

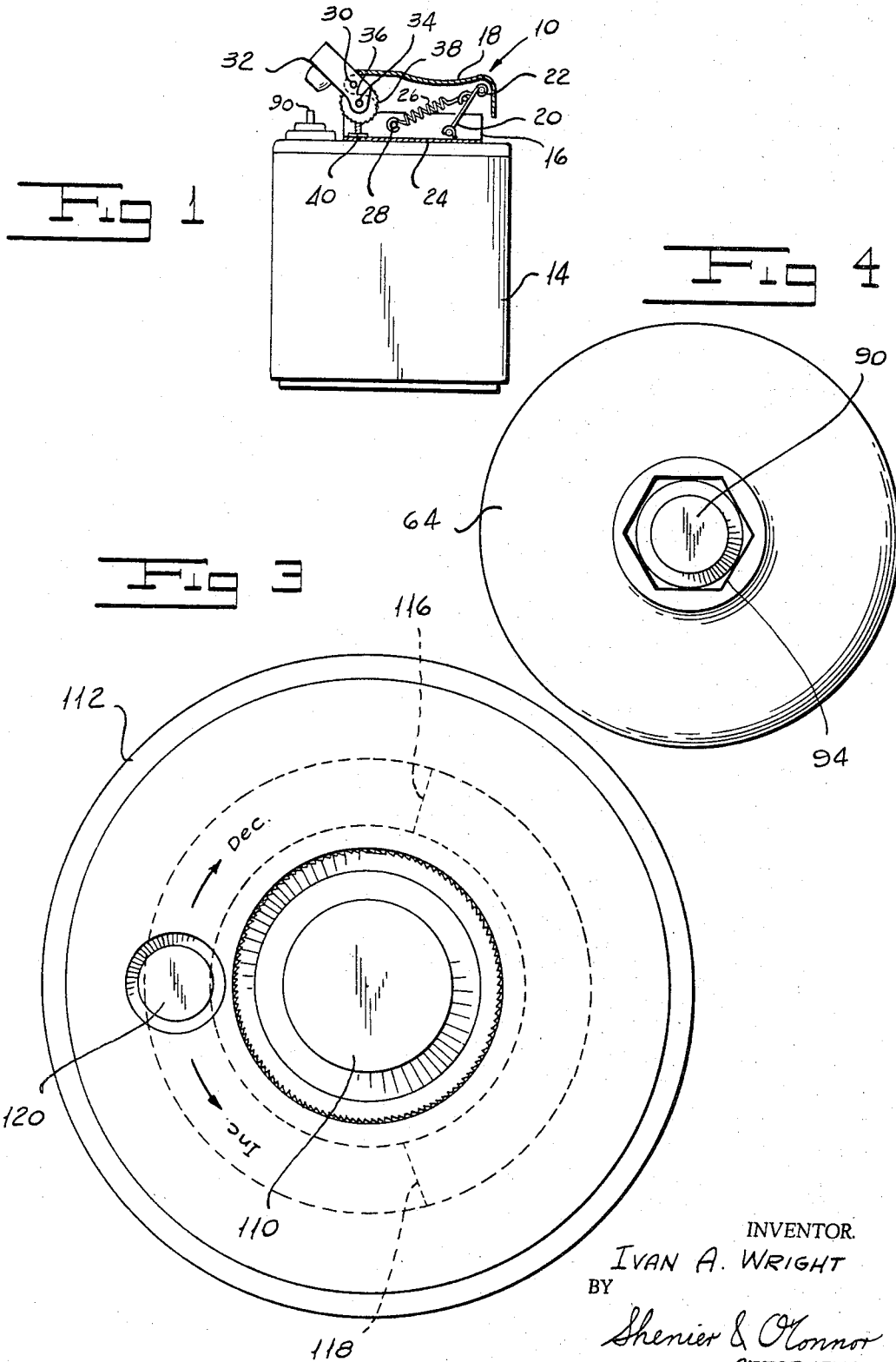
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LIQUEFIED NORMALLY GASEOUS FUEL CONTROL SYSTEM
FOR MINIATURE BURNERS

