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TEMPERATURE COMPENSATED GAS CONTROL VALVE

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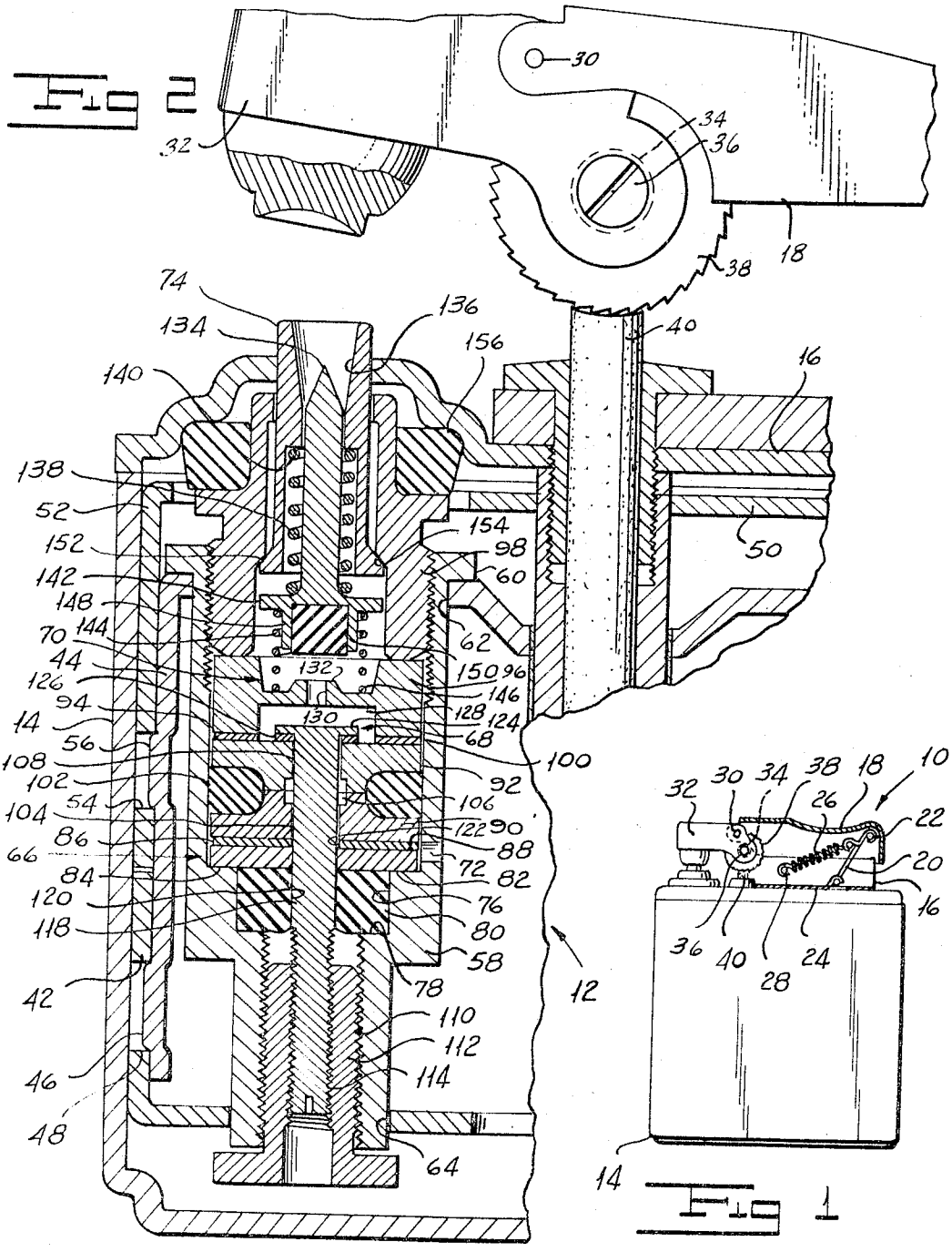


FIG 2

FIG 1

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TEMPERATURE COMPENSATED GAS CONTROL VALVE

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My invention relates to a temperature compensated gas control valve and more particularly to a control valve for stabilizing the flame height of a gas fueled lighter.

