United States Patent [19]

Hefling

[11] **3,876,364**

[45] **Apr. 8, 1975**

[54] **FUEL CONTROL MEANS FOR CAMP STOVES**

[75] Inventor: **Dennis V. Hefling**, Wichita, Kans.

[73] Assignee: **The Coleman Company, Inc.**, Wichita, Kans.

[22] Filed: **July 12, 1973**

[21] Appl. No.: **378,711**

[52] **U.S. Cl.** **431/123**; 126/38

[51] **Int. Cl.** **F23d 11/38**; F23d 13/28

[58] **Field of Search** 431/123, 210, 247; 126/38, 126/44

[56] **References Cited**

UNITED STATES PATENTS

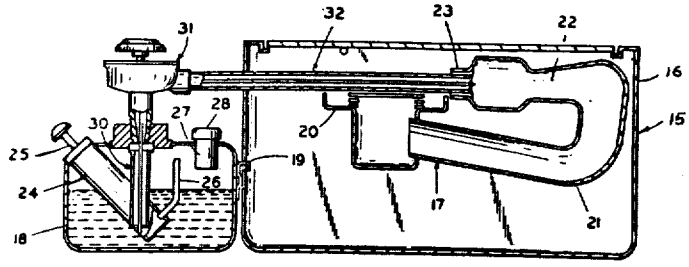
1,686,348	10/1928	Schmidt	431/123
3,485,567	12/1969	Hutchinson et al.	126/38 X
3,687,125	8/1972	Weimer	126/38

Primary Examiner—Edward G. Favors
Attorney, Agent, or Firm—Dawson, Tilton, Fallon & Lungmus

[57] **ABSTRACT**

A fuel control means is provided for supplying vaporized fuel to the burner of a camp stove. The control means includes a fuel tube assembly which extends upwardly from a fuel tank, a shut-off valve above the fuel tube assembly, and a generator tube extending from the shut-off valve to a fuel burner. The fuel tube assembly includes a reciprocable rod for restricting the fuel inlet orifice thereof, and the generator assembly includes a reciprocable cleaner rod for cleaning the generator orifice. A single control member is used for opening and closing the shut-off valve, reciprocating the inlet restricting rod, and reciprocating the inlet restricting rod, and reciprocating the generator cleaner rod, and rotation of the control member operates these components in the proper coordinated sequence to provide optimum operation.