3,406,000

Filed Aug. 2, 1965

2 Sheets-Sheet 1



INVENTOR
IVAN A. WRIGHT
BY
Shenier & Connor
ATTORNEYS

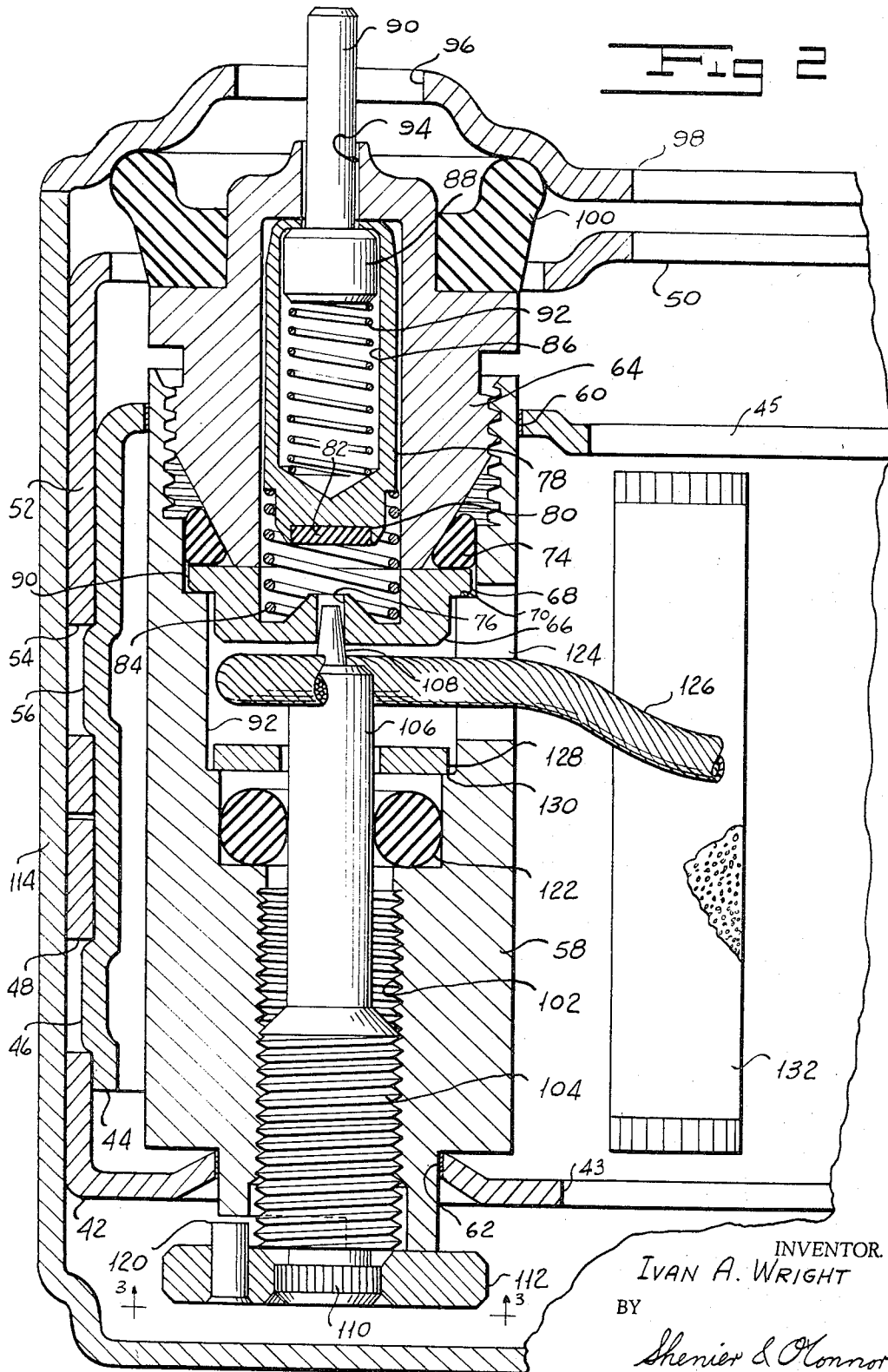
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Ivan A. Wright, Pearl River, N.Y., assignor to Jacques Kreisler Manufacturing Corporation, North Bergen, N.J., a corporation of New Jersey
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ABSTRACT OF THE DISCLOSURE