Gas fueled lighters have become increasingly popular owing to the relatively long period of time over which they may be used without refilling and for other reasons such, for example, as absence of odor and the relative cleanliness as compared with liquid fueled lighters. Some lighters of the prior art are provided with a flow control valve disposed adjacent the top of the lighter and operable by means of an exposed actuator to permit the user to adjust flame height within a maximum limit in addition to the on-off valve of the lighter.

Owing principally to the danger of accidental actuation of the exposed actuating member of user-adjust valves of the type described above, attempts were made to provide a user-adjust valve operable by means of a member mounted in the bottom of the tank and normally concealed by the decorative cover of the lighter.

While gas fueled lighters incorporate a number of advantages over liquid fueled lighters, they are more sensitive to temperature than are liquid fueled lighters. This is true to a highly undesirable degree of lighters of the prior art having a user flame adjusting valve actuatable by a member mounted in the bottom of the tank. That is to say, in response to an increase in ambient temperature, the flame is excessively high and an undesirable blast of gas issues from the lighter when it is operated with the consequent danger of injury to the user. On the other hand, if the ambient temperature drops to below a certain degree, then the amount of gas issuing from the burner mouth when the lighter operates either is so little as to produce so small a flame as not to be useful or no flame at all.

I have discovered that the undesirable temperature responsive characteristics of gas fueled lighters of the prior art results from the action of the flame height control valve. That is, where the temperature increases to increase the pressure of gas within the lighter reservoir, the effect on the parts making up the flow control valve is to decrease the effective restriction provided by the valve so that more gas under higher pressure flows to the burner. Conversely, when the temperature drops to decrease the gas pressure, the restriction of the flow control valve also increases and only a minute quantity of gas passes through the restriction to the burner.

I have invented a temperature compensated gas control valve which overcomes the defects of gas control valves of the prior art. My valve acts to stabilize flame height with temperature change. I so construct my flow regulating valve that the restricted opening provided thereby becomes smaller with increasing temperature. Conversely, the restricted opening of the valve enlarges with a decrease in temperature. My construction thus eliminates the undesirable excessive amount of gas fed to the burner at high temperatures while ensuring that an adequate supply of gas flows to the burner at low temperatures.

One object of my invention is to provide a temperature compensated gas control valve which overcomes the defects of gas control valves of the prior art.

Another object of my invention is to provide a temperature compensated gas control valve which stabilizes

flame height in a gas fueled lighter with changes in temperature.

A further object of my invention is to provide a temperature compensated gas control valve, the orifice of which is enlarged with decreasing temperature and is made smaller with increasing temperature.

A still further object of my invention is to provide a temperature compensated gas control valve which prevents an excessive flow of gas to the burner of a lighter at high temperatures while ensuring an adequate supply of gas to the burner at low temperatures.

Other and further objects of my invention will appear from the following description.

In general my invention contemplates the provision of a temperature compensated gas control valve for a lighter having a reservoir with opposed walls in which a housing secured to the opposed walls and having a passage for fuel from the reservoir to the atmosphere through a burner located adjacent one of the reservoir walls carries a valve, actuated by a member accessible outside the other wall of the tank, which moves away from the burner and toward a seat in the passage between the reservoir and the burner to decrease the restricted opening between the valve and the seat and toward the burner and away from the seat to enlarge the restricted opening. In response to temperature change the valve restriction increases as temperature increases and decreases as temperature decreases, thus to compensate for corresponding changes in gas pressure and to stabilize the flame height to that for which it is set at normal temperature.

In the accompanying drawings which form part of the instant specification and which are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

FIGURE 1 is an elevation of a lighter incorporating my temperature compensated gas control valve with parts shown in section.

FIGURE 2 is a fragmentary view with parts broken away and with other parts shown in section of the lighter shown in FIGURE 1 drawn on an enlarged scale to illustrate the parts of my temperature compensated gas control valve.

