March 3, 1970 D. G. WOLFE 3,498,730

HEAT MOTOR SAFETY VALVE CONSTRUCTION AND PARTS THEREFOR

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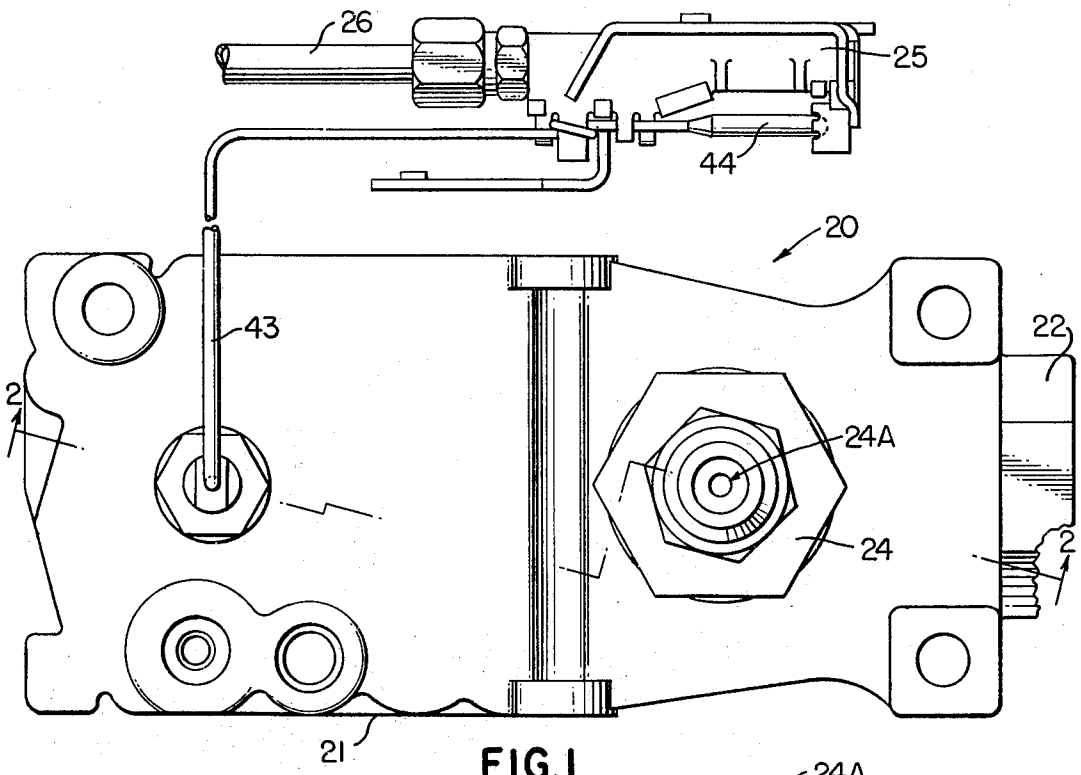