A fuel control system for a gas fueled device employing a miniature burner in which a chamber formed in a housing within the fuel reservoir below a gas passage and through which a valve stem extends adjustably to position a frusto-conical valve in the passage houses a wick extending from the reservoir in a relaxed condition. A positive mechanical stop limits the adjustment of the valve to provide a built-in maximum flame height adjustment. A decorative casing covers the adjustment element so that it is normally inaccessible and a compressible member within the reservoir avoids swelling of the tank as a result of overfilling.

My invention relates to gas fueled devices and more particularly to a liquefied normally gaseous fuel control system for miniature burners which is simple and which accurately regulates the amount of fuel flowing from a reservoir to a burner.

Many forms of gas fueled devices such, for example, as cigarette lighters and candles and the like are known in the prior art. Most of these devices are provided with some means which is used to control the height of the flame. For example, many devices are provided with a wick of fibrous material compressed between two relatively movable elements which are actuated to change the compression of the wick to regulate flame height. This type of adjustment has proved generally unsatisfactory owing to the fact that the wick has residual compression and after a period of time in use the regulating action in response to relative movement of the members becomes very uncertain and any effective control may be entirely lost. The actuating element for this flame height control usually is exposed so as to be readily accessible to the user. While being readily accessible to the user, it may also accidentally be operated while in the user's pocket or the like so that he may get an unexpectedly large flame when he operates the device. This condition of course is undesirable and may be unsafe.

Many of the gas fueled devices of the prior art are provided with a second flame height adjustment which is set at the factory in the course of manufacture of the device to determine the maximum flame height within which the user adjustment can operate. This second adjustment usually involves a second flow control valve independent of the user-adjust valve. This of course adds to the complexity of the device and to the expense of constructing the device. The so-called "factory" maximum flame height adjusting element normally is within the outer casing of the lighter so as not to be readily accessible. It is possible, however, that a tinkerer may partially disassemble the lighter and operate the maximum flame height adjust. The potential danger of this happening will readily be appreciated.

A further defect of liquefied gas fueled devices of the prior art and particularly cigarette lighters is swelling of the fuel tank or reservoir in response to temperature change when the lighter is full, for example. This effectively destroys the usefulness of the lighter since it becomes impossible to remove the tank from the decorative

casing. To avoid this defect, many lighters of the prior art are provided with relatively complicated refilling mechanisms which bleed off some of the gas either during or immediately following a refilling operation.

A further defect of many gas fueled devices of the prior art is their extreme sensitivity to changes in temperature. That is, the flame height will vary greatly as the ambient temperature changes. No truly satisfactory solution to this problem has been found. It further appears that the more complicated the construction as in those permitting flame height adjustment, the more significant this problem becomes.

Some devices of the prior art incorporate a further defect which is an undesirable puff of fuel upon operation of the lighter resulting from the buildup of a charge of fuel in the valve housing.

I have invented a liquefied normally gaseous fuel control system for miniature burners which overcomes the defects of systems of the prior art. My system is simpler and less expensive for the results achieved than are systems of the prior art. It accurately controls the flow of fuel from the reservoir to the burner while avoiding undesirable puffs of fuel. I so construct my system as to be compensated for changes in temperature. The factory maximum flame height adjustment of my system cannot readily be changed by the user. The user flame height adjustment is normally not accessible so that accidental actuation thereof is avoided. I provide my system with means for avoiding swelling of the tank in response to temperature change.