6 Claims, 12 Drawing Figures



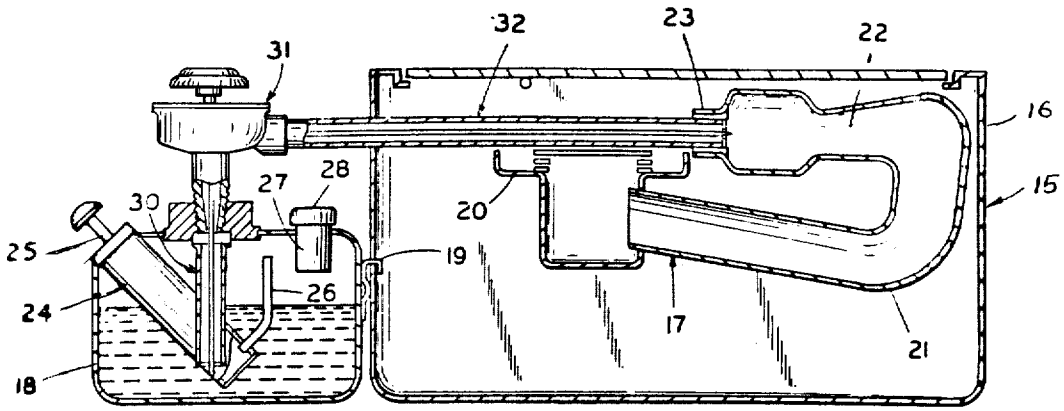


FIG.1

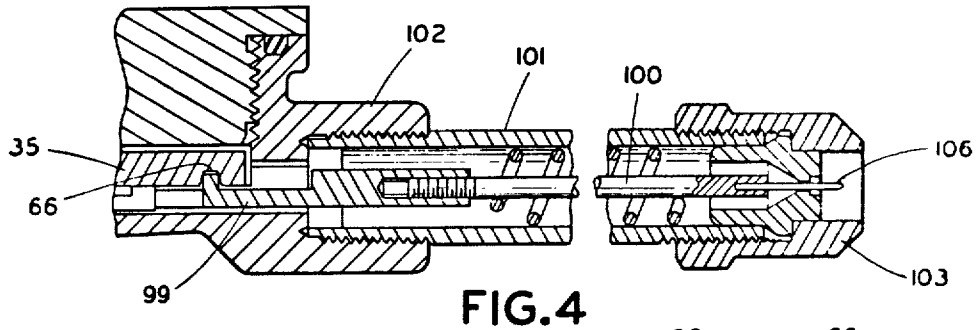


FIG.4

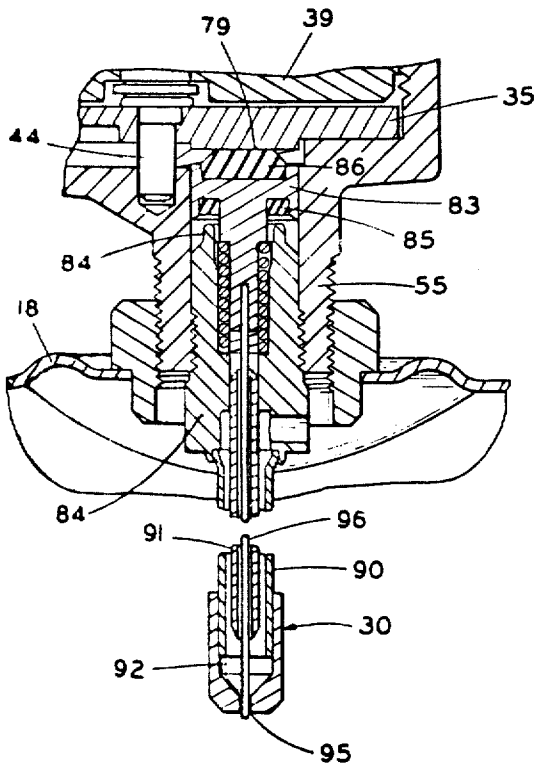


FIG.5

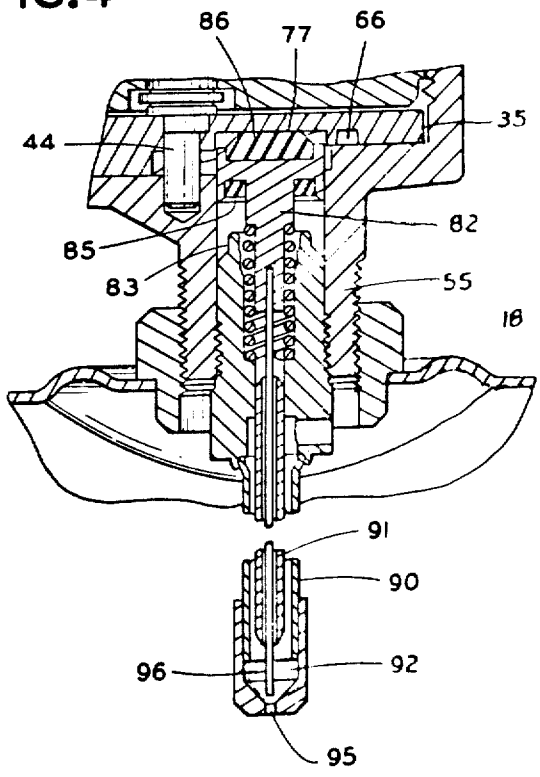


FIG.6

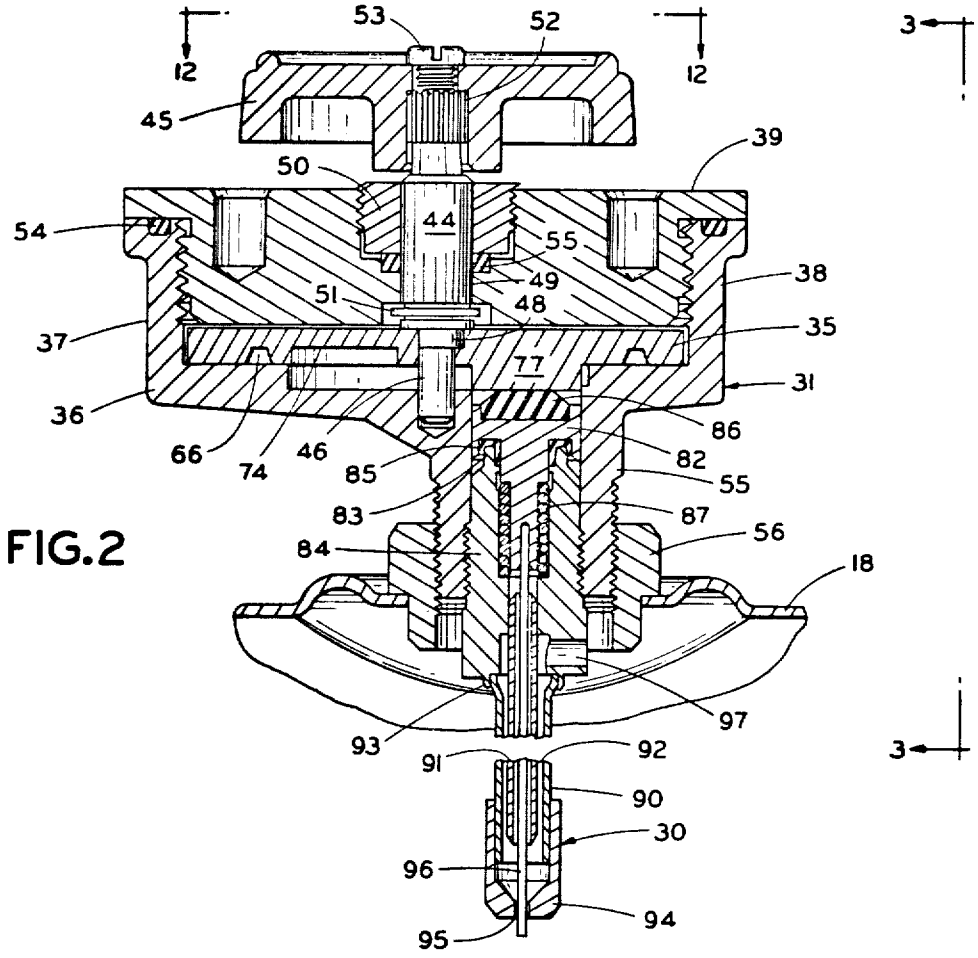

53
52
12
12
3
45
39
50
44
54
55
49
51
48
38
37
35
77
31
36
86
66
74
46
85
82
55
83
87
56
84
18
97
93
91
92
3
90
30
96
94
95

