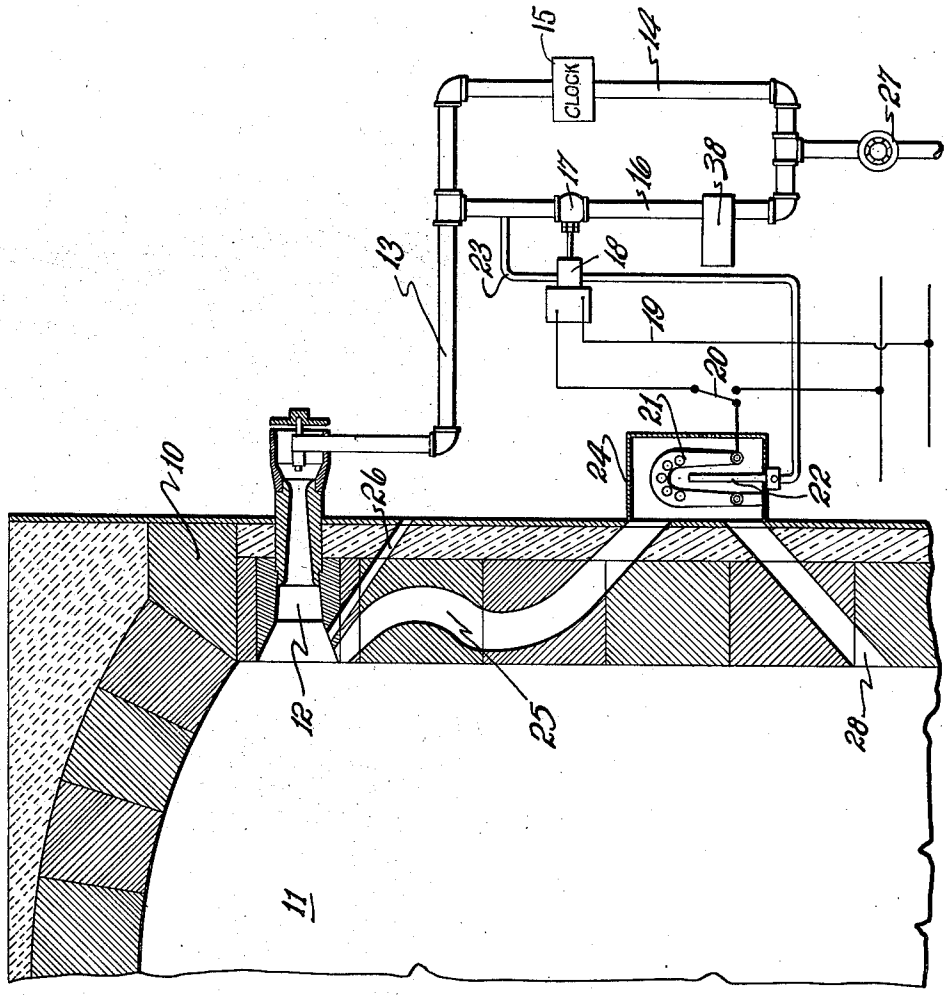
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METHOD OF FUEL FEED CONTROL AND APPARATUS THEREFOR

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METHOD OF FUEL-FEED CONTROL AND APPARATUS THEREFOR

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This invention relates to a method of fuel-feed control and apparatus therefor, and more specifically to a safety control for feed lines which feed fuel to flames.

In general, it is an object of the invention to provide a method of the character described and means of the character described, which will efficiently perform the purposes for which they are intended and which are simple and economical of construction, which can be expeditiously, conveniently and safely manipulated and which can be readily manufactured and assembled.

Another object of the invention is to provide a device which will shut off from a jet the supply of fuel when in due course that fuel has not become ignited; to provide such a device which is not relied upon for the original igniting of the jet; and to provide such a device which may be operated out of the high temperature zone of the jet or the chamber which the jet heats and which, however, may be subject to other atmospheric conditions prevailing in such chamber.

Another object of the invention is to provide a safety device for a jet which prevents the unignited jet from receiving further fuel after the source of supply has been shut off even though that source were later and otherwise made available therefor.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangements of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawing, which is a view in elevation, partly in section and partly diagrammatic, of a device embodying one form of the invention.

