Dec. 31, 1929. W. C. McKEOWN 1,741,725

APPARATUS FOR UTILIZING FLUID FUELS

Filed Jan. 25, 1927 2 Sheets-Sheet 1

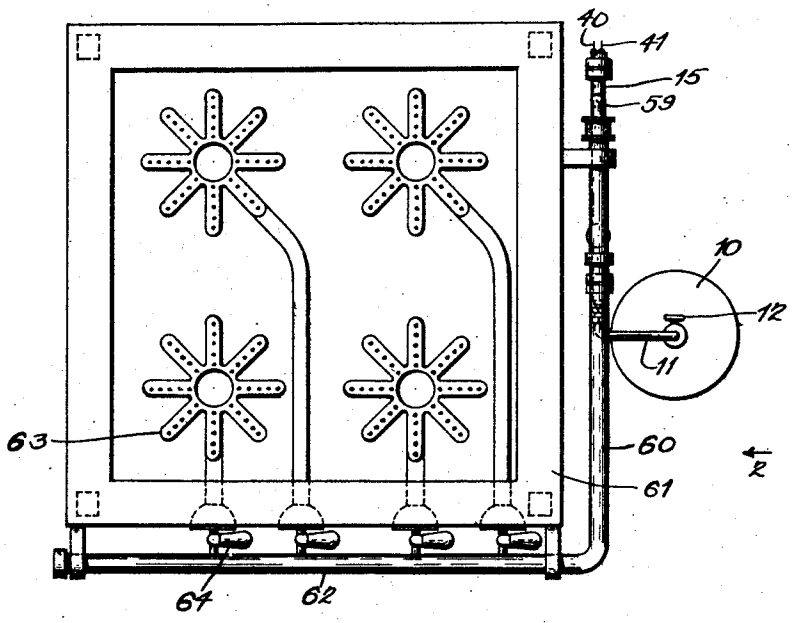


Fig. 1

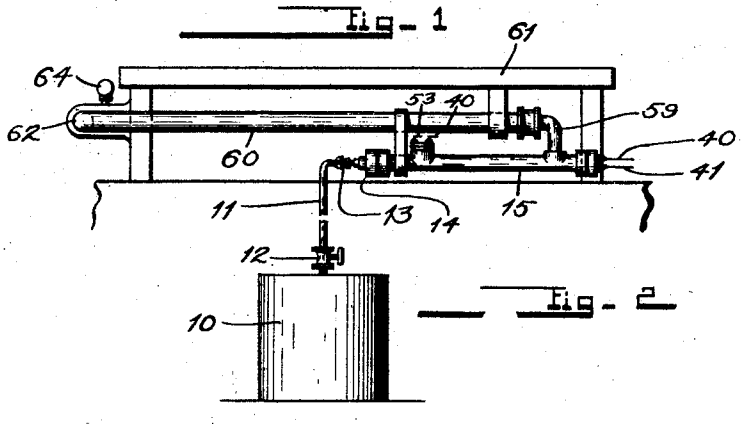


Fig. 2

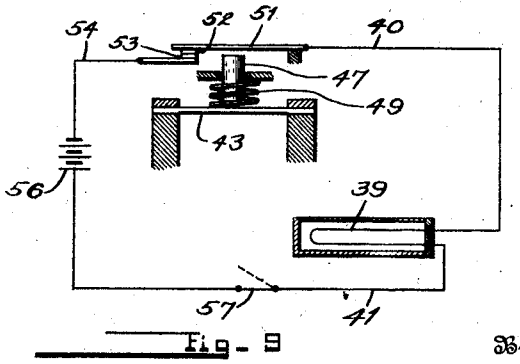


Fig. 3

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APPARATUS FOR UTILIZING FLUID FUELS