FIG.2

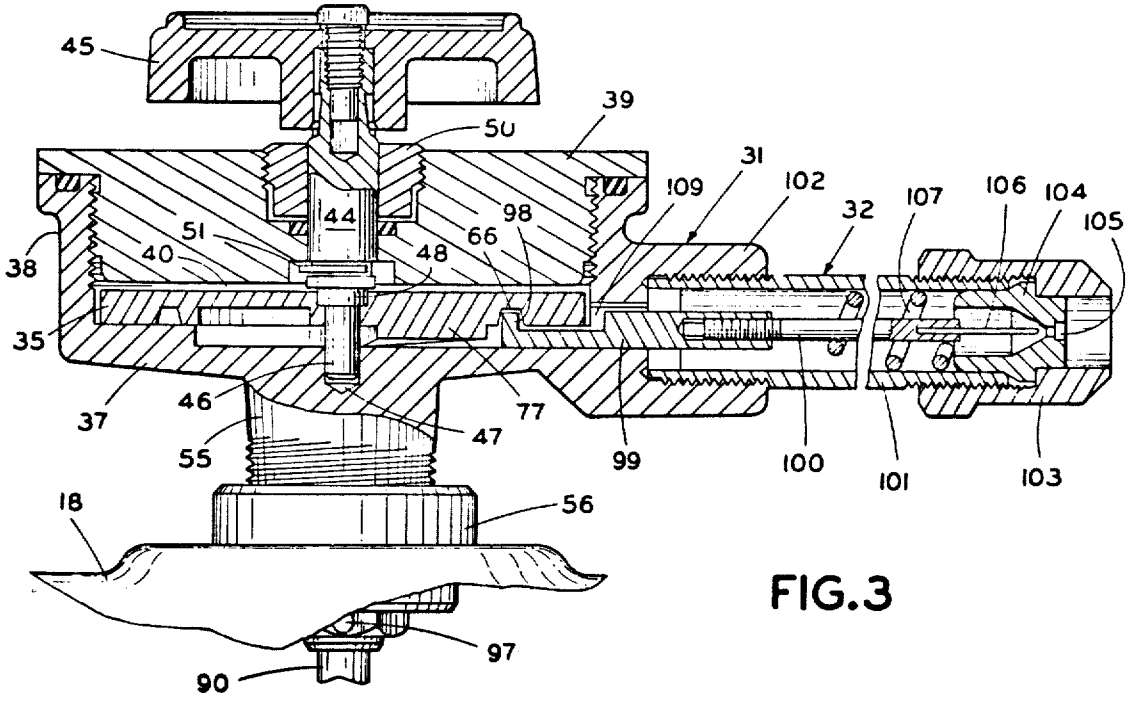

45
39
50
31
109
102
107
106
104
105
44
98
66
32
51
40
48
38
35
46
77
47
37
55
99
100
101
103
18
56
97
90