FIG.1

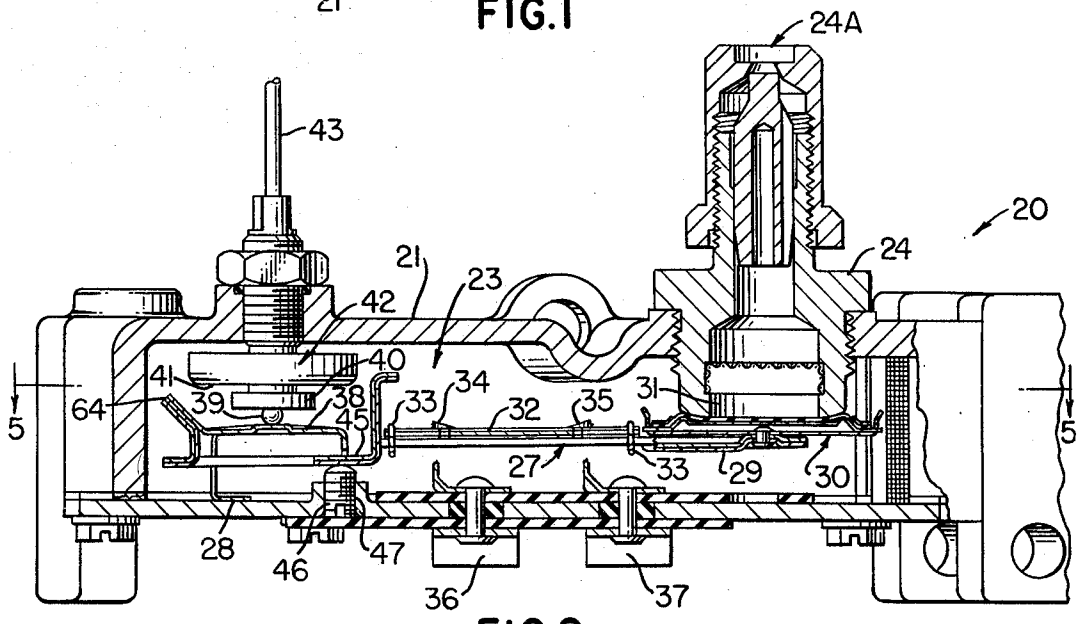


FIG.2

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HEAT MOTOR SAFETY VALVE CONSTRUCTION AND PARTS THEREFOR

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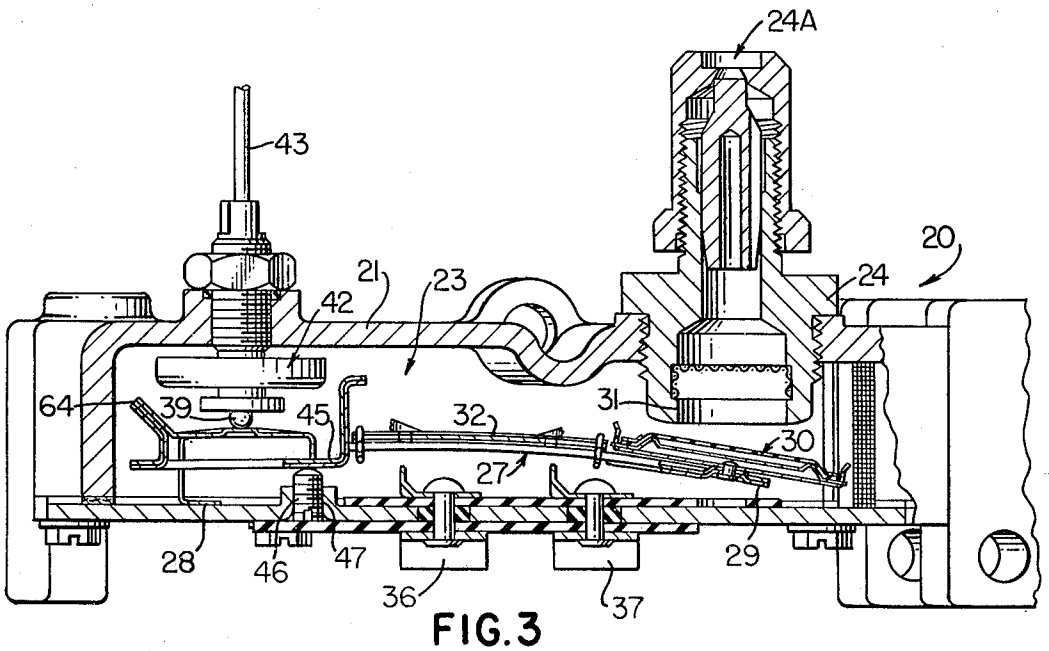


