, disposed in contact with an atmosphere to be maintained at a selected temperature, partially filled with a liquid boiling at a temperature a few degrees below the temperature to be maintained; a conduit for vapor disposed in communication with an upper part of said bulb and with said second chamber; a first rod attached to and extending from a central part of said diaphragm toward said control rod; a spring housing, having an opening therethrough, attached to and carried by an end of said first rod opposite to said diaphragm; a coil spring disposed within said spring housing; a second rod having one end slideably disposed through said opening and the other end attached to said control rod; and a head member on said second rod within said spring housing in position to receive thrust from said coil spring when said diaphragm is advanced and to receive tension from said spring housing when said diaphragm is retracted.

2. A burner of the class described which comprises in combination a burner body having a passage for liquid fuel therethrough; adjustable

means for continuously feeding liquid fuel into said passage at selected constant pressure; a nozzle adapted to atomize liquid fuel disposed upon said burner body in communication with said passage; a longitudinally movable control rod disposed in said nozzle to close the nozzle when advanced and to open the nozzle when retracted; a housing attached to said burner body in communication with said passage; a fluid-tight pressure-responsive reciprocating diaphragm disposed within said housing to divide the housing into two chambers, namely, a first chamber communicating with said passage and a second chamber; a bulb, disposed in contact with an atmosphere to be maintained at a selected temperature, partially filled with a liquid boiling at a temperature a few degrees below the temperature to be maintained; a conduit for vapor disposed in communication with an upper part of said bulb and with said second chamber; a first rod attached to and extended from a central part of said diaphragm toward said control rod; a spring housing, having an opening therethrough, attached to and carried by an end of said first rod opposite to said diaphragm; a coil spring disposed within said spring housing; a second rod having one end slideably disposed through said opening and the other end attached to said control rod; a head member on said second rod within said spring housing in position to receive thrust from said coil spring when said diaphragm is advanced and to receive tension from said spring housing when said diaphragm is retracted; and means for limiting advancement of said control rod.

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