One object of my invention is to provide a liquefied normally gaseous fuel control system for miniature burners which accurately controls the flow of fuel from a reservoir to a burner while avoiding undesirable puffs of fuel upon operation of the device.

Another object of my invention is to provide a fuel control system for miniature burners which is simpler and less expensive than are systems of the prior art intended to accomplish the same result.

A further object of my invention is to provide a fuel control system for miniature burners which has a built-in mechanical maximum flame height adjustment.

Still another object of my invention is to provide a fuel control system for miniature burners which has a user adjustment, the actuating element of which is normally inaccessible.

A still further object of my invention is to provide a fuel control system for miniature burners which avoids the swelling of the fuel tank in response to temperature change.

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

In general my invention contemplates the provision of a liquefied normally gaseous fuel control system for miniature burners in which an uncompressed wick extends from a fuel reservoir into valve housing chamber and around a rod carrying a tapered flow control valve. This valve moves axially toward and away from a generally cylindrical seat in response to rotary movement of the rod, and without compressing the wick, between fixed mechanical stops which determine the maximum and minimum flame heights. I so construct my system that the valve moves toward the seat in response to a temperature increase and away from the seat in response to a temperature drop.

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 one type of device to which I may apply my liquefied normally gaseous fuel control system.

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FIGURE 2 is a fragmentary view with parts in section of the device shown in FIGURE 1 and drawn on an enlarged scale to illustrate the parts of my system.

FIGURE 3 is a fragmentary bottom plan of my system taken along the lines 3—3 of FIGURE 2.

FIGURE 4 is a fragmentary top plan of my system.

More particularly, referring now to the drawing, I may apply my system to a device such as a cigarette lighter indicated generally by the reference character 10 having an outer decorative case 14 and a frame 16 supporting the operating mechanism which includes a thumbpiece 18, one end of which is connected to a link 20 by a pin 22. Link 20 is pivotally supported on the base 24 of the frame 16. A spring 26 extending between the link and a pin 28 on the frame normally urges the thumbpiece to the position shown. Pins 30 connect the thumbpiece 18 to the snuffer cap 32 which is mounted for pivotal movement on a bushing 34 carried by the pivot 36 which rotatably supports the flint wheel 38.

When pressure is exerted on the thumbpiece 18 pins 30 rotate the snuffer cap 32 in a clockwise direction as viewed in FIGURE 1. Concomitantly, a ratchet mechanism (not shown) of a type known in the art rotates the flint wheel 38 to strike a shower of sparks from the flint 40.

My fuel control system is used with a reservoir made up of an outer shell 42 within which I telescope an inner shell 44 retained in position by means of bosses 46, for example, received in openings 48 in the outer shell 42. The sub-frame 50 of the lighter has legs 52 which resiliently engage the inner shell and which may be provided with openings 54 for receiving bosses 56 on the inner shell to hold the sub-frame 50 on the reservoir. The inner and outer shells 44 and 42 have respective top and bottom openings 45 and 43 for the flint feed tube (not shown).

The valve assembly of my system includes a housing 58 extending generally vertically through the reservoir formed by the shells 42 and 44. I secure the upper end of the housing 58 in an opening 60 in the top of shell 44 by any suitable means such, for example, as solder. I also solder the lower end of the housing 68 in an opening 62 in the bottom of the shell 42. I screw a burner 64 into the threaded upper end of housing 58. Burner 64 bears on a seat-forming element 66 having a peripheral flange 68 which rests on a shoulder 70 in the bore 72 of housing 58. An O-ring 74 or the like disposed between the burner 64 and the wall of the housing provides a gas-tight seal for a reason which will be explained hereinafter. I provide the element 66 with a central generally cylindrical bore 76 to permit the passage of gas through the element 66. The portion of the element 66 surrounding bore 76 provides a seat for a shutoff valve rod 78, the lower end of which has a recess 80 in which I glue a rubber insert 82. A spring 84 bearing between the element 66 and the rod 78 normally urges rod 78 and the insert 82 away from the seat around the opening 76.