FIG. 3

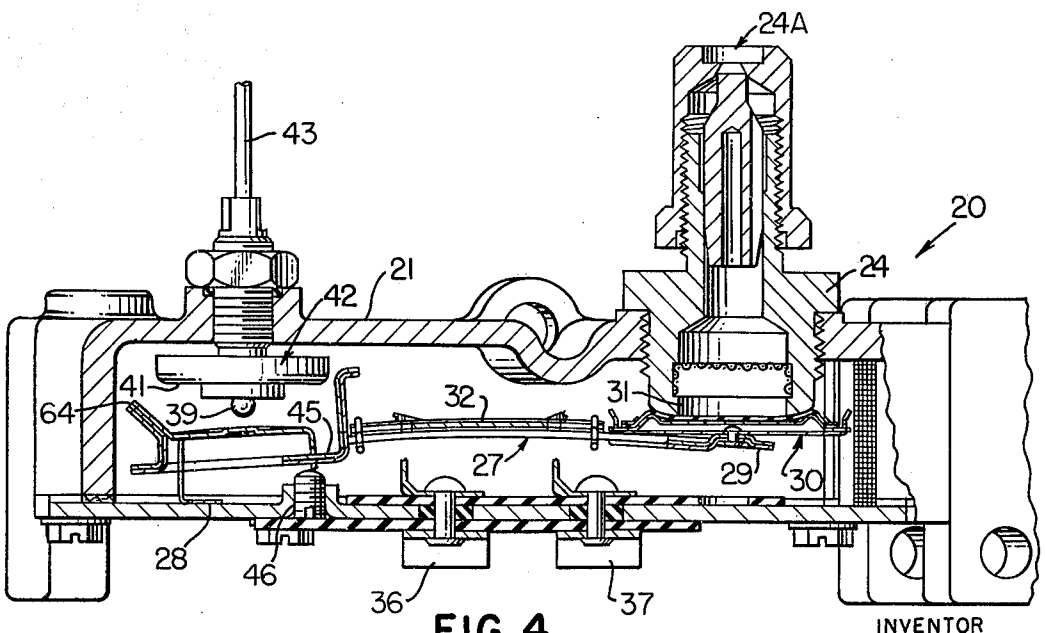


FIG. 4

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HEAT MOTOR SAFETY VALVE CONSTRUCTION AND PARTS THEREFOR

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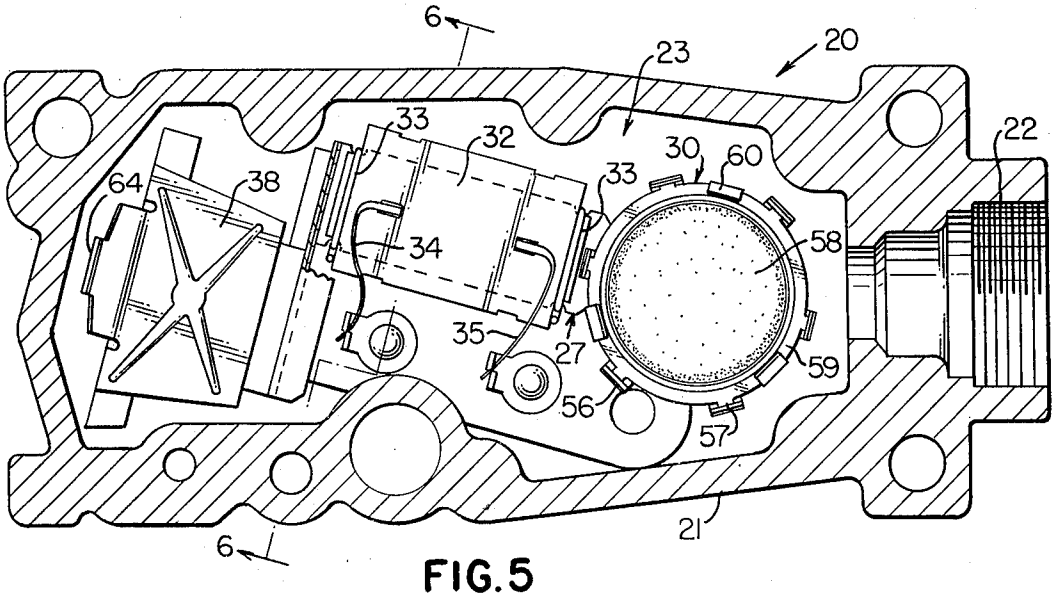


FIG.5

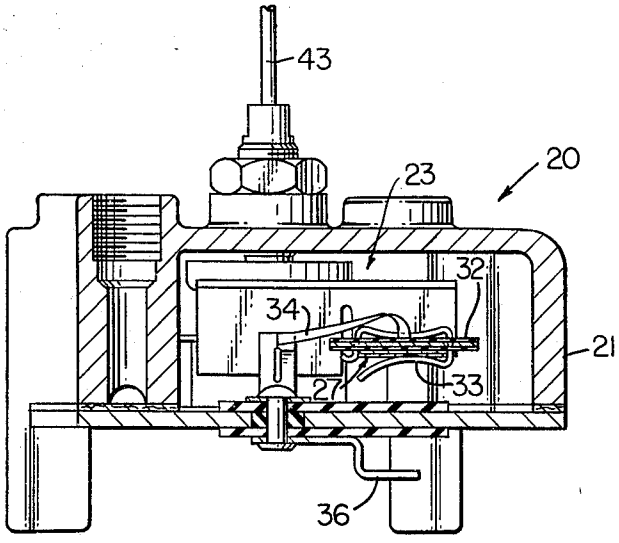


FIG.6

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March 3, 1970 D. G. WOLFE 3,498,730