Filed Jan. 25, 1927 2 Sheets-Sheet 2

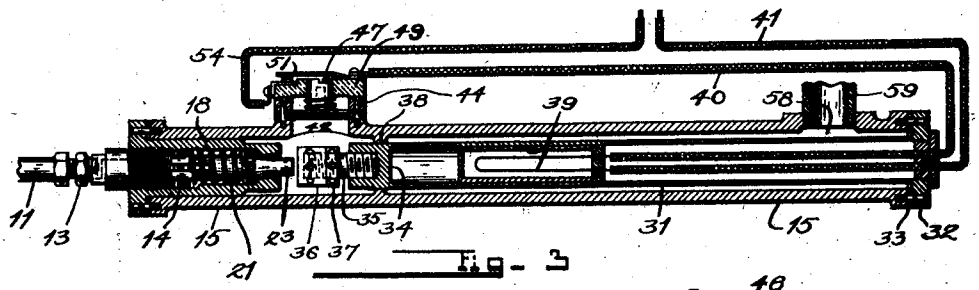


Fig - 3

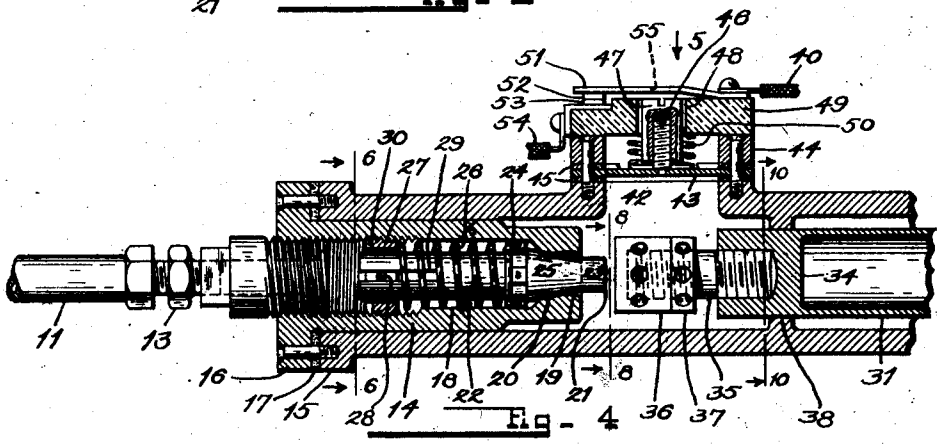


Fig - 4

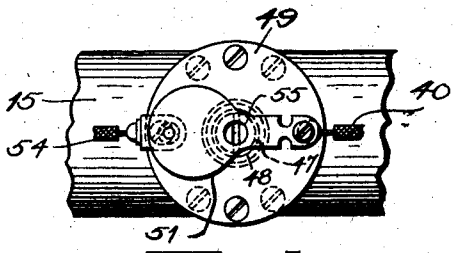


Fig - 5

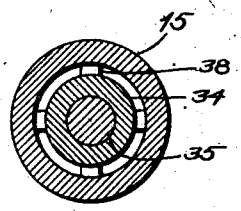


Fig - 10

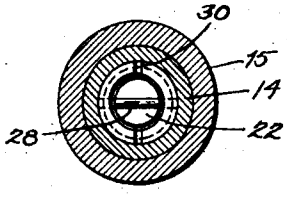


Fig - 6

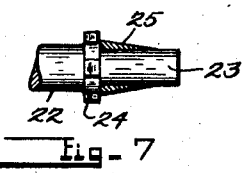


Fig - 7

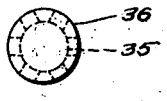


Fig - 8

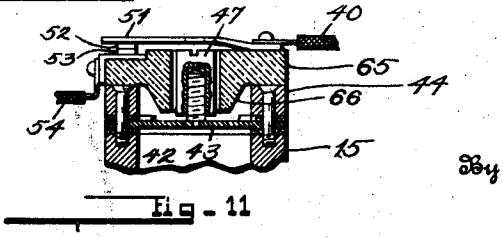


Fig - 11

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UNITED STATES PATENT OFFICE

WILLIAM C. McKEOWN, OF BALTIMORE, MARYLAND

APPARATUS FOR UTILIZING FLUID FUELS

Application filed January 25, 1927. Serial No. 163,356.

My invention relates to an apparatus for utilizing fluid fuels.

The principal object of my invention is to devise an apparatus of the gas range type that is intended more especially for use with tank fuels, as contrasted with piped fuel distribution, and which is arranged to regulate the flow of the fuel from the tank in accordance with the demand of the burners therefor.

A further object is to devise an apparatus of the character described, which is adapted to secure a substantially instantaneous flow of dry, combustible gas, without the necessity for priming or preheating the burners, whether the fuel be a gas or liquid.

A further object is to effect the above noted results through utilizing present standard gas ranges in connection with a device for regulating and preheating the fuel flow, as hereinafter described.