Referring to the drawings, a lighter indicated generally by the reference character **10** including my temperature compensated gas control valve assembly indicated generally by the reference character **12** comprises an outer decorative case **14** and a frame **16** supporting the operating mechanism comprising a thumbpiece **18**, one end of which is connected to a link **20** by a pin **22**. Link **20** is supported on the bast **24** of the frame **16**. A spring **26** connected between the link and a pin **28** on the frame normally urges the thumbpiece **18** to the position shown. Pins **30** connect the thumbpiece **18** to the snuffer cap **32**. Snuffer cap **32** is pivoted for movement on a bushing **34** carried by a pivot **36** which rotatably supports the flint wheel **38**.

From the structure just described it will readily be apparent that when pressure is exerted on the thumbpiece **18** the pins **30** act on the snuffer cap to rotate the cap in a clockwise direction as viewed in FIGURE 1. At the same time, as will be appreciated by those skilled in the art, a ratchet mechanism (not shown) rotates the flint wheel **38** to strike sparks from the flint **40**.

The fuel supply tank or reservoir of the lighter with which my valve is employed includes an outer shell **42** within which I telescope an inner shell **44** in fluid-tight relationship with the inner shell **44** retained in position, for example, by bosses **46** received in openings **48** in the outer shell **42**. The subframe **50** of the lighter has legs **52**, one of which is shown in FIGURE 2, which resiliently engage the sides of the inner shell and which are pro-

ided with openings 54 which snap over bosses 56 on the hell 44.

The valve assembly incorporating my temperature ompensated flow control valve comprises a main hous-ıg 58 having a flange 60 at its upper end soldered or therwise secured in fluid-tight relationship in opening 2 in the top of the inner shell. I also solder the lower nd of the housing in an opening 64 in the bottom of ıe outer shell. The assembly of the inner and outer hells 44 and 42 and the frame 50 receive the decorative uter cover 14.

Within the housing 58 I provide a factory flame-height djusting valve, a user adjusting valve and an on-off valve ndicated generally, respectively, by the reference char-cters 66, 68 and 70 in series betwen an inlet port 72 eading from the inside of the reservoir to the inside of ıousing 58 and a burner 74. A recess 76 in the bore of he housing 58 above a shoulder receives a sealing mem-ıer 80 such as an o-ring or the like. A shoulder 82 ormed in the bore of housing 58 above the portion 76 upports a disc washer 84 formed from any suitable mate-ial such, for example, as annealed brass. Disc 84 sup-ıorts a relatively soft washer 86 of ordinary or the like. score or otherwise roughen the surface 88 of the plate ır disc 84 in engagement with washer 86 to permit re-tricted flow of gas radially inwardly between the surfaces ıf the disc and the washer. I superpose a filter plate 90 ıaving a roughened undersurface on washer 86 and I dis-ıose a control plate 92 having a lapped upper surface 94 ıver the washer 86.

A shutoff seat-forming element 96 to be described more ully hereinafter is adapted to be moved downwardly as iewed in FIGURE 2 upon movement downwardly of an ıdjusting screw 98 to adjust the pressure with which the wo plates 84 and 90 clamp the soft washer 86. A seal-ng element 100 between the seat-forming element 96 ınd the surface 94 of plate 92 prevents the flow of fuel :adially outwardly between these two members.

From the structure just described it will readily be ap-ɔarent that the clamping pressure exerted by plates 84 ınd 90 on the washer 86 determines the rate of flow of fuel radially inwardly of the housing from the opening 72. I so form plates 90 and 92 as to provide a recess in which I dispose a seal 102 which prevents the flow of fuel axially upwardly of the housing in the space between the outboard rims of the plates and the inside wall of the housing. By the same token the seal 80 prevents the flow of fuel axially downwardly of the housing.