HEAT MOTOR SAFETY VALVE CONSTRUCTION AND PARTS THEREFOR

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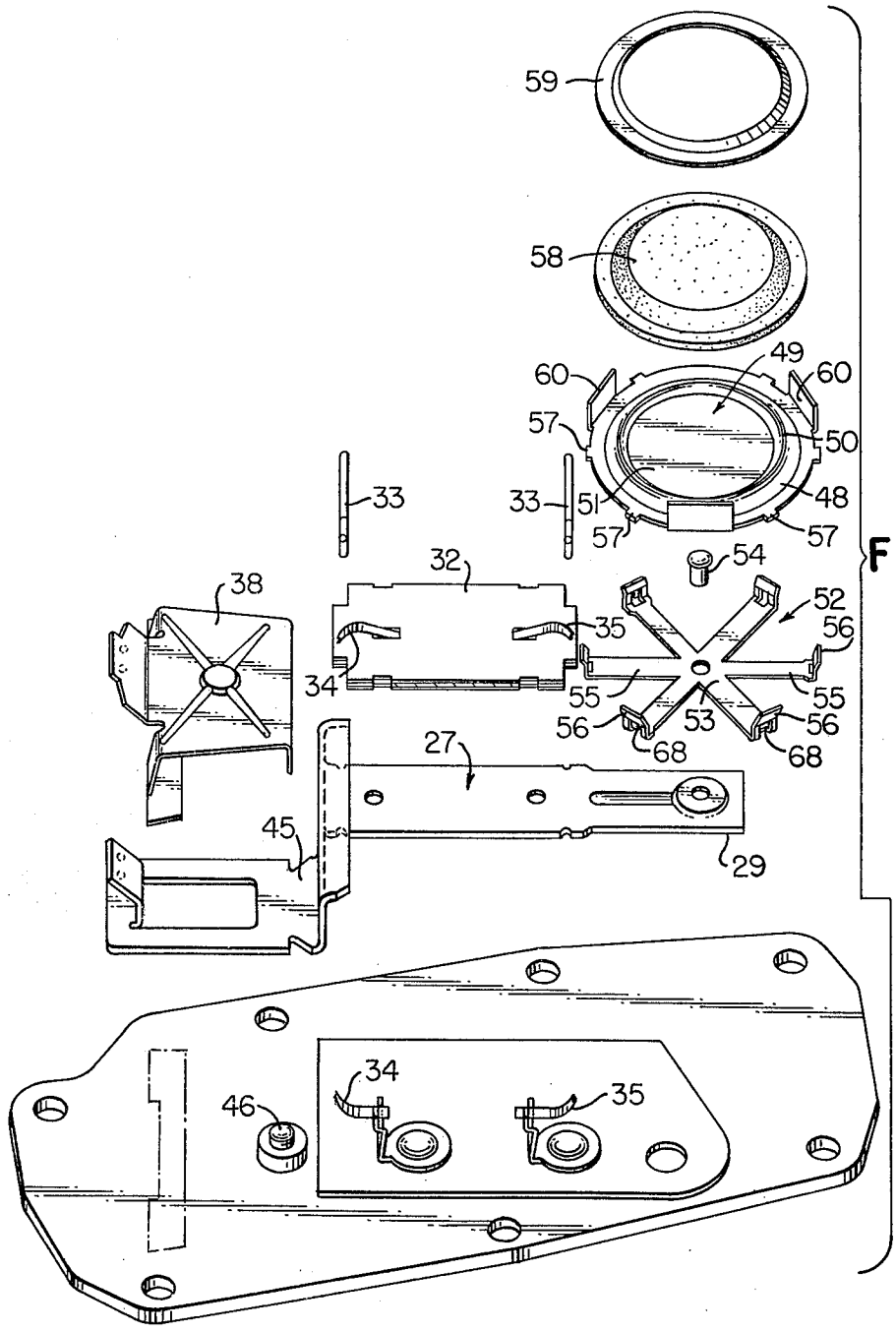


FIG. 7

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HEAT MOTOR SAFETY VALVE CONSTRUCTION AND PARTS THEREFOR

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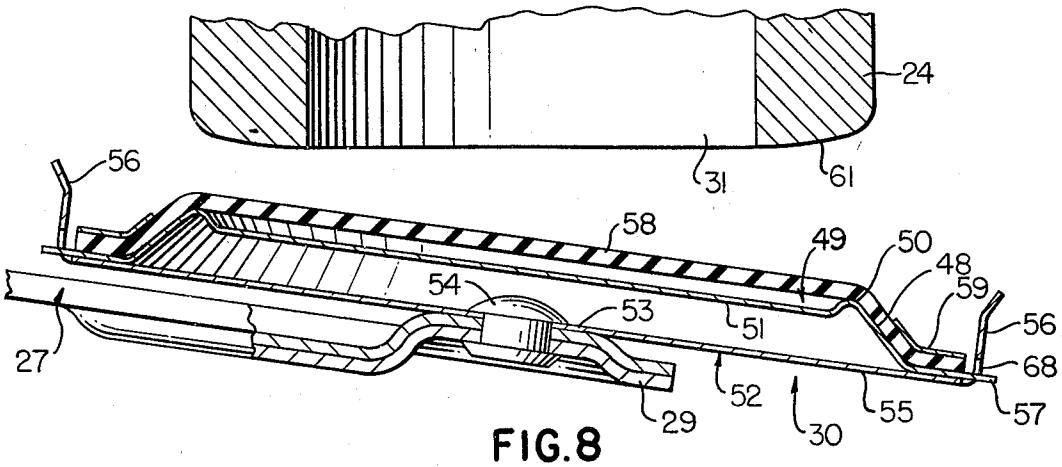