FIG.3

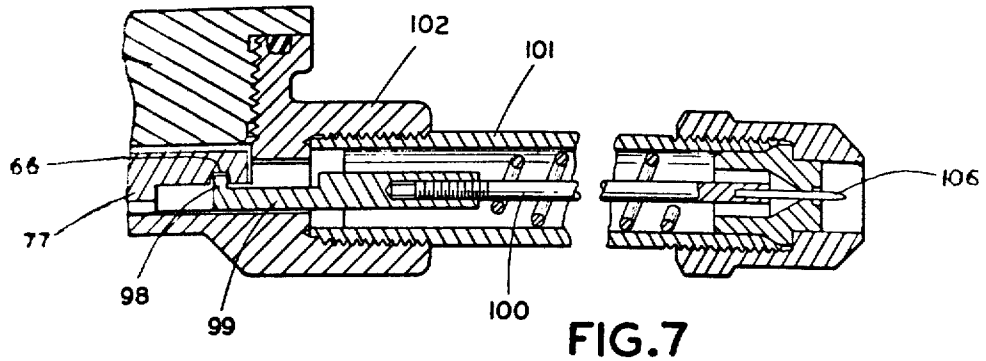


FIG.7

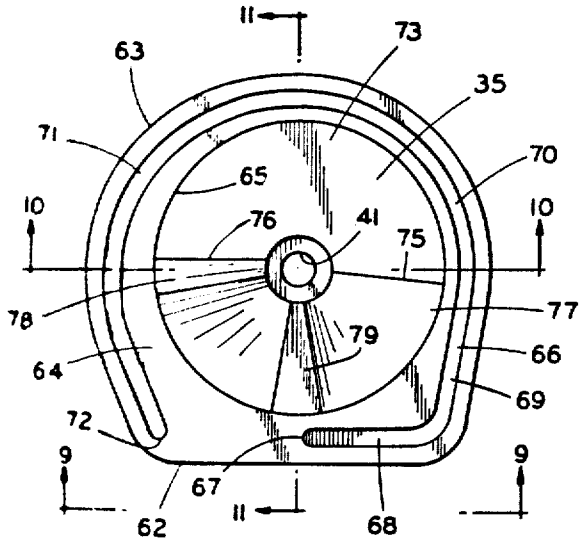


FIG.8

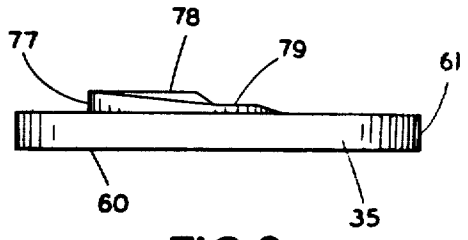


FIG.9

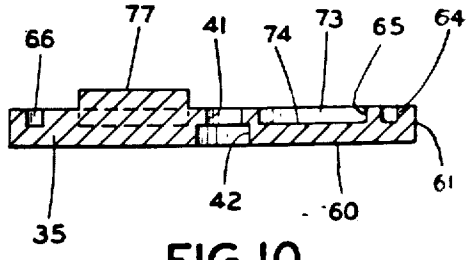


FIG.10

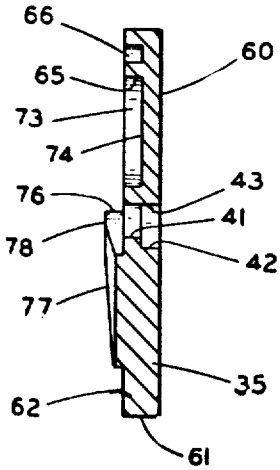


FIG.11

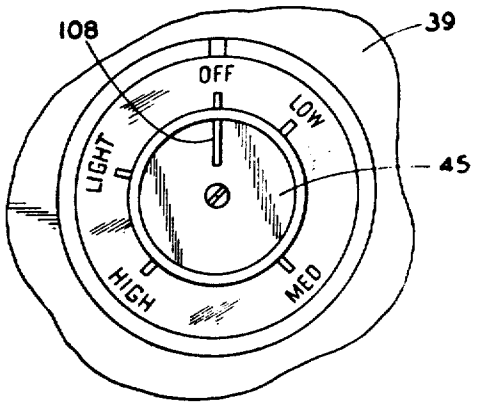


FIG.12

FUEL CONTROL MEANS FOR CAMP STOVES

BACKGROUND

This invention relates to a vaporized fuel burner such as a camp stove, and, more particularly, to fuel control means for the burner which uses a single control member for operating the shut-off valve, the inlet restricting member, and the generator orifice cleaner rod.

Vaporized fuel burners such as camp stoves generally include a fuel tank, a fuel conduit including a generator tube, and a burner which is supplied with a mixture of fuel and air. The generator tube is positioned adjacent the burner so that fuel passing through the heated generator tube is vaporized, and a valve is interposed in the fuel conduit to open and close the fuel flow passage therethrough. A cleaner rod is usually disposed within the generator tube and is movable into and out of the orifice of the generator to clean the orifice of carbon and soot, and, in the case of camp stoves, to throttle the flow of fuel therethrough.

When the burner is to be lighted and before the generator tube is heated sufficiently to vaporize the fuel, an inlet restricting rod is used to restrict the flow of fuel into a chamber below the fuel conduit to permit air to flow through the chamber and become entrained with the fuel passing into the conduit. This restricting rod is removed from the inlet orifice when the generator is heated sufficiently to vaporize the fuel.

In prior camp stoves the cleaner rod and the shut-off valve are generally operated by the same control member, and a separate control member of lighting lever is required for operating the inlet restricting means. When such a camp stove is lighted, the lighting lever for the restricting means must be operated to move the restricting means into the inlet orifice, and the control member for the shut-off valve and the cleaner rod should be moved to a fully open position to open the valve and to withdraw the cleaner rod from the generator orifice. However, because the restricting means is operated by a separate control member, many people forget or disregard the instruction to operate this control member before opening the shut-off valve. If this control member is not operated, the fuel will generally burn with a poor smokey flame that can rise to abnormal heights and can fail to heat the generator adequately. If the control member for the restricting means is actuated to light the burner but is not reset after the generator is sufficiently heated to vaporize the fuel, the pressurized air within the fuel tank will be rapidly depleted, and the fuel mixture supplied to the burner will be excessively lean.

If the control member for the shut-off valve and the cleaner rod is not turned to a fully open position, proper lighting of the stove might not be obtained. May gasoline lanterns are lighted by rotating the control knob for the shut-off valve only one-fourth turn, and many people follow the lantern lighting procedure when lighting a camp stove and do not fully open the valve. Other people do not think that it is necessary to open the camp stove valve fully because the fuel might burn with a high flame even when the valve is not fully open.

After the stove is lighted, the burner flame is adjusted by how far the cleaner rod extends into the generator orifice. Several turns of the control member for the valve and cleaner rod are usually required to adjust the cleaner rod from a high to a low position.

Another problem with camp stoves occurs when the camp stove is shut off. When the control member for the valve is rotated to close the valve, the cleaner rod moves into the generator orifice while the generator is still filled with vaporized and liquid fuel. The cleaner rod will restrict the flow of fuel through the orifice, and the stove will continue to burn for several minutes before finally going out. Even after the flame is extinguished, noxious fumes may still be emitted from the generator for several minutes.

SUMMARY

The invention provides a fuel control means in which a single control member actuates the shut-off valve, the generator cleaner rod, and the inlet restricting means in the proper sequence. The single control knob is rotatable in one direction from an off position to a light position to a high position, and each position of the knob may be provided with detent means and visual indicating means to provide the operator with assurance that the components of the fuel control system are in the proper position. Since only a single control member is used, the number of parts required can be reduced, the packing gland for a second control member is eliminated, and a potential area for fuel leakage is eliminated. The fuel control means insures that the generator orifice will be cleaned before the burner is lighted and insures that the inlet restricting rod is in the proper position for optimum lighting characteristics when the shut-off valve is opened to the light position. When the generator is heated sufficiently to varporize the fuel passing therethrough, the control knob is turned to move the valve and the cleaner rod to the high position, and the inlet restricter is simultaneously moved out of the inlet orifice. Further rotation of the control knob from the high position toward a low position will return the cleaner rod toward the orifice to throttle the fuel flow as desired. When the control knob is rotated to the off position to close the valve, the cleaner rod is again reciprocated into the generator orifice and back out to clean the orifice before the control knob reaches the off position. The orifice is therefore fully open in the off position, and fuel in the generator will burn out rapidly to eliminate the long shut-off time of prior stoves. All of the foregoing operations are performed automatically merely by rotating the control knob from one position to another, and the operator need not worry about coordinating the movements of separate control members.