Many combustion chambers are so designed that it is difficult to tell whether or not the fuel burned therein has been properly ignited. This is especially true in connection with gas and/or oil ovens or burners where the burning jet is frequently completely enclosed and normally hidden from view. Furthermore the negligence of the operator frequently permits the continuous flow of a non-ignited jet or fuel, even under circumstances where ordinarily the failure of the jet to ignite would be readily noticeable. The present invention is concerned with a method and apparatus for controlling the flow of fuel so as to automatically quench a jet of fuel if the jet is not properly ignited.

In the drawing, 10 denotes the wall of any suitable combustion chamber 11. Fuel to be burned in the chamber is supplied from a suitable source, not shown in the drawing, and is brought to the place of burning in any desired fashion. As shown a burner or a nozzle 12 is provided through which the fuel to be ignited is passed to form a jet within the chamber 11. Any means for bringing the fuel from a suitable source of supply to the nozzle 12 may be employed, as for example, the conduit 13. Means, preferably valve means 15, are provided to control the flow of fuel through the conduit. In the embodiment of the invention shown in the drawing this valve means 15, which may take the form of any standard manually operated time valve mechanism, i. e., any manually operated valve mechanism adapted to remain open for a predetermined period of time only, is preferably normally closed so as to prevent the passage of fuel through the conduit 14. Such a valve is described in United States Patent No. 2,028,933, to Johnson.

A by-pass conduit 16 is provided and means, preferably valve means 17, are provided in this by-pass conduit to control the flow of fuel therethrough in a manner hereinafter to be described. This valve means 17 is preferably controlled either directly or indirectly by a device in the nature of a safety unit in such a way that when the safety unit is ignited, the valve 17 will be opened and will remain open until the unit is quenched, whereupon the valve will remain shut until the unit has again been ignited. In the device shown in the drawing valve 17 is operated by electric motive means shown generally at 18, a circuit therefor, shown at 19, having a switch 20 therein and means to operate the switch, whereby the circuit is closed and the electric motive means actuated to keep the valve 17 open.

In the device shown in the drawing the means employed for closing the switch 20 and activating the means 18 consists of a standard expansion and contraction element which may take the form of a horseshoe-shaped metal strip 21 positioned adjacent a fuel supply nozzle 22 in such a way that a flame emitted from said nozzle will cause the horseshoe-shaped element to expand, thereby closing the switch 20.

As shown, fuel is fed to the nozzle 22 through

the conduit 23, which is so positioned with respect to the valve 17 that the fuel flow through this conduit, when valve 15 is closed, is responsive to the opening and closing of that valve.

The switch-closing means may be suitably protected, as for instance by a casing 24, and is preferably positioned outside the wall 10 of the chamber 11, so that the expansion and contraction element 21 may be protected from the intense heat within the chamber 11. Additional means may be provided for cooling the casing 24 and the chamber therein, as for example, cooling fins attached to the casing 24. It is, however, desirable to vent the chamber containing the switch-controlling element in such a way that changes in atmospheric conditions prevailing within the chamber 11 will be transmitted to the switch-controlling element. This may be done by providing suitable vents or passageways between the chamber 11 and the chamber formed by the casing 24, as for example, by means of the passageway 28.

A conduit or vent 25 is provided leading from the chamber formed by the casing 24 to a point adjacent the place of formation of the jet within the chamber 11. This conduit may take any desired form but should be preferably so positioned and formed with sufficient cross-section as to permit a flashing over of the flame from the ignited jet to the nozzle 22, the flow of fuel through the conduit 25 acting to permit such a flashing over. A curvature of the conduit 25 may be utilized to prevent radiant heat reaching the interior of the casing 24.

Adjacent the nozzle 12, means are provided, as for example, the vent 26, whereby the jet formed from the nozzle 12, may be ignited. This may be accomplished either by a fixed and permanent pilot, not shown, or by the insertion of any igniting element through the vent 26. Thus the flaming end of a long wick may be inserted from the outside of the wall 10 through the vent 26 and into the fuel which is being dispersed by the nozzle 12. That fuel will thereupon begin to undergo combustion. The said long wick may then, if desired, be withdrawn and thrown away. Certain unexpected, untoward and highly irregular circumstances may in some instances lead to the result that, although the said wick is inserted into the chamber 11, the dispersed fuel does not start to combust. The herein described device then performs one of its most important functions in operating, after a predetermined period, to shut off any further fuel to the nozzle 12. The device is contrived, however, should the material from nozzle 12 have ignited, not to shut off from but to continue to supply fuel to that nozzle.

A main control valve 27 is preferably positioned in the fuel feed line in the manner shown. There may also be a valve 38 in conduit 16, controlled automatically by the temperature in the chamber 11 and adapted to govern the amount of fuel passing through conduit 16.