FIG. 8

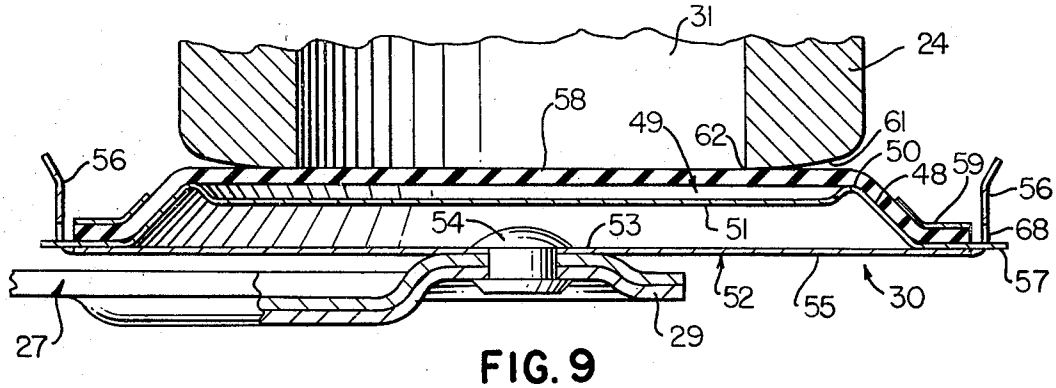
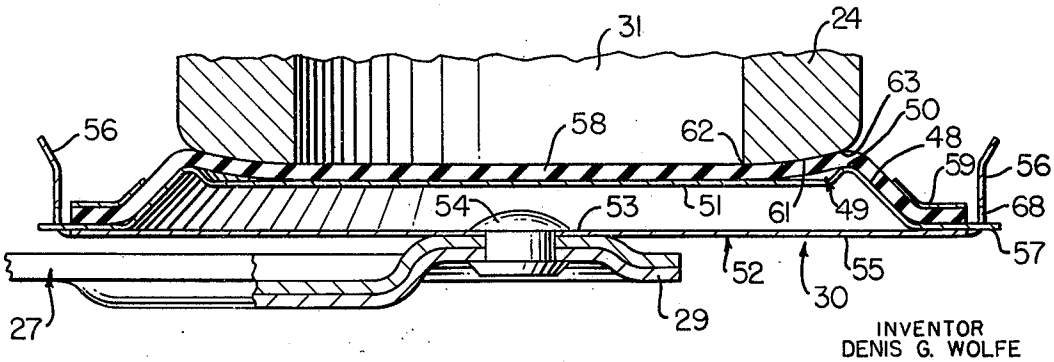


FIG. 9



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FIG. 10

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United States Patent Office 3,498,730 Patented Mar. 3, 1970

3,498,730

HEAT MOTOR SAFETY VALVE CONSTRUCTION AND PARTS THEREFOR

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Int. Cl. F23q 9/12
U.S. Cl. 431—42 13 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a heat motor operated valve means which is only adapted to open the valve means when the heat motor is actuated and a condition responsive means is sensing a certain flame at a pilot burner means that will ignite fuel passing through the subsequently opened valve means to a main burner means, the valve member of the valve means being carried on one end of a bi-metallic lever means that carries the heat motor thereon and against which the condition responsive means is engageable when sensing the certain flame.

This invention relates to a heat motor operated safety valve construction as well as to improved parts for such a valve construction or the like.

It is well known that many fuel burning appliances are provided with electrically operated valve constructions for interconnecting a fuel supply manifold to the main burner means and will be opened only when a thermostatic means sends an electric signal to the valve construction to provide heat input for the cooking apparatus or the like and will terminate the supply of electrical current to the valve construction to close the same when the temperature effect reaches or exceeds a selected temperature effect.

However, in such prior known electrically operated safety valve constructions, some means must be provided for preventing the operation of the electrically operated fuel supply valve means if the ignition system for igniting the fuel issuing from the main burner means is inoperative for any reason.

Accordingly, one of the features of this invention is to provide an improved safety means for an electrically operated fuel supply valve construction wherein the valve construction cannot be opened unless the valve construction senses a predetermined condition, such as the sensing of the pilot burner flame that is utilized for igniting the fuel subsequently passing through the electrically operated valve construction to the main burner.

Accordingly, it is an object of this invention to provide an improved electrically operated fuel supply valve having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide improved parts for such a valve construction or the like.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIGURE 1 is a top view illustrating the improved valve construction of this invention as well as the pilot burner means utilized in combination therewith.

FIGURE 2 is a cross-sectional view taken substantially on line 2—2 of FIGURE 1, FIGURE 2 illustrating the valve construction in its closed position.

FIGURE 3 is a view similar to FIGURE 2 and illustrates the valve construction in its opened condition.

FIGURE 4 is a view similar to FIGURE 2 and illustrates the valve construction in its closed condition even though the heat motor thereof has been energized and the condition responsive means thereof is not sensing a pilot flame.

FIGURE 5 is a cross-sectional view taken substantially on line 5—5 of FIGURE 2 with the valve seat member removed.

FIGURE 6 is a cross-sectional view taken on line 6—6 of FIGURE 5.

FIGURE 7 is an exploded perspective view of various parts of the valve construction of this invention.

FIGURE 8 is an enlarged, fragmentary, cross-sectional view illustrating the improved valve seat and valve member being in an opened position.

FIGURE 9 is a view similar to FIGURE 8 and illustrates the valve member initially engaging against the valve seat.

FIGURE 10 is a view similar to FIGURE 9 and illustrates the valve member fully closing the valve seat.