DESCRIPTION OF THE DRAWING

The invention will be explained in conjunction with an illustrative embodiment shown in the accompanying drawing, in which

FIG. 1 is a sectional view of a camp stove provided with a fuel control assembly formed in accordance with the invention;

FIG. 2 is a fragmentary sectional elevational view, partially broken away, of the fuel control assembly;

FIG. 3 is a fragmentary sectional elevational view partially broken away, taken along the line 2—2 of FIG. 1;

FIG. 4 is a fragmentary view of a portion of FIG. 3 showing the cleaner rod in the cleaning position;

FIG. 5 is a fragmentary view of a portion of FIG. 1 showing the valve and the inlet restricting rod in the light position;

FIG. 6 is a view similar to FIG. 5 showing the valve and the inlet restricting rod in the high position;

FIG. 7 is a view similar to FIGS. 3 and 4 showing the cleaner rod in the low position;

FIG. 8 is a bottom plan view of the control knob of the fuel control assembly;

FIG. 9 is an elevational view of the control knob taken along the line 9—9 of FIG. 8;

FIG. 10 is a sectional view of the control knob taken along the line 10—10 of FIG. 8;

FIG. 11 is a sectional view of the control knob taken along the line 11—11 of FIG. 8; and

FIG. 12 is a top plan view of the control knob taken along the line 12—12 of FIG. 2 showing the various indicated positions for the knob.

DESCRIPTION OF SPECIFIC EMBODIMENT

Referring first to FIG. 1; the numeral 15 designates generally a camp stove which is designed to burn a vaporizable fuel such as gasoline. The camp stove includes a conventional burner housing or stove box 16 which supports a burner assembly 17, and a fuel tank 18 is secured to the stove box by brackets 19. The burner assembly includes a burner 20 which is supplied with a mixture of fuel and air by a gas pipe 21 which is connected to a venturi tube 22 and an air intake tube 23. The fuel tank 18 is equipped with a manual pump 24 which includes a plunger 25 and an air outlet pipe 26 which extends upwardly above the level of the fuel within the tank. The tank may be filled through a spout 27 which is closed by a removable cap 28. The foregoing parts are conventional, and a detailed description thereof is unnecessary.

Fuel is conducted from the tank to the burner assembly by means of a fuel tube assembly 30, a valve assembly 31, and a generator assembly 32. These three assemblies are interconnected and provide a fuel conduit or flow passage for the fuel as will be described hereinafter.

Referring now to FIGS. 2 and 3, the valve assembly 31 includes a somewhat disc-shaped cam 35 (see also FIGS. 8–11) which is rotatably mounted within a valve housing 36. The valve housing includes a cup-like base portion 37 which has an internally threaded upwardly extending cylindrical collar 38 and a generally cylindrical cover or plug portion 39 which is threadedly engaged with the collar of the cup portion to enclose the cam disc 35 and provide a fuel chamber 40 within the housing.

Comparing FIGS. 10 and 11, the cam disc 35 is provided with a central opening which has a lower cylindrical portion 41 and an upper portion 42. The upper portion is cylindrical along most of its periphery but is provided with a chordal flat wall 43 (FIG. 11) to provide the upper portion with a generally half-moon shape.

The cam disc is rotated by a shaft 44 (FIGS. 2 and 3) and a control knob 45 secured thereto. The shaft 44 includes a lower cylindrical portion 46 which extends through the cylindrical portion 41 of the central opening in the cam disc and is journalled in a bore 47 in the base of the valve housing. The cam is non-rotatably splined to the cam disc by a lug portion 48 on the shaft which has a shape corresponding to the shape of the upper portion 42 of the opening in the cam disc and which is received therein.

A radially enlarged central portion 49 of the shaft extends through the cover 39 of the valve housing and an annular bushing 50 which is screwed into the cover, and the shaft is prevented from being withdrawn from the cover by an E-ring 51 which is positioned in an annular groove of the central portion 49 of the shaft. The knob 45 is non-rotatably splined to the upper end of the shaft by a serrated portion 52 on the shaft which engages grooves in the bore of the knob, and the knob is retained on the shaft by a screw 53.

The fuel chamber within the housing is maintained gas-tight by an O-ring 54 which is received by a peripheral groove in the collar of the base of the housing and which sealingly engages an outwardly extending perimetric flange on the cover and by an O-ring 55 which is compressed between the annular bushing 50 and the cover 39 and which sealingly engages the shaft 44.

The valve housing is secured to the fuel tank 18 by an externally threaded, downwardly extending bushing portion 55 which is threadedly engaged with an internally threaded bushing 56 secured to the top of the tank.

Referring now to FIGS. 8—11, the cam disc 35 is seen to include a generally flat top surface 60 and a depending perimetric side wall 61. As can be seen in FIG. 8, the depending side wall 61 is somewhat U-shaped and includes a flat portion 62 and a somewhat arcuate portion 63. A flat bottom wall 62 extends inwardly from the depending side wall and terminates at a circle 65 having a center at the axis of rotation of the disc and the shaft 44.

A camming groove 66 is formed in the bottom flat wall between the side wall 61 and the circular inner periphery 65 of the bottom wall. The camming groove 66 has a first end 67, a pair of substantially straight angularly related portions 68 and 69, an arcuate portion 70 which extends from about 3 o'clock to about 12 o'clock in FIG. 8, and a curved or spiral portion 71 which gradually moves away from the circular inner periphery 65 between 12 o'clock and the second end 72 of the groove.

The inner portion of the cam disc is provided with a generally half-moon shaped recess 73 having a flat top wall 74 which extends for about 180° from a line 75 (FIG. 8) to a shoulder 76 (FIGS. 8 and 11). A camming ramp 77 extends gradually downwardly from the flat upper wall 74 of the recess beginning at the line 75 and extends clockwise as viewed in FIG. 8 to the shoulder 76, at which point the camming ramp has its maximum thickness as seen in FIGS. 10 and 11. Although the camming surface of the ramp moves gradually downwardly as it proceeds from the line 75 to the shoulder 76, the camming surface is provided with a pair of sector-shaped flat portions 78 and 79 at about the 9 o'clock and the 6 o'clock positions of FIG. 8, respectively.