The operation of the device is as follows: The valve 27 is opened, permitting the flow of fuel into the conduits 14 and 16, the valves 15 and 17 being closed. The valve 15 is then opened, permitting the flow of fuel through the conduit 14, the conduit 13 and the conduit 23, so that fuel is supplied to the nozzle 12 and the nozzle 22. The valve 15 may preferably be equipped with some time-control mechanism so that it will remain open for a predetermined period only. If the fuel emitted from the nozzle 12 is then ignited, a flaming jet is formed. The fuel flowing from the nozzle 22 and through the conduit 25 then provides a path for a flashing over from the ignited jet to the nozzle 22, so that the fuel emitted at the nozzle 22 is ignited. This causes an expansion of the element 21, a closing of the switch 20, an activation of the motive means 18, and an opening of the valve 17, so that fuel then passes through the conduit 16, the conduit 13 and the conduit 23, as well as through the conduit 14. Thereafter, when the valve 15 closes, the supply of fuel through the conduit 16 is still available. Should the jet from nozzle 12 fail to become ignited, the jet at the nozzle 22 will also remain unignited and the valve 17 will not open. Thereafter and when the valve 15 closes, the fuel supplied to the nozzles 12 and 22 will be completely cut off. It will be obvious that such an arrangement prevents the excessive ejection of unignited fuel into the chamber 11.

Should some atmospheric disturbance within the chamber 11 quench the jet from nozzle 12, then it is intended that the vents 26 will cause a transmission of that disturbance to the jet at 22 so as to quench it also, causing a contraction of the element 21 and an opening of the switch 20, thus affecting a closure of the valve 17, which cuts off the supply of fuel to the nozzles 12 and 22.

Many modifications in the structure described may be used without departing from the invention. For example, a single compound valve may be employed instead of the two valves 15, 17. Such a valve might be positioned in conduit 14. Its blocking element might be operated not only by a time controlled mechanism, described in connection with valve 15, but also by the mechanism 18 so that the valve would be held open in either of these ways. It is not necessary that the valve, as for example valve 17, be controlled by electric motive means. Furthermore, other devices may be employed in lieu of the expansion and contraction device shown at 21. Thermoresponsive elements have been effectively used in connection with other types of safety pilots and might be well here employed.

Devices of this kind are particularly adapted for use in connection with heating ovens and similar structures, where the flaming jet is not continuously employed, but where the temperature of the oven is controlled by thermostatic means which periodically shut off the ignited jet. A workman may erroneously believe that if he supplies fuel to nozzle 12, after it has been turned off for a time, by and after the action of thermostatic means, there will be sufficient heat left in the walls adjacent that nozzle to ignite the material to be dispensed from nozzle 12. Or, due to rather elevated temperature of the chamber 11, he does not take the pains, an event which sometimes occurs, to look into the furnace to see whether he has pushed a wick far enough into the chamber 11, through vent 26, to ignite the material issuing from nozzle 12. Under these and other circumstances it frequently happens that the oven is not under observation when the fuel supply is again opened by the workman as well as when it is originally opened by the workman. A device such as has been here described is adapted to prevent the excessive flow of unignited fuel into the oven. It acts as a safety means to shut off the fuel supply if the main jet is not ignited.

Since certain changes in carrying out the above process and in the constructions set forth, which embody the invention, may be made without departing from its scope, it is intended that all matter contained in the above description or shown

in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In combination, means forming a combustion chamber, a burner positioned to supply a fuel jet within said chamber, a second burner positioned away from said first burner and exteriorly of said chamber to supply a fuel jet exteriorly of said chamber, means comprising a casing for said second burner to prevent the ignition of the jet at said second burner from any point save one in the path of the fuel jet supplied by said first-mentioned burner, means providing a conduit for the flow of fuel from said second-mentioned burner to a point in the path of the jet from said first-mentioned burner to cause the ignited jet at said first mentioned burner to ignite the jet at said second burner, manually operable time valve means adapted to permit the flow of fuel to both burners for a predetermined time only, valve means responsive to the ignition of the jet at said second burner for thereafter controlling the supply of fuel to both burners, and means providing vents from said combustion chamber to said second burner whereby the ignition of the jet at said burner is responsive to changes in atmospheric conditions within said combustion chamber.