While the various features of this invention are hereinafter described and illustrated as being particularly adaptable for controlling the fuel supply of burner means for a cooking apparatus or the like, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide control means for other devices as desired.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGURES 1 and 2, the improved valve construction of this invention is generally illustrated by the reference numeral **20** and comprises a housing means **21** having an inlet **22** for supplying fuel from a fuel supply manifold (not shown) into an interior chamber **23** of the housing means **21** that leads to an outlet means **24A** of the housing means **21** through a valve seat member **24**, the outlet means **24A** leading to a main burner means (not shown) disposed closely adjacent a pilot burner means **25** normally being supplied fuel in a continuous manner by a conduit means **26** interconnected to the fuel supply manifold.

A bimetallic lever means **27** is disposed within the chamber **23** of the housing means **21** and has one end means **28** secured to the housing means **21** and the other end means **29** free to move in the housing means **21** and carrying a valve member **30** for opening and closing a passage **31** passing through the valve seat member **24** and leading to the outlet means **24A**.

The bimetallic lever means **27** carries a heat motor **32** that is secured thereto by spring clips **33**, the heat motor **32** comprising an electrical heater having terminal means **34** and **35** respectively interconnected to external terminals **36** and **37** carried by the housing means **21** and adapted to be interconnected to a thermostat or the like that will supply electrical current to the heat motor **32** to energize the same when the thermostat senses a temperature effect requiring that the main burner means be supplied fuel by the valve means **20** and that will terminate such electrical current when the thermostat senses that the heat input of the burner means should be terminated.

The lever means **27** includes an L-shaped part **38** adapted to be engaged by a ball **39** carried on the end of a stud **40** interconnected to the movable wall **41** of an expandible and contractible power element **42** secured to the housing means **21** in any suitable manner. The internal chamber of the power element **42** is intercon-

nected to a capillary tube **43** that leads to a bulb **44**, FIGURE 1, disposed in such a position relative to the pilot burner means **25**, that when a flame exists at the pilot burner means **25**, such flame is sensed by the bulb **44** and causes the fluid therein to expand in such a manner that the movable wall **41** of the power element **42** is moved downwardly in the drawings to carry the lever means **27** therewith so that an intermediate part **45** of the lever means **27** will abut against an adjustable abutment means **46** of the housing **21**.

As illustrated in the drawings, the adjustable abutment means **46** comprises a threaded adjusting screw disposed in a threaded bore **47** of the housing means **21** for a purpose hereinafter described.

When the bulb **44** senses that no flame exists at the pilot burner means **25**, the fluid therein contracts in such a manner that the movable wall **41** of the power element **42** is moved upwardly in the drawings to the position illustrated in FIGURE 4 whereby it can be seen that the ball end **39** thereof is not engaging the lever means **27** so that the same will not hold the intermediate part **45** thereof against the adjustable stop or abutment means **46** for a purpose hereinafter described.

The valve member **30** carried by the movable end **29** of the lever means **27** is best illustrated in FIGURES 7–10 and includes a cup-shaped rigid backing member **48** having an open end **49** surrounded by an annular surface means **50** provided with a substantially inverted V-shaped cross-sectional configuration with the closed end being defined by a substantially circular flat wall **51**. The rigid backing member **48** is secured to the movable end **29** of the lever means **27** by a spider member **52** having the central portion **53** secured to the end **29** of the lever means **27** by rivet-like fastening means **54** whereby the plurality of fingers **55** of the spider member **52** can have the outer ends **56** thereof snap fittingly receiving radially outwardly directed tongues **57** on the rigid backing member **48** in suitable slot means **68** thereof. In this manner, the rigid backing member **48** can float relative to the spider member **52** while still being carried thereby on the end means **29** of the lever means **27** whereby the valve member **30** can seat with a proper facing relationship relative to the valve seat member **24**.

A flexible elastomer membrane diaphragm **58** or the like is disposed over the open end **49** of the rigid backing member **48** and is held thereto by an annular retainer **59** held on top of the flexible membrane **58** at the outer periphery thereof by bent over tab means **60** of the rigid backing member **48**.

Thus, it can readily be seen in FIGURE 8 that when the valve member **30** is disposed away from the valve seat **24**, the flexible membrane **58** is substantially flat across the open end **49** of the cup-shaped backing member **48** and is held in such flat condition by the natural resiliency of the flexible diaphragm or membrane **58**.

The valve seat member **24** is so constructed and arranged that the valve seat surface **61** thereof is annular and is arcuate in cross section so that the substantially 90° part of the surface **61** immediately adjacent the passage **31** passing therethrough will be first engaged by the flexible diaphragm **58** of the valve member **30** when the same initially closes against the seat **24** as illustrated in FIGURE 9, such initial point of substantially annular line contact being defined by the reference numeral **62** in FIGURE 9.

