Feb. 8, 1966 C. D. BRANSON ETAL 3,233,830

BURNER VALVE CONSTRUCTION

Filed June 15, 1962 3 Sheets-Sheet 1

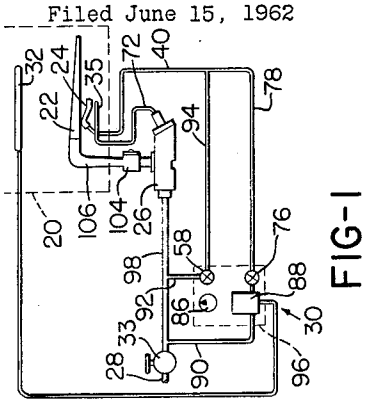


FIG-1

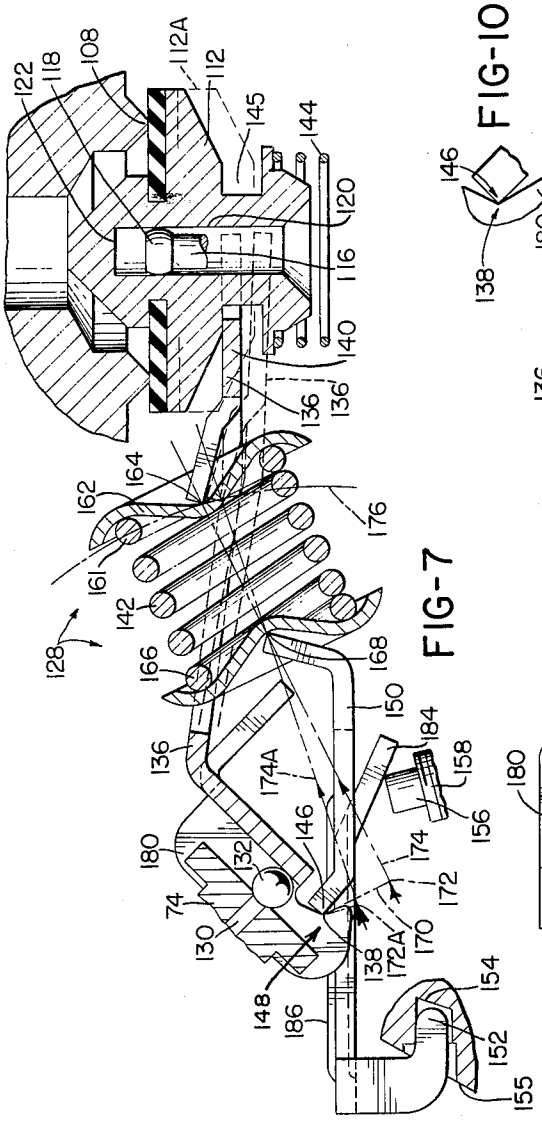


FIG-7

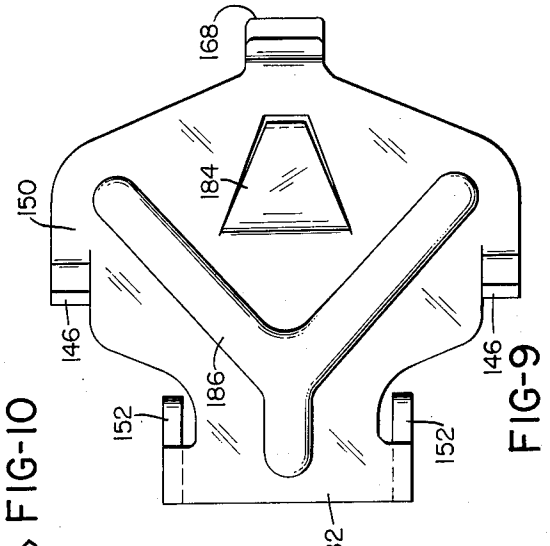


FIG-9

FIG-10

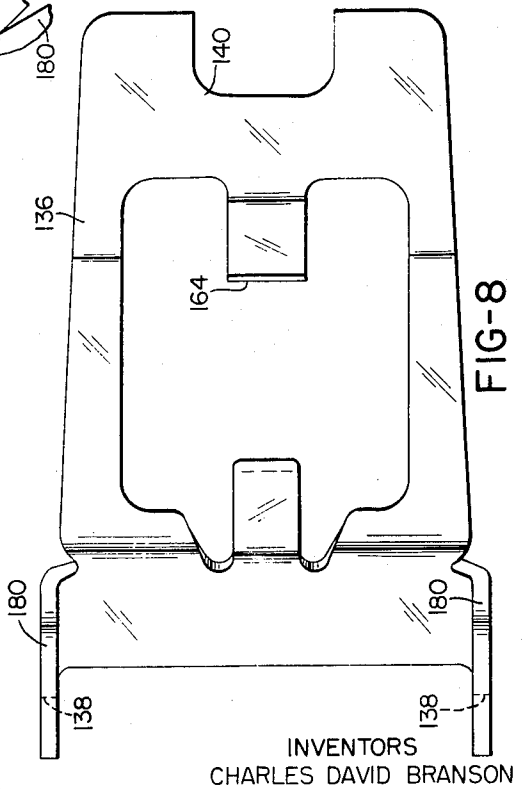


FIG-8

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BURNER VALVE CONSTRUCTION

Filed June 15, 1962 3 Sheets-Sheet 2