Referring again to FIG. 2, the camming ramp 77 cooperates with a valve core 82 which is reciprocably mounted within the bushing 55 of the valve housing. The outermost periphery of the valve core rides along the cylindrical inner surface of the bushing 55, and an annular valve seat 83 is provided by an annular plug member 84 which is threaded into the annular bushing 55. A compressible and resilient annular valve seal 85 carried by the valve core 82 is engageable with the

valve seat **83** to close the fuel passage through the valve assembly. A cam follower **86** is secured to the upper end of the valve core **82**, and the cam follower may be made of suitable low-friction material such as rigid urethane. The valve core is resiliently biased toward the camming ramp of the cam disc by a coil spring **87** which is compressed between radially extending shoulders on the valve core and the plug **84**. The outer periphery of the valve core may be provided with axially extending grooves outwardly of the valve seal **85** to permit fuel to flow past the valve core when the seal is spaced from the valve seat.

In the position illustrated in FIG. **2**, the cam follower **86** is engaged by the flat portion **78** of the camming ramp **77**, this being the thickest part of the camming ramp. The cam follower and valve core are urged downwardly by the camming ramp to compress the valve seal **85** against the valve seat **83** to close the valve. As will be explained more fully hereinafter, as the control knob **45** is rotated to rotate the cam disc **35**, the thickness or depth of the portion of the camming ramp engaging the cam follower decreases, and the valve core will be urged upwardly by the spring **87** to raise the valve seal **85** above the valve seat to open the valve.

The fuel tube assembly **30** includes an outer tube **90** and an inner tube **91** concentrically mounted within the outer tube and having an outer diameter less than the inner diameter of the outer tube to provide an annular space or chamber **92**. The upper end of the inner tube **91** if secured within the central bore of the plug member **84**, and the upper end of the outer tube **90** is secured to the bottom of the plug **84** by a collar **93** which is crimped over the upper end of the tube. The securement of the inner and outer tubes to the plug **84** maintains the proper relationship therebetween, and a bottom cap **94** is secured to the lower end of the outer tube. A fuel inlet orifice **95** is provided through the cap **94** in alignment with the axis of the inner tube **91**, and an elongated orifice restricting rod **96** which is secured to the valve core **82** extends downwardly through the inner tube **91** and through the orifice **95**. The outer tube and the cap **94** act as casing means around the inner fuel tube and provide the chamber **92**. This chamber communicates with the air space in the fuel tank above the fuel level through a port **97** which is provided through the lower end of the plug **84** just above the outer tube **90**.

Referring now to FIG. **3**, the camming groove **66** of the cam disc cooperates with an upwardly extending finger portion **98** of a cam follower rod **99** which is threadedly engaged with an elongated cleaner rod **100** provided as part of the generator assembly **32**. The generator assembly also includes a generator tube **101** which is secured to an internally threaded bushing **102** which extends outwardly from the valve housing. An end bushing or cap **103** is threadedly secured to the outer end of the generator tube and holds a gas tip **104** which is provided with an orifice **105** through which fuel flows from the generator assembly into the venturi of the burner assembly. A cleaner needle **106** which is sized to pass through the orifice is carried by the end of the cleaner rod **100**. The generator assembly also includes a wire helix **107** within the generator tube which facilitates heat transfer from the wall of the generator tube to the fuel passing through the generator.

In the position illustrated in FIG. **3**, the camming groove **66** maintains the cam follower **99** and the cleaner rod in a position in which the cleaner needle **106** is completely withdrawn from the generator orifice and does not restrict flow of fuel through the orifice. As will be explained more fully hereinafter, rotation of the control knob **45** and the cam disc causes the camming groove **66** to move the cleaner needle relative to the generator orifice to clean the orifice or to throttle the fuel passing therethrough.

OPERATION

Before the camp stove is turned on, the hand pump **24** is used to pressurise the air space above the fuel in the tank. The tank is pressurized when the control knob **45** and the cam disc **35** are in the off position illustrated in FIGS. **2** and **3**. In this position the cam follower **86** of the valve assembly engages the flat portion **78** of the camming ramp **77** and is depressed by the camming ramp so that the valve seal **85** engages the valve seat **83** and the valve is maintained closed. The cam follower **99** engages the camming groove **66** adjacent the first end portion **67** (FIG. **8**) thereof, and the cleaner needle **106** is maintained out of the generator orifice.

The stove is lighted by turning the control knob **45** about one-fourth turn or slightly less than 90° counterclockwise from the off position to the light position. As shown in FIG. **12**, the knob is provided with an indicator **108** which cooperates with markings on the valve housing to indicate the various positions of the knob.

The bottom surface of the disc is shown in FIG. **8**, and counterclockwise rotation of the control knob and the cam disc will appear as clockwise rotation in FIG. **8**. The cam follower **99** for the cleaner rod engages the camming groove **66** adjacent the 6 o'clock position in FIG. **8**, and as the disc and the camming groove are rotated clockwise to FIG. **8**, the cam follower will be moved radially outwardly from the axis of rotation of the cam disc by the straight portion **68** of the groove. The cam follower is axially slidable within a bore **109** (FIG. **2**) through the valve housing, but the bore prevents movement of the cam follower tangentially relative to the cam disc.

The cam follower **99** and the cleaner rod will be cammed to their outermost position at the juncture between the straight portions **68** and **69** of the groove after about one-eighth turn of the control knob, and in this position the cleaner rod will extend through the generator orifice as shown in FIG. **4** to clean the orifice of carbon, soot, and other foreign material. Continued rotation of the disc to the light position will bring the portion of the camming groove which is located generally at 3 o'clock in FIG. **8** into engagement with the cam follower **99**. The cam follower and the cleaner rod will thereby be returned by the camming groove to their original positions and the cleaner needle will be withdrawn from the generator orifice. The distance of the camming groove from the axis of rotation of the cam disc is approximately the same at the end portion **67** or 6 o'clock position in FIG. **8** and at the 3 o'clock position.