While the initial seating of the flexible membrane or diaphragm **58** of the valve member **30** against the valve seat member **24** as illustrated in FIGURE 9 substantially seals off the passage means **31** from the fuel receiving chamber **23** of the housing means **21**, further upward movement of the movable end **29** of the lever means **27** is effected in a manner hereinafter set forth to cause the flexible diaphragm **58** to progressively wrap against the valve seat surface **61** in an outward radial direction as illustrated in FIGURE 10 while distorting the flexible diaphragm **58** into the open end **49** of the cup-shaped rigid backing member **48** against the closed wall **51** thereof. In this manner, any chips, dirt or the like being located on the valve seat surface **61**, membrane **58** or both to tend to prevent the closing of the passage means **31** by the valve member **30** will be completely enveloped by the flexible compressed nature of the flexible diaphragm **58** of the valve member **30** against the valve seat surface **61** to insure a positive sealing of the valve seat member **24** so that when the valve member **30** is disposed in its fully closed position illustrated in FIGURE 10, not only is positive sealing effected at the point **62** immediately adjacent the passage means **31** in the manner previously described, but also the annular ridge **50** of the rigid backing member **48** substantially compresses the flexible diaphragm **58** between the same and the outer annular part **63** of the valve seat surface **61** to insure the sealing effect of the diaphragm **58** against the valve seat member **24**.

Accordingly, the flexible membrane **58** when disposed in its fully closed position against the valve seat member **24** substantially seals against a relatively wide annular valve seat surface **61** from the point **62** in FIGURE 10 to the point **63** in FIGURE 10 completely around the passage means **31** to fully seal closed the same even though dirt or the like might be disposed on the valve seat surface **61**, membrane **58** or both which will be fully enveloped by the flexible membrane **58**.

Thus, it can be seen that the improved valve means member **30** and valve seat member **24** of this invention permit a full sealing closed thereof when the valve member **30** is moved to its closed position.

Conversely, when the valve member is moved from its fully closed position illustrated in FIGURE 10 toward its open position, the valve member **30** is moved downwardly from the position illustrated in FIGURE 10 to the position illustrated in FIGURE 9 before any opening of the passage means **31** of the valve seat member **24** to the fuel chamber **23** can take place whereby moving inertia is built up into the valve member **30** before the same opens the valve seat **24** so that a rapid opening thereof will take place in substantially a snap manner to insure that a sufficient quantity of fuel will be supplied to the main burner means for full ignition thereof each time the valve member **30** is cracked open.

The operation of the valve construction **20** will now be described.

Under normal conditions, the pilot burner means **25** is being continuously supplied fuel from the conduit means **26** and has been previously ignited so that the continuously burning pilot means **25** comprises a continuously burning standby ignition flame means for the main burner means even though the thermostatic device for the cooking apparatus or the like is disposed in its "off" position so that the thermostatic device will never supply electrical current to the heater means **32** of the valve construction **20** until the thermostatic device is turned to an "on" position thereof. However, with the pilot burner means **25** having the continuously burning pilot flame, such flame is sensed by the bulb **44** so that the movable wall **41** of the power element **42** is in its expanded downward condition as illustrated in FIGURE 2 to hold the intermediate part **45** of the lever means **27** against the abutment or stop means **46**.

If the downward expansion of the power element **42** should exceed the condition illustrated in FIGURE 2, the L-shaped lever part **38** will be further moved downwardly in an overshoot manner by a mere bending at the point **64** so that undue pressure will not be placed on the lever means **27** during an overshoot condition of the power element **42**.

In addition, the lever means **27** and L-shaped part **38** thereof are so constructed and arranged that the same will compensate for ambient temperature changes in a conventional manner and need not be further described whereby

when the heater means **32** is not energized, the natural condition of the lever means **27** is to compress the valve member **30** against the valve seat **24** in the manner illustrated in FIGURE 10 and maintain that sealed condition regardless of whether or not the bulb **44** is sensing a pilot flame.

However, with the valve construction **20** normally disposed in the position illustrated in FIGURE 2 and the thermostatic device is turned to a selected "on" position thereof so that the thermostatic device of the cooking apparatus initially determines that fuel should be supplied to the main burner means because the thermostatic device is sensing a temperature effect below the selected temperature effect, the thermostatic device will supply electrical current to the heater means **32** whereby the electrical heater means **32** will heat the bimetallic lever means **27** and cause the same to warp or bend between the engaged abutment or stop means **46** and the end means **29** thereof in the manner illustrated in FIGURE 3 to open the valve seat member **24** and permit fuel to flow from the fuel chamber means **23** and out of the outlet means **24A** to the main burner means to be ignited by the pilot burner flame at the pilot burner means **25**.

Thus, electrical energy is supplied to the heater means **32** of the valve construction **20** as long as the thermostatic device determines that a heat input is required.

When the thermostat device senses that the heat input being supplied by the main burner means has now reached or slightly exceeded the selected temperature effect, the electrical current to the heater **32** of the lever means **27** is terminated by the thermostatic device whereby the subsequently cooling lever means **27** begins to straighten out to the condition illustrated in FIGURE 2 to close the valve seat **24** in the manner previously described in connection with FIGURES 8–10 so that the supply of fuel to the main burner means is terminated until the thermostatic device again determines that heat input is required. In this manner, the valve construction **20** is cycled between its opened and closed positions to maintain the selected temperature effect of the main burner means.