The two plates 84 and 90 cooperating with the soft washer 86 form a factory flame-height adjustment to de-termine the maximum flame which is permitted. To re-duce this maximum flame height the screw 98 is turned in a clockwise direction as viewed from the top in FIGURE 2 to increase the clamping pressure exerted on washer 86 by the washer 84 and the plate 90 to reduce the maximum flame height. Turning the screw in the other direction increases the maximum flame height.

Fuel traveling inwardly of the housing 58 through the maximum height control valve 66 is admitted into a central bore 104 in the plate 90 and travels upwardly into an expansion chamber 106 formed by enlarged bore portions in plates 90 and 92 and thence upwardly through a bore 108 in plate 92.

I provide the lower end of the housing 58 with internal threads 110 which receive a threaded adjuster screw 112. Screw 112 in turn has internal threads 114 which receive the threaded shank 116 of a control rod 118 extending upwardly through an opening 120 in seal 80 through a central opening 122 in washer 84 and through the bores 104 and 108 to a point above the surface 94. I so arrange the parts that seal 80 resiliently engages rod 118 to pre-vent rotation thereof.

I form the top of rod 118 with a peripheral flange or valve head 124. Between the head or flange 124 and the surface 94 of plate 92 I dispose a washer 126 formed of

a suitable material such as polyethylene terephthalate. In response to a turning operation of screw 112 in one direction or the other, rod 118 is moved axially upwardly or downwardly to either increase or decrease the amount of fuel which is permitted to flow radially outwardly be-tween the head 124 and the washer 126. The threads 110 have such a differential pitch with respect to the threads 114 that a relatively large rotary motion of screw 112 is required to produce a relatively small axial movement of the head 124. In this way a very close control over flame height within the maximum permitted by the fac-tory adjusting valve 66 is achieved.

From the structure thus far described it will be clear that fuel from the reservoir formed by shells 42 and 44 passes through opening 72 and thence flows radially in-wardly of the factory-adjust valve 66, upwardly through bores 104, into chamber 106 and along bore 108 to the user-adjust valve 68. It flows radially outwardly under head 124 forming part of the valve 68 to a space 128 in the underside of the seat-forming member 96. A cen-tral bore 130 in member 96 leads upwardly past a seat 132 on member 96.

The valve assembly includes a shutoff rod 134, the upper end of which extends into a bore 136 in the burner 74. A spring 138 bears between a shoulder 140 inside the burner 74 and a flange 142 adjacent the lower end of rod 134 normally to urge the rod downwardly. A shock-absorbing spring 144 bears between the underside of the flange 142 and the base of recess 146 surrounding seat 132. The lower end of the shutoff rod 134 is formed with a housing 148 which receives a slug 150 of a resilient material adapted to engage seat 132. I flare the lower end of the burner 74 outwardly as indicated at 152 to form a stop to engage a sloping shoulder 154 in the bore of the factory-adjust screw 98. An O-ring 156 or the like surrounding the upper portion of the screw 98 pro-vides a seal between the frame 16 and the housing to pre-vent gas from flowing backwardly into the lighter as-sembly between the tank and the shell.

The copending application of Burchett et al., Ser. No. 385,394, filed July 29, 1964, now Patent No. 3,254,511, shows a lighter valve assembly having a user adjustment provided under the bottom of the fuel reservoir of the lighter. In that arrangement a valve rod is moved up-wardly toward a seat surrounding an orifice provided in a member supported within the valve housing which, in turn, is secured to the top and bottom of the reservoir. In response to movement of the rod upwardly, the re-stricted opening provided by the user-adjust valve is re-duced and by movement downwardly, the restricted open-ing is enlarged. It is this construction which, as is pointed out above, I have discovered embodies the defect of dangerously increasing flame height as temperature in-creases while reducing the flame height to an undesirable extent in response to a decrease in temperature.