A bore 86 in the rod 78 receives a head 88 on the lower end of a striker rod 90. A spring 92 in bore 86 normally urges rod 90 upwardly with respect to the shutoff rod 78 so that the striker rod 90 extends upwardly through the burner opening 94 and through an opening 96 in the decorative cover 98 at a position at which it can be engaged by the snuffer cap.

In the normal position of the parts when the lighter is not operating, the spring 26 urges the snuffer cap 32 into engagement with rod 90 and shock-absorbing spring 92 transmits force to the shutoff rod 78 to move the rod downwardly against the action of spring 84 until the insert 82 seats over the bore 76. Conversely, when the thumbpiece is pressed to operate the lighter, rod 90 and rod 78 move upwardly to permit gas to flow through the burner opening. In order to prevent any backflow of gas into the space between the reservoir and the cover 98, I place a seal 100 between the burner and the cover 98.

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I provide the lower end of the housing 58 with internal threads 102 which rotatably receive the threaded shank 104 of a control valve rod 106. The upper end of the rod 106 is formed as a very slightly tapered valve element 108 which has a taper of about four degrees to the center line of the rod. It will readily be appreciated that as the rod 106 moves vertically, valve 108 moves with relation to the bore 76 to regulate the flow of fuel between the valve and the wall of the bore. I make the threads 104 very fine so that a close control over fuel flow is achieved. For example, I may use 112 threads per inch. The lower end of the shank 104 is formed as a serrated head 110 which extends out of the housing to a position spaced from the bottom of shell 42. I press fit a control knob 112 on the head 110 to permit the rod 106 to be turned when the outer decorative cover 114 is removed.

I cut away a portion of the wall of the housing 58 extending out of the shell 42 to form respective stops 116 and 118. Knob 112 carries a pin 120 adapted to engage the respective stops 116 and 118 in response to rotation of the knob 112. In the particular embodiment of my system illustrated in the drawings, knob 112 is turned in a clockwise direction as viewed from the bottom to decrease the flow of fuel through the bore 76. When the pin 120 strikes the stop 116, the minimum amount of fuel is permitted to flow through the bore 76 so that the flame height is a minimum.

In order for the user to increase the height of the flame, he rotates the knob 112 in a counterclockwise direction as viewed from the bottom. Ultimately, pin 120 engages stop 118 to give the maximum flame height. I achieve a factory adjustment of maximum flame height in the course of making the lighter by pressing the knob 112 on the head 110 with the pin so located with relation to the stop 118 as to provide the desired maximum flame height when the pin 120 hits stop 118. Thus the relationship of the pin 120 to the stop 118 provides a maximum flame adjustment made at the factory which cannot readily be disturbed by the user. An O-ring 122 around the rod 106 prevents flow of fuel downwardly in the housing.

Fuel from the reservoir formed by shells 42 and 22 passes through an opening 124 in the side of the reservoir and into the bore 92 from which it can flow upwardly through bore 76 when the shutoff rod 78 is released. In order to ensure a constant flow of fuel to the regulating valve at all positions of the valve rod 106 and to prevent an undesirable buildup which might cause a puff, I provide my system with a wick 126 of woven cotton or the like extending from the reservoir and into the bore 92 and around the rod 106. A washer 128 loosely surrounding the rod 106 rests on a shoulder 130 and isolates the wick from the portion of the rod below the shoulder to prevent the wick from accidentally becoming entangled with the rod. That is, washer 128 ensures that the wick 126 merely rests in the portion of the bore 92 below the seat-forming element 66 and above the shoulder 130 without becoming entangled or otherwise fouled. Owing to this arrangement, the wick 126 is not disturbed by movement of rod 106 and will convey fuel to the metering valve at a constant rate.