However, if no pilot flame is existing at the pilot burner means **25**, the movable wall **41** of the power element **42** is disposed in the up condition as illustrated in FIGURE 4 so as not to hold the intermediate part **45** of the lever means **27** against the abutment or stop means **46** of the housing means **21**. Under these conditions, should the thermostatic device direct an electrical current to the heater means **32** to tend to open the valve seat member **24** in the manner previously described, the heated bimetallic member **27** will now bend or warp between the opposed ends **28** and **29** thereof in the manner illustrated in FIGURE 4 so that such bending of the bimetallic member **27** will not permit the valve member **30** to open away from the valve seat **24** as illustrated in FIGURE 4.

Therefore, it can be seen that it requires two conditions to be present for the valve construction **20** before the valve construction **20** can pass fuel therethrough, namely, not only must the heat motor means **32** for the bimetallic lever means **27** be energized to cause warping or bending thereof, but also the condition responsive means **42** must be sensing a predetermined condition in order to engage the lever means **27** and hold the intermediate part **45** thereof against the stop means or abutment means **46** to permit the warping and bending of the lever means **27** to act in the manner to fully open the valve seat member **24**. Thus, merely the sensing of the certain condition by the power element **42** will not by itself open the valve construction **20** and the mere energizing of the heat motor **32** by itself will not cause opening of the valve construction **20**.

Accordingly, it can be seen that not only does this invention provide an improved valve construction having improved safety features, but also this invention provides improved parts for such a valve construction or the like.

While the form of the invention now preferred has been disclosed as required by the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. In combination, a housing means having an inlet and an outlet separated by a valve seat, a bimetallic lever means disposed in said housing means and carrying a valve member on one end means thereof for opening and closing said valve seat, said lever means having the other end means carried by said housing means to normally cause said lever means to close said valve seat, said housing means carrying heater means for tending to bend said lever means in a direction to open said valve seat when said heater means is energized, and condition responsive means carried by said housing means and only engaging said lever means when said condition responsive means senses a predetermined condition, said lever means only being adapted to open said valve seat when said heater means is energized and when said condition responsive means is sensing said predetermined condition.

2. A combination as set forth in claim **1** wherein said heater means is carried on said lever means between said end means thereof.

3. A combination as set forth in claim **1** wherein said condition responsive means comprises an expandible and contractible power element.

4. A combination as set forth in claim **1** wherein said condition responsive means comprises a flame sensing means that will only engage said lever means when said sensing means senses a certain flame.

5. A combination as set forth in claim **4** wherein a pilot burner means is provided for creating said certain flame.

6. A combination as set forth in claim **1** wherein an abutment means is carried by said housing means, said condition responsive means holding an intermediate part of said lever means against said abutment means only when said condition responsive means senses said predetermined condition.

7. A combination as set forth in claim **6** wherein said abutment means is adjustable relative to said housing means.

8. A combination as set forth in claim **6** wherein said lever means bends between said end means thereof when said heater means is energized and said condition responsive means is not sensing said predetermined condition whereby said lever means maintains said valve member against said valve seat.

9. A combination as set forth in claim **6** wherein said lever means bends between said one end means and said abutment means when said heater means is energized and said condition responsive means is sensing said predetermined condition whereby said bent lever means holds said valve member away from said valve seat.

10. A combination as set forth in claim **1** wherein said valve member has a substantially cup-shaped rigid backing member having the open end thereof covered by a flexible membrane that will engage against said valve seat and distort into said open end of said backing member to seal closed said valve seat.

11. In combination, a housing means, a lever means having one end means carried by said housing means and having the other end means movable relative thereto for operating purposes, said lever means normally maintaining said other end means in one position relative to said housing means, said housing means carrying actuating means for tending to bend said lever means in a direction to move said other end means thereof away from said one position to another position relative to said housing means when said actuating means is actuated, and condition responsive means carried by said housing means and only engaging said lever means when said condition responsive means senses a predetermined condition, said lever means only being adapted to bend said other end means from said one position thereof to said other position thereof

when said actuating means is actuated and said condition responsive means is sensing said predetermined condition and thus remains in engagement with said lever means during said bending of said other end means from said one position thereof to said other position thereof.

12. A combination as set forth in claim **11** wherein a stop means is carried by said housing means, said condition responsive means holding an intermediate part of said lever means against said stop means only when said condition responsive means senses said predetermined condition.

13. A combination as set forth in claim **12** wherein said lever means bends between said end means thereof when said actuating means is actuated and said condition responsive means is not sensing said predetermined condition whereby said lever means maintains said other end means thereof in said one position, said lever means bending between said stop means and said other end means when said actuating means is actuated and said

condition responsive means is sensing said predetermined condition whereby said bent lever means holds said other end means thereof in said other position thereof.

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U.S. Cl. X.R.

236—68; 337—3, 312, 334