My improved apparatus is more particularly intended for the utilization of liquefied casing head gas, or a similar natural gas fuel. This gas is compressed under a pressure of seventy-five or more pounds into a liquid state and is distributed in containers, thus providing in a concentrated form an amount of gas which becomes relatively large by volume when expanded to a pressure slightly above that of the atmosphere. Due to its extremely volatile nature and the high tank pressure, it is deemed inadvisable to depend upon the usual range cock as a means of flow control, this conclusion being further strengthened by the fact that when expanded to a working pressure, the gas is comparatively wet and hence not in the most desirable condition for combustion. Some form of preheating is therefore imperative and, in my improved apparatus, this phase of the problem has been solved so that the drying of the expanded gas and the regulation of the flow thereof are interrelated functions.

Essentially, my invention comprises a commercial type of gas range, to the manifold or tail pipe of which is secured a generating control tube, the latter in turn being connected to a suitable tank which contains the fuel. This tube is constructed and arranged to secure the flow of fuel from the tank at a rate dependent upon the demand of the burners. In passing through the tube, the expanded gas is dried electrically, the drying being a continuous or intermittent process, as the rapidity of consumption dictates and regardless of whether any of the burners are in operation. Accordingly, dry combustible gas is always accessible for instant use.

Hence, it will be obvious that my improved apparatus renders available, without the necessity for extensive pipe line systems, a fuel having a thermal content which is superior to those cooking ranges which utilize kerosene, gasoline and similar liquid fuels. Moreover, these latter are transformed to a gaseous state with some difficulty and are ordinarily not capable of instant use.

For purposes of illustration, my invention has been shown as comprising a simple four burner range, but it is to be understood that the presence of additional or a less number of burners does not affect its efficient operation.

These and further objects of my invention will be set forth in the following specification, reference being had to the accompanying drawings, and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawings:

Fig. 1 is a plan view of four burner range embodying the features of my invention.

Fig. 2 is a view looking in the direction of the arrow 2 in Fig. 1.

Fig. 3 is an enlarged sectional elevation of the generator control tube, when viewed in the direction of the arrow 2 in Fig. 1.

Fig. 4 is an enlarged view of the left hand portion of Fig. 3.

Fig. 5 is a view looking in the direction of the arrow 5 in Fig. 4.

Fig. 6 is a section along the line 6—6 in Fig. 4, looking in the direction of the arrows.

Fig. 7 is an elevation, partly in section, of the valve used in my improved apparatus.

Fig. 8 is a section along the line 8—8 in Fig. 4, looking in the direction of the arrows.

Fig. 9 is a diagram of the electrical connections as used in my invention.

Fig. 10 is a section along the line 10—10 in Fig. 4, looking in the direction of the arrows.

Fig. 11 shows a modified arrangement of a portion of the structure shown in Fig. 4.

In the drawings:

The numeral 10 represents a tank, containing the liquefied natural gas product, which serves as a source of fuel supply. From said tank leads a supply pipe 11 in which may be placed the valve 12 as a means for isolating said tank whenever required. One end of the pipe 11 is connected to a valve housing 14 by means of a nipple 13.

Said housing is mounted within one end of a casing 15 and is flanged as at 16 for securement thereto. A gasket 17 may be interposed between said flange and casing to provide a gas tight connection at this point. Aligned passages 18 and 19 of different diameters are provided in said housing, the former being threaded for a predetermined portion of its length, and the junction of said passages forms a valve seat 20.

A valve 21 is slidably mounted in said passages, being composed of a stem 22 which is arranged in the passage 18 and a stem 23 which is disposed in the passage 19. The stem 23 extends beyond the end of the housing 14 for coacting with a part hereinafter described. At the junction of said stems is formed a radial projection 24 which has bearing contact with the wall of the passage 18 and on the stem 23 is provided a tapered portion 25, formed of some deformable metal such as lead, which serves as a valve face for engagement with the seat 20. The valve 21 is normally maintained in engagement with said seat through the medium of a spring 26 which encircles the stem 22 and is interposed between the projections 24 and a nut 27 which is threaded in the passage 18. The stem 22 fits loosely within said nut so that fuel may pass freely at this point and extends through said nut sufficiently to always maintain engagement of a pin 28, secured in said nut, with a slot 29 formed in the stem 22. Accordingly, the valve 21 is restricted to a pure longitudinal movement. Said nut may have slots 30 by which it may be adjusted to obtain any desired compression of the spring 26.