2. In combination, means forming a combustion chamber, a burner positioned to supply a fuel jet within said chamber, a second burner positioned exteriorly of said chamber to supply a fuel jet exteriorly of said chamber, housing means to prevent the ignition of the jet at said second burner from any point save one in the path of the jet at said first-mentioned burner, means providing a conduit for the flow of fuel from said second burner to a point in the path of the jet from said first burner to cause the ignited jet at said first mentioned burner to ignite the jet at said second burner, valve means adapted to permit the flow of fuel to both burners for a predetermined time only, and means comprising valve means and a thermoresponsive element positioned to be responsive to the heat from the burning jet at said second burner and adapted, after the expiration of said predetermined time, for controlling the supply of fuel to both burners, said second burner being positioned to be responsive to changes in the atmospheric conditions within said combustion chamber.

3. In combination, means forming a combustion chamber, a burner positioned to supply a fuel jet within said chamber, a second burner spaced from said first burner and outside said combustion chamber and positioned to supply a fuel jet exteriorly of said chamber, means comprising a casing substantially surrounding said second burner to prevent the ignition of the jet at said second burner from any point save one substantially in the path of the jet at said first mentioned burner, means providing a conduit from said second burner to a point in the path of the jet from said first burner whereby the ignited jet at said first mentioned burner may ignite the jet at said second burner, manually operable time valve means adapted to permit the flow of fuel to both burners for a predetermined time only, and means positioned exteriorly of said chamber and operative independently of temperature conditions within said chamber and comprising a thermoresponsive element responsive to the heat from the burning jet at said second burner and adapted to control the supply of fuel to both burners after the expiration of said predetermined time, and means to provide vents from the interior of said combustion chamber to the interior of the casing surrounding said second burner whereby the ignition of the jet at said second burner is responsive to changes in atmospheric conditions within said combustion chamber.

4. In combination, means forming a combustion chamber, a burner positioned to supply a fuel jet within said chamber, a second burner spaced from said first burner and exteriorly of said chamber and positioned to supply a fuel jet exteriorly of said chamber, means comprising a casing surrounding said second burner to prevent the ignition of the jet at said second burner from a point exteriorly of said combustion chamber, means providing a conduit from within said casing to a point in the path of the jet from said first burner whereby the ignited jet at said first mentioned burner is caused to ignite the jet at said second burner, time valve means adapted to permit the flow of fuel to both burners for a predetermined time only, and valve means responsive to the ignition of the jet at said second burner for thereafter controlling the supply of fuel to both burners, the jets at both burners being similarly responsive to changes in the atmospheric conditions within said chamber.

5. In a device of the character described, means to supply fuel to a plurality of burners, one of said burners being adapted to provide a jet of fuel within a combustion chamber, another of said burners being spaced from said first burner and being adapted to supply a jet of fuel exteriorly of said chamber, means comprising a casing to permit the ignition of said last mentioned jet only from said first mentioned jet, whenever said first mentioned jet is ignited, means providing vents from the interior of said combustion chamber to said second burner to insure the extinction of said second mentioned jet whenever said first mentioned jet is extinguished by changes in atmospheric conditions within said combustion chamber, said fuel-supplying means comprising means including a manually operable time valve adapted to supply fuel to all of said jets for a predetermined time only, irrespective of the ignition of any of said jets, and means including a valve and thermoresponsive means adapted for thereafter supplying fuel to all of said jets but only while said second mentioned jet is ignited.

6. In combination, means providing a combustion chamber, a burner positioned to supply a jet of fuel within said chamber, a second burner positioned outside said chamber and spaced from said first burner and adapted to supply a second jet of fuel outside said chamber, means providing a conduit for the insertion into said combustion chamber and in the path of the fuel jet from said first burner of a flaming wick whereby said jet may be ignited, means providing a second conduit from said second burner to a point in the path of the jet from said first burner but spaced from said first-mentioned conduit whereby fuel may flow from said second burner to a point in the path of the jet from said first burner where-

by said second burner may be ignited from the ignited jet at said first burner, means comprising a casing for said second burner to prevent ignition thereof from any point outside said combustion chamber, means to supply fuel to each of said burners comprising time valve means adapted to permit the flow of fuel to each burner for a predetermined period irrespective of the ignition of the jets at either burner, and thermoresponsive means associated with said second burner and responsive to the ignition of the jet at said second burner and cooperating with other valve means and adapted to supply fuel to each of said burners only when the jet at said second burner is ignited, said thermoresponsive means being so positioned with respect to said combustion chamber as not to respond to changes of temperature therein, said second burner being so positioned with respect to said combustion chamber that the ignition of the jet of fuel at said burner is responsive to changes in atmospheric conditions within said chamber.

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