The defect incorporated in the lighter described in the copending application may come about for a number of reasons. Under the action of a change in temperature the parts may differentially expand or contract so as to open or close the user-adjust valve in an undesirable man-ner. Another possible explanation of the action of that valve is the fact that a rise in temperature, for example, increases the gas pressure to tend to tension the hous-ing supported by the top and bottom wall of the reser-voir, thus to decrease the pressure between the seat-form-ing element and the valve rod owing to the fact that the seat-forming element is positioned on the housing at a point above the point at which the rod is mounted on the housing. Whatever the cause, I have discovered that my construction overcomes these defects.

In operation of my gas control valve, in order to de-crease the flame height the head 124 is moved down-wardly toward the surface 94 and away from the burner 74. In response to movement of the head 124 away from surface 94 the restricted opening provided by valve 68

increases. It will readily be appreciated that this operation is readily contrasted with that of the valve shown in the copending application in that a movement upwardly of rod **118** in my construction tends to open the valve **68** whereas a movement upwardly of the valve rod in the structure shown in the copending application tends to close the valve.

In determining the effect of a temperature change on the condition of my valve **68**, by analogy, owing to the fact that the direction of movement of my rod **118** in effect on valve **68** is opposite to that of the valve rod shown in the copending application, it will be clear that temperature changes affect the operation of my valve **68** in the opposite manner. That is, an increase in temperature results in a relative movement of head **124** and surface **94** toward each other to decrease the valve opening while a drop in temperature tends to move these parts away from each other. It will be appreciated that these relative movements produce the desired results since increasing temperature results in increasing gas pressure so that the consequent reduction in the amount of gas permitted to pass through the valve **68** gives the desired regulating action.

As is pointed out hereinabove, the reason for the functioning of the device is not entirely clear. It may be that the tension described above in housing **58** resulting from an increase in gas pressure produced by a temperature increase tends to move the seat-forming element **92** upwardly relative to head **124**. In any event, I have discovered that by changing the direction of movement of the valve rod with respect to the resultant valve action provided affords the desired regulating effect.

It will be seen that I have accomplished the objects of my invention. I have provided a temperature compensated gas control valve for stabilizing the flame height of a gas fueled lighter with temperature change. My construction reduces the user-adjust valve opening in response to an increase in temperature. Conversely, it enlarges the user-adjust control valve opening in response to a decrease in temperature. It avoids the dangers incident to temperature changes in gas lighters of the prior art.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is

1. In a gas fueled lighter having a reservoir holding supply of normally gaseous liquefied fuel, said reservo having opposed walls, a valve assembly including a valv housing providing a fuel passage, means mounting sai housing between said walls, a burner, means supportin said burner in said passage adjacent one of said wall an element forming a valve seat, means positioning sai element in said passage between said walls, a valv adapted to cooperate with said seat to form a flow cor trol opening for fuel flowing between said reservoir an said burner, means mounting said valve for movemer away from said burner and toward said seat to reduc said opening and for movement away from said seat an toward said burner to enlarge said opening, and mean accessible from outside the other wall for moving sai valve.

2. A lighter as in claim **1** in which said valve mount ing means is between said element and said other wall.

3. A lighter as in claim **1** in which said seat-formin element comprises a bore and in which said valve com prises a rod extending through said bore and having head disposed between said element and said burner.

4. In a gas fueled lighter having a reservoir holdin a supply of normally gaseous liquefied fuel, said reservoi having top and bottom walls, a valve assembly includ ing a housing extending between said walls and secure thereto, an element having a bore therein, said elemen providing a valve seat surrounding said bore, said hous ing admitting fluid from said reservoir to said bore, rod extending through said bore, means attaching sai rod to said housing adjacent said bottom wall and a hea on the end of said rod above said seat adapted to mov toward said seat to restrict flow of fluid from said bor past said seat and away from said seat to permit free flow of fluid from said bore past said seat.

5. A valve assembly as in claim **4** including a plasti washer between said head and said seat.

6. A valve assembly as in claim **4** in which said attach ing means comprises screw threads.

7. A valve assembly as in claim **4** in which said a taching means comprises screw threads and includin means restraining said rod against rotary movement.

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EDWARD J. MICHAEL, *Primary Examiner.*