The purpose of this arrangement of said valve is to secure a complete closing of the passage 19 at such times as said valve may be in a closed position, thereby eliminating minute leaks that may occur through an imperfect seating caused by a rotation of said valve. In placing the valve in position, it will be given a driving movement that is sufficiently severe to cause the soft tapered portion 25 to flow into and take the precise shape of the seat 20. Since said valve is incapable of rotation, this construction insures a perfect sealing of the seat 20 at all times when the portion 25 is in engagement therewith.

The casing 15 may be of any desired length and at the end opposite to the housing 14, a tube 31 is inserted having a flanged end 32 for securement to said casing. A gasket 33 may be interposed between said flange and casing. The inner end of said tube is closed as at 34 and one end of a stud 35 is mounted therein. An adjusting nut 36 and a lock nut 37 are threaded on the opposite end of said stud, the former nut being positioned at some predetermined distance from the end of the stem 23, depending upon the characteristics of the range with which my improved flow regulating mechanism is used. It will be apparent that the tube 31 is both secured and supported at one end through the flange 32, but at the opposite end is only supported by a series of radial projections 38 which extend inwardly from the interior walls of the casing 15. Accordingly, when said tube is heated, as hereinafter described, its length will be increased in the direction of the stem 23.

An electric heating element 39 of approved type is disposed within the tube 31 and from said element leads 40 and 41 extend without the casing 15.

An opening 42 is formed in the wall of the casing 15 at a point which is preferably convenient to the nuts 36 and 37, so that the latter may be readily adjusted without the necessity for removing the tube 31 from said casing. A diaphragm 43 closes said opening and is secured in position by means of a ring 44 which is attached to said casing. Gaskets 45 may be interposed between said diaphragm and casing and between said diaphragm and ring. A stud 46 is secured in said diaphragm and an adjustable sleeve 47 is threaded thereon. Said sleeve extends upwardly through a passage 48 which is provided in a cap 49 that is secured to a ring 44. Said cap is formed of an appropriate insulating material and a spring 50, which encircles said sleeve and is interposed between said cap and diaphragm, normally maintains the latter in the position shown in Fig. 4, or assists in returning the same when displaced therefrom.

A flat spring 51 is secured at one end to the cap 49 and has electrical connection with the lead 40. A contact 52 is formed on said spring and normally has engagement with a contact 53 which is also secured on said cap, the contact 53 having electrical connection with the lead 54. A hole 55 may be formed in the spring 51 above the sleeve 47 so that the latter may be readily adjusted, for any indicated movement.

The opposite end of the lead 54 is connected to a suitable source of electrical energy, which is indicated generically by the battery 56 and from said battery, the lead 41

passes to the heating element 39. A switch 57, which is closed under ordinary domestic conditions, is disposed between battery 56 and heating element 39. If the use of the range should be discontinued for any considerable length of time, the switch 57 will be opened to prevent the consumption of current. From the foregoing, it will be understood that the electrical circuit comprised within my regulating mechanism, consists of the following parts, a source of electrical energy 56, lead 41, heating element 39, lead 40, spring 51, contacts 52 and 53, and lead 54. Under ordinary operating conditions, this circuit is intermittently broken between the contacts 52 and 53.

A second opening 58 is provided in the wall of the casing 15 at any convenient point and one end of an elbow 59 is secured therein. The other end of said elbow is attached to one end of a tail pipe 60 on a range 61. Said pipe is in communication with the usual manifold 62 from which suitable pipes connect with burners 63. The usual gas cocks 64 may be provided to vary the size of flame desired. Under certain conditions, the casing 15 may be connected directly to the manifold 62. The tail pipe 60 and manifold 62 will be given a slight gradient in the direction of the casing 15 in order to drain any condensation that may occur into said casing. By this construction, leakage at the cocks 64 is prevented. The operation of my improved range is as follows:

Assuming that the various elements are as shown in the drawings, with the cocks 64 in a closed position, it will be apparent that the valve 21 will be closed, owing to the pressure in the tank 10 and the impulse exerted by the spring 26. The contacts 52 and 53 being in engagement, an electrical current will flow through the circuit heretofore described to heat the element 39 and accordingly the tube 31. From this heating two results follow; first, the temperature of such gas as may exist within the casing 15 will be raised, thereby drying said gas and raising its pressure, and second, the tube 31 will increase in length, thereby moving the nut 36 toward the stem 23. Under the conditions just described, the initial position of the nut 36 is so arranged with reference to the stem 23 that engagement of these parts will not occur before the pressure within the casing 15 has risen to an extent that will move the diaphragm 43 upwardly and thus cause a lifting of the contact 52 away from the contact 53, through the interaction of the sleeve 47 with the spring 51. The electrical circuit is then broken and the heating element 39 cools, thus causing a contraction of the tube 31.