Another element of my system which ensures the proper storage and handling of the liquefied normally gaseous fuel is a compressible member 132 which is placed in the reservoir formed by the shells 42 and 44 when they are assembled. Element 132 normally has a volume which is about 20 percent of the volume of the reservoir formed by the shells. I form the element 132 from closed cell-expanded buna N rubber so that it has about eighty percent gas. When the tank is filled, if the temperature should rise so as to tend to distort the tank, member 132 compresses to avoid damage to the reservoir.

Referring to FIGURE 4, while the rod 90 is generally cylindrical in cross-section, I form the bore 94 with a non-cylindrical cross-sectional shape such, for example, as a hexagonal shape. I have discovered that this construction ensures the proper flow of fuel through the bore.

Generally the operating parts of the valve assembly of my system are formed from brass while the housing 58 is formed of steel. Specifically, the striker rod 90, the burner 64, the seat-forming element 66 and the rod 106 as well as the washer 128, all are formed from brass. The plunger 78 may be aluminum. Owing to the different rates of thermal coefficient of expansion of steel and brass, in response to an increase in ambient temperature rod 106 moves upwardly relative to element 66 to tend to reduce the valve opening, thus to compensate for the increase in gas pressure. Conversely, when the temperature drops, rod 106 tends to move valve 108 away from element 66, thus effectively increasing the valve opening to compensate for a reduction in gas pressure. This operation tends to maintain flame height relatively constant with changes in temperature.

In operation of my fuel control system, fuel from the reservoir is led by the wick 126 into bore 92 below element 66. To operate the lighter, the thumbpiece 18 is pressed and snuffer cap 32 lifts away from the burner 64. When this occurs, rod 90 and rod 78 move upwardly to lift the insert 82 off the seat around bore 76. Fuel is then permitted to flow past valve 108, through the bore 76, up through the portion of the burner housing rod 78 and then outwardly through the bore 94 to a location at which it can come into contact with the shower of sparks which is struck from the flint as the wheel 38 rotates. After use, the thumbpiece is released and element 82 seats on the member 66. To adjust the height of the flame, knob 112 is moved in a clockwise direction as viewed from the bottom to decrease the flame height. It is turned in a counterclockwise direction as viewed from the bottom to increase flame height. Engagement of stop pin 120 with stop 118 determines the maximum flame height. This maximum flame height has previously been determined during the manufacture of the lighter by the relative position of pin 120 with reference to stop 118 as knob 112 is pressed on head 110 after rod 106 has been set for a particular flame height. The movement of rod 106 to adjust flame height does not disturb the portion of wick 126 around the rod. Moreover, the isolating washer 128 ensures that the wick will not become tangled with the rod.

In response to temperature change, the steel housing 58 and the brass rod 106 differentially expand to compensate for the temperature change and regulate flame height. With the reservoir full, the insert 132 prevents distortion of the reservoir when the temperature increases by collapsing as is necessary to provide the additional volume required.

It will be noted that the valve assembly of my system is relatively easy to assemble with the rod 106 being threaded into the housing through the lower end thereof and with the remaining parts, including the subassembly of the burner and shutoff rod, being inserted from the top of the housing. The maximum flame height is readily determined when the knob 112 is pressed onto head 110.

It will be seen that I have accomplished the objects of my invention. I have provided a liquefied normally gaseous fuel control system for miniature burners which is relatively simple and inexpensive for the result achieved. My system has a maximum flame height adjustment which cannot readily be disturbed. The user adjustment of my arrangement is normally inaccessible. My system so distributes fuel and controls the flow thereof as to provide an even steady flame. The user adjustment affords close control over flame height and will not change its operation even after a relatively long period of time in use. My system regulates flame height with changes in temperature. It prevents distortion of the tank in response to temperature change.