When the cam disc is in the off position, the cam follower **86** of the valve assembly engages the flat portion **78** of the camming ramp, or the 9 o'clock position of the ramp as viewed in FIG. **8**. When the cam disc is rotated clockwise as viewed in FIG. **8** from the off posi-

tion to the light position, the flat portion **79** of the camming ramp will be rotated into engagement with the cam follower **86**. As can be seen in FIG. **9**, the thickness of the camming ramp is less at the flat portion **79** than at the flat portion **78**, and the cam follower **86** and the valve core **82** move upwardly within the bushing **55** of the valve assembly under the urging of the spring **87** to the position illustrated in FIG. **5**. In this position the valve seal **85** has been raised above the valve seat **84** to open the fuel passage through the valve assembly. The inlet orifice-restricting rod **96** is also raised from its FIG. **2** position as the valve core moves upwardly, but the length of the rod is such that its lower end is still positioned within the inlet orifice **95** of the fuel tube assembly.

Pressurized air from the fuel tank communicates with the chamber **92** between the inner and outer fuel tubes **90** and **91** through the port **97**, and when the valve and rod **96** are in the FIG. **5** or light position, pressurized air in the chamber forces fuel from the chamber upwardly through the inner tube **91**. The end portion of the rod **96** restricts the flow of fuel from the tank through the inlet orifice **95**, and fuel is forced from the chamber **92** upwardly through the inner tube **91** by the pressurized air faster than fuel can flow through the inlet orifice. The level of the fuel within the chamber **92** therefore drops below the bottom of the inner tube **91**, and air from the chamber **92** becomes entrained with the liquid fuel and passes upwardly through the inner tube with the fuel.

The mixture of liquid fuel and air passes through the valve assembly and the generator assembly and issues from the generator orifice as an atomized spray. This mixture then passes through the venturi **22** (FIG. **1**) where it aspirates additional combustion air supplied to the venturi by the air tube **23**, and the fuel and air mixture flows to the burner **20** where it is ignited by a match or other ignition means. The heat of the flame on the burner brings the generator tube to a temperature in excess of the vaporizing temperature of the fuel after approximately **60** seconds, and this is evidenced by the fuel burning as a hard blue flame.

When the generator has been heated sufficiently to vaporize the fuel passing therethrough, the operator turns the control knob counterclockwise from the light position to the high position, which is about three-eighths of a turn from the off position (FIG. **12**).

Referring again to FIG. **8**, rotation of the cam disc to the high position brings the portion of the camming ramp which is located at about 3:30 o'clock into engagement with the cam follower **86** of the valve assembly. At this location the camming ramp has just about reached the level of the flat surface **74** of the central recess **73** of the cam disc, the juncture between the ramp and the flat surface **74** being indicated by the line **75**. The cam follower **86** and the valve core **82** are thereby allowed to ride further upwardly within the bushing **55** to the position illustrated in FIG. **6** in which the restricting rod **96** has been completely withdrawn from the inlet orifice **95**. When the restricting rod is withdrawn from the inlet orifice, the rate of flow from the tank through the orifice is increased sufficiently to cause the level of the fuel in the chamber **92** to rise above the lower end of the inner tube **91**. Air from the chamber **92** thus no longer becomes entrained in the fuel that is forced upwardly through the inner tube. As the liquid fuel passes through the heated generator tube, it is vaporized, and the fuel vapor issues from the generator orifice at high energy and entrains and mixes with air as it passes through the venturi to produce the optimum flame at the burner.

Referring again to FIG. **8**, as the cam disc and the camming groove **66** are rotated clockwise as viewed therein to the high position, the portion of the camming groove at about 12:30 or 1 o'clock will be brought into engagement with the cam follower **99** for the cleaner rod. The portion of the camming groove **66** between about 3 o'clock and 12 o'clock extends along an arc about the axis of rotation of the disc, and the cam follower **99** is therefore maintained in the same position as the cam disc is rotated from the light position to the high position. The cleaner needle is thus maintained in the fully withdrawn position relative to the generator orifice which is shown in FIG. **3**, and fuel flows through the generator without restriction by the cleaner needle.

As the control knob and the cam disc are rotated from the high to the low position, the cam follower **86** of the valve assembly engages the flat upper surface **74** of the half-moon shaped recess **73** in the cam disc, and the valve core **82** and the restricting rod **96** do not move up or down but remain in approximately the positions illustrated in FIG. **6**. However, the cam follower **99** for the cleaner rod is gradually forced outwardly by the camming groove **66**, and the cleaner needle **106** gradually moves toward and into the generator orifice to throttle or regulate the flow of fuel from the generator. The low position of the cleaner rod is illustrated in FIG. **7**.

Referring to FIG. **8**, the portion of the camming groove **66** from the 12 o'clock position to the end **72** gradually moves away from the axis of rotation of the cam disc along a portion of a somewhat spirally shaped path. As the distance of the camming groove from the center of the disc increases, the cam follower **99** and the cleaner rod **100** are forced outwardly toward the generator orifice. The setting of the camp stove can therefore be maintained anywhere between the high and low positions as desired by the operator.

When the camp stove is to be turned off, the control knob is rotated clockwise directly from the operating position between the high and low positions to the off position. As the cam disc is rotated beyond the high position, the camming ramp **77** engages the cam follower **86** of the valve and begins to move the valve core downwardly toward the valve seat **84** and the restricting rod **96** toward the inlet orifice **95**. Before the valve becomes fully closed, the cam follower **99** is engaged by the straight portion **69** of the camming groove, and the cleaning needle **106** is passed into the orifice to clean the orifice. As the cam disc continues to rotate, the straight portion **68** of the camming groove withdraws the cleaner needle from the generator orifice and returns the cleaner needle to the off position shown in FIG. **3**. Since the cleaner needle is out of the generator orifice in the off position, the generator and valve housing will be quickly purged of fuel after the valve is closed. The inlet restricting rod **96** is returned to its original position in the inlet orifice when the valve is closed as shown in FIG. **2**, and this insures that the restricting rod will be in position to provide air entrainment with the fuel as soon as the valve is opened.