The foregoing operation continues indefinitely so long as the switch 57 is maintained closed. The only fuel which passes through this cycle is that which is contained within the casing 15 and allied parts, since the valve 21 is not opened by the change in length of the tube 31. It will be apparent that this manner of functioning renders instantaneously available a dry, combustible gas, regardless of the condition in which the fuel may have emerged from the tank 10.

If now one of the cocks 64 is opened, the pressure within the casing 15 falls, and if not already in engagement, the contacts 52 and 53 are brought into this position through the return of the diaphragm 43 to a horizontal position by means of the spring 50. The electrical current then continues, or begins, to flow as the case may be and the tube 31 increases in length, until the nut 36 bears against the end of the stem 31 to open the valve 21 and admit new fuel to the interior of the casing. In passing around the valve 21, the liquid from the tank 10 is throttled and reduced in pressure to such an extent as to transform the same into a moist, gaseous condition, the relation between the valve 21 and seat 20 in respect of size and shape being such as to obtain this result. When a supply has been established which is adequate for the demand of one burner, the pressure within the casing 15 will rise to cause a movement of the diaphragm 43 and a consequent interruption of the circuit at the contacts 52 and 53. The tube 31 then decreases in length, as hereinbefore described, and the valve 21 moves toward a closing position. Said valve may actually achieve full closure, or prior to that time, the electrical circuit may again be closed to cause a resumption of the lengthening of the tube 31 under the application of heat. Accordingly, it will be obvious that said valve may slowly float between a fully closed position and that to which it was originally opened, depending upon the demand of the burner 63 for fuel. During this operation, the heating of the tube 31 not only controls the admission of fresh fuel but also preheats and thoroughly dries the same on its journey to the burner, so that it arrives in a condition that is most desirable for efficient combustion.

If other burners are subsequently opened, the foregoing procedure is repeated, except that the periods of closure of the electrical circuit will be lengthened thereby securing an increased opening of the valve 21 in order to provide a supply of fuel that is commensurate with the demand. If one or more burners are in operation and all, or less than the original number are extinguished, the flow of fuel, which had been established to meet the original demand, exceeds the new requirement. Hence, the pressure in the casing 15 will rise rapidly to cause an interruption of the current flow, a contraction of the tube 31, and a movement of the valve 21 towards a closing position. This condi-

tion will obtain until the excess supply within the casing 15 has been utilized by the burner or burners then in operation, or the gas has been condensed to a liquid owing to temperature conditions, whereupon the diaphragm 43 will return to the position shown in Fig. 4 and movement thereafter of the valve 21 will depend upon the demand of the burners then functioning, in the manner hereinbefore described.

It is contemplated that the diaphragm 43 may be made of a sufficiently resilient material as will obviate any necessity for the spring 50. This modified construction is illustrated in Fig. 11, the arrangement therein being identical with that heretofore described, except that the cap 65, which occupies a position similar to the cap 49, is formed with a depending portion 66. In its upward movement under the action of the pressure within the casing 15, the diaphragm 43 will abut against said portion as a limiting stop. Said portion will be disposed a distance above said diaphragm so that when the latter contacts therewith, the contact 52 will be moved from engagement with the contact 53. When the pressure in said casing falls, said diaphragm will return to its original position by reason of its inherent resilient property.

From the foregoing, it will be apparent that I have not only devised a method for regulating the flow of a fluid through a valve, but I have provided an arrangement which operates with rapidity in response to changing conditions of operation and with a high degree of precision. During such times as the range is not in operation, the heating of any gas that may reside within the casing 15 proceeds without change, subject to the intermittent cessation of current flow which occurs and lasts at and for short intervals. Dry combustible gas is therefore instantaneously available at all times without the necessity for a preliminary warming or priming period.

While I have shown one set of elements and combinations thereof for effectuating my improved apparatus and method of handling the fuel supply, it will be understood that the same are for the purpose of illustration only and in nowise to limit my construction to the exact forms and structures shown, for many changes may be made therein without departing from the spirit of my invention.

I claim:

1. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a valve biased in a closing direction, a heat expandible member arranged in operative relation to said valve, means for applying heat to said member to expand the same and open said valve, and means for regulating the application of heat to said member controlled by the pressure on the exhaust side of said valve.

2. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a valve biased in a closing direction, a heat expandible member arranged in operative relation to said valve in the path of said fuel for preheating the same, means for applying heat to said member to expand the same and open said valve, and means for regulating the application of heat to said member controlled by the pressure on the exhaust side of said valve.

3. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a valve biased in a closing direction, a heat expandible member arranged in operative relation to said valve, an electric heating element operatively associated with said member for heating and expanding the same to open said valve, and means for regulating the passage of current through said element in compliance with the pressure on the exhaust side of said valve.

4. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a valve biased in a closing direction, a heat expandible member arranged in operative relation to said valve, an electric heating element operatively associated with said member for heating and expanding the same to open said valve, and means for regulating the passage of current through said element controlled by the pressure on the exhaust side of said valve.

5. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a valve biased in a closing direction, a heat expandible member arranged in operative relation to said valve and in the path of said fuel, an electric heating element operatively associated with said member for heating and expanding the same to open said valve, and means for regulating the passage of current through said element in compliance with the pressure on the exhaust side of said valve.

6. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a valve biased in a closing direction, a heat expandible member arranged in operative relation to said valve, and means for intermittently applying heat to said member to expand the same, thereby causing movements of said valve as said member expands and contracts,

said intermittent means being controlled by the pressure on the exhaust side of said valve.

7. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in the inlet end of said casing, a heat extendible member arranged in said casing in operative relation to said valve, means for applying heat to said member to lengthen the same and open said valve, and means for controlling the application of said heat depending upon the pressure on the exhaust side of said valve.

8. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in the inlet end of said casing, a heat extendible member arranged in said casing in operative relation to said valve, means for varying the initial length of said member, means for applying heat to said member to lengthen the same and open said valve, and means for controlling the application of said heat depending upon the pressure on the exhaust side of said valve.

9. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in said casing, a hollow metallic tube arranged in said casing with the end thereof in operative relation to said valve, an electric heating element mounted in said tube, and means for regulating the passage of current through said element controlled by the pressure on the exhaust side of said valve.

10. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in said casing, a hollow metallic tube arranged in said casing with the end thereof in operative relation to said valve, means for varying the initial length of said tube, an electric heating element mounted in said tube, and means for regulating the passage of current through said element controlled by the pressure on the exhaust side of said valve.

11. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a non-rotatable valve biased longitudinally in a closing direction, a heat expandible member arranged in operative relation to said valve, means for applying heat to said member to expand the same and open said valve, and means for regulating the application of heat to said member controlled by the pressure on the exhaust side of said valve.

12. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in said casing, a heat expandible member arranged in said casing in operative relation to said valve, means for applying heat to said member to expand the same and open said valve, a diaphragm actuated by the pressure in said casing, and means operated by the movement of said diaphragm for controlling the application of said heat.

13. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in said casing, a heat expandible member arranged in said casing in operative relation to said valve, an electric heating element operatively associated with said member for heating and expanding the same to open said valve, a diaphragm actuated by the pressure in said casing, and means operated by the movement of said diaphragm for controlling the passage of current through said element.

14. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in said casing, a hollow metallic tube arranged in said casing with the end thereof in operative relation to said valve, an electric heating element mounted in said tube for lengthening the same and opening said valve, a diaphragm actuated by the pressure in said casing, and means operated by the movement of said diaphragm for controlling the passage of current through said element.

15. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in said casing, a hollow metallic tube, adjustable in length, arranged in said casing with the end thereof in operative relation to said valve, an electric heating element mounted in said tube for lengthening the same and opening said valve, a diaphragm actuated by the pressure in said casing, and means operated by the movement of said diaphragm for controlling the passage of current through said element.

16. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a valve biased in a closing direction, a heat expand-

ible member arranged in operative relation to said valve in the path of said fuel for preheating the same, means for applying heat to said member to expand the same and open said valve, and means for regulating the application of heat to said member in compliance with the pressure on the exhaust side of said valve, said flow regulating means being arranged at a lower elevation than said burning means to receive the condensation of said fuel.

17. The combination with a source of fluid fuel, of means for burning said fuel, and flow regulating means interposed between said source and burning means comprising a casing, a valve biased in a closing direction mounted in said casing, a heat expandible member arranged in said casing in operative relation to said valve, means for applying heat to said member to expand the same and open said valve, a diaphragm actuated by the pressure in said casing, means operated by the movement of said diaphragm for controlling the application of said heat, and means for limiting the movement of said diaphragm.

In testimony whereof, I affix my signature.

WILLIAM C. McKEOWN.