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. A fuel control system for a gas fueled device including in combination, a reservoir having a top wall and a bottom wall, a housing, means mounting said housing in said reservoir between said top and bottom walls, a burner mounted on said housing adjacent said top wall, said housing provided with an inner chamber and a wall, said housing providing a passage for the flow of fuel from said reservoir to said burner, a seat forming element provided with a bore, means mounting said element in said housing above said chamber, an on-off valve, means mounting said on-off valve in said housing between said element and said burner for movement between a first position at which it closes said bore and a second position clear of said bore, a tapered flow control valve comprising a stem extending through said chamber to form an annular space between said stem and said housing wall, said tapered valve extending into said bore, means disposed below said bore mounting said tapered valve for movement axially of said bore to regulate the flow of fluid therethrough and a wick of compressible material extending from said reservoir into said chamber and partly around said stem in said chamber annular space, the diameter of said wick in uncompressed condition being less than the space between said stem and the housing wall so that said wick in said chamber is in substantially relaxed and uncompressed condition.

2. A system as in claim 1 including a compressible member in said reservoir outside said housing in uncompressed condition normally occupying a volume appreciably less than that of said reservoir.

3. A system as in claim 1 in which said tapered valve mounting means comprises a rotatable element, said system including mechanical stops for limiting the movement of said rotatable element to less than a complete revolution thereby to limit the movement of said tapered valve with relation to said bore.

4. A device as in claim 1 including a shoulder in said housing passage below said chamber and a washer on said shoulder.

5. A fuel flow control system for a gas fueled device having a hermetically sealed reservoir providing a wall containing a supply of normally gaseous liquefied fuel, under superatmospheric pressure, a housing in said reservoir, a burner carried by said housing, said housing provided with a passage for the flow of fuel from the reservoir to said burner, an on-off valve, a flow control valve, means mounting said flow control and said on-off valves in series in said passage between said reservoir and said burner and a normally expanded compressible body enclosed by said reservoir wall outside said passage, said body having skin impervious to said fuel.

6. A fuel control system as in claim 5 in which said compressible member is formed from unicellular expanded organic resin.

7. In a gas fueled device having a reservoir holding a supply of liquefied normally gaseous fuel and a burner, a housing in said reservoir having an inner chamber and a wall, said housing providing a passage between said reservoir and said burner, an element having a bore therein, means mounting said element in said housing above said chamber, a valve adapted to cooperate with said bore to regulate the flow of fuel therethrough, means including a rod extending through said chamber for mounting said valve for movement relative to said bore to form an annular space between said chamber wall and said rod and a wick of compressible material extending from said reservoir into said chamber and around said rod, said wick in uncompressed condition having a diameter less than the width of said annular space to lie in said

space in substantially relaxed and uncompressed condition.

8. A fuel control system for a gas fueled device including in combination, a reservoir having a top wall and a bottom wall, a housing, means mounting said housing in said reservoir between said top and bottom walls, a burner mounted on said housing adjacent said top wall, said housing provided with an inner chamber and a wall, said housing providing a passage for the flow of fuel from said reservoir to said burner, a seat forming element provided with a bore, means mounting said element in said housing above said chamber, an on-off valve, means mounting said on-off valve in said housing between said element and said burner for movement between a first position at which it closes said bore and a second position clear of said bore, a tapered flow control valve comprising a stem extending through said chamber to form an annular space in said chamber between said stem and said wall, said tapered valve extending into said bore, means disposed below said bore mounting said tapered valve for movement axially of said bore to regulate the flow of fluid therethrough and a wick extending from said reservoir into said chamber annular space, the diameter

of said wick being less than the space between said stem and the wall so that said wick in said chamber is in substantially relaxed condition, said housing and said tapered valve being formed of materials having such differential coefficient of thermal expansion that said valve moves into said bore in response to a temperature increase.

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EDWARD J. MICHAEL, *Primary Examiner.*