The camp stove is therefore operated by a single control knob, and rotation of the control knob automati-

cally actuates the components of the fuel control assembly in the proper coordinated sequence. The sequence of the various operating positions of the control knob follows the logical sequence of off, light, and run, and the control knob operates in much the same manner as the control knob of a conventional gas stove which is familiar to most people. The simplicity and familiarity of operation reduces the fear or hesitancy that many operators feel when lighting a camp stove and helps insure safe and correct operation.

The operation need not worry about coordinating the movement of the inlet restricting rod with the movement of the valve and the cleaner rod, and the cleaner needle cleans the generator orifice both before and after use to insure that the orifice is always clean. The needle is maintained out of the orifice when the camp stove is turned off, and this permits the camp stove to burn out quickly without the emission of noxious fumes.

Rotational limits of the control knob and the cam disc are provided at the off and low positions by engagement of the cam follower **99** with the ends **67** and **72** of the camming groove. The flat portion **79** of the camming ramp **77** provides a tactile sensation when the cam disc reaches the light position, and, if desired, the light and high positions can be detented to provide a tactile or audible indication when the control knob is rotated to the desired position. Suitable detent means could be provided between the operating knob and the cover **39** of the valve housing or between the cam disc and the valve housing.

While in the foregoing specification a detailed description of a specific embodiment of the invention was set forth for the purpose of illustration, it is to be understood that many of the details hereingiven may be varied considerably by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. In a camp stove having a fuel tank, means for pressurizing fuel within the tank, a fuel burner, a valve housing mounted on the camp stove, a fuel conduit extending between the fuel tank and the valve housing and being provided with a fuel inlet opening, generator means extending from the valve housing toward the burner means and having a fuel outlet orifice, and pipe means extending between the generator means and the fuel burner for supplying fuel from the generator means to the burner, an improved fuel control means for supplying fuel from the fuel tank to the fuel burner comprising cam means rotatably mounted within the valve housing, a single control member connected to the cam means for rotating the cam means, the cam means having first and second camming surfaces, a first cam follower mounted within the valve housing for movement in a direction generally perpendicular to the plane in which the cam means is rotatable, the first cam follower being engageable by the first camming surface of the cam means as the cam means rotates whereby the first cam follower is moved within the valve housing, valve means mounted within the valve housing for movement between a closed position in which fuel is prevented from flowing through the valve housing and one or more open positions in which fuel is permitted to flow through the valve housing, the valve means being movable between the closed and open positions by the first cam follower as the first cam follower is moved by the cam means, restricting rod means extending through the fuel conduit and being connected to the valve means for movement therewith, the restricting rod means including a restricting portion which is movable into and out of the fuel inlet orifice of the fuel conduit means as the valve mens is moved by the first cam follower, the restricting portion being positioned in the inlet opening when the valve means is closed, a second cam follower mounted within the valve housing for movement in a direction parallel to the plane in which the cam means rotates, the second cam follower being engageable by the second camming surface of the cam means as the cam means rotates whereby the second cam follower is moved within the valve housing, a cleaner rod extending through the generator means and being connected to the second cam follower for movement therewith, the cleaner rod having a cleaning end portion and being movable by the second cam follower as the second cam follower is moved by the second camming surface between a first position in which the cleaning end portion is out of the fuel outlet orifice of the generator means and a second position in which the cleaning end portion is in the fuel outlet orifice.

2. The structure of claim **1** in which the second camming surface maintains the cleaner rod in the fist position when the first camming surface maintains the valve means in the closed position.

3. The structure of claim **1** in which the cam means is rotatable between off, clean, light, and high positions, the first camming surface maintaining the valve means in the closed position and the second camming surface maintaining the cleaner rod in the first position when the cam means is in the off position, the second camming surface moving the cleaner rod into the second position when the cam means is in the clean position, the first cam surface maintaining the valve means in one open position and the restricting portion of the restricting rod means in the inlet opening and the second camming surface maintaining the cleaner rod in the first position when the cam means is in the light position, the first camming surface maintaining the valve means in another open position and the restricting portion of the restricting rod means out of the inlet opening and the second camming surface maintaining the cleaner rod in the first position when the cam means is in the high position.

4. The structure of claim **3** in which the cam means is also movable between the high position and a low position, the second camming surface moving the cleaner rod from its first to its second positions as the cam means is rotated from the high to the low positions whereby fuel flow through the fuel outlet orifice is restricted by the cleaning end portion.

5. The structure of claim **1** in which the cam means includes a generally planar disc having an axis of rotation extending generally perpendicularly therethrough, the first camming surface being provided by a ramp extending around the axis of rotation of the disc and being inclined relative to the plane of the disc whereby the first cam follower may be moved perpendicularly relative to the plane of rotation of the disc, the second camming surface being provided by a groove formed in the disc and extending around the axis of rotation of the disc, the distance of the groove from the axis of rotation of the disc being different at various positions along the length of the groove whereby the second cam

follower may be moved toward and away from the axis of rotation.

6. The structure of claim **5** in which the valve means includes a valve core mounted within the valve housing for movement in a direction generally perpendicular to the plane of the disc, seal means carried by the valve core, the valve housing including a valve seat below the seal means in the valve core, spring means within the valve housing resiliently urging the valve core and the first cam follower against the ramp of the disc, the disc being rotatable to an off position in which the ramp moves the first cam follower and the valve core downwardly to force the seal means against the valve seat, rotation of the disc away from the off position causing movement of the ramp relative to the first cam follower to permit the first cam follower and the valve core to move upwardly under the urging of the spring means.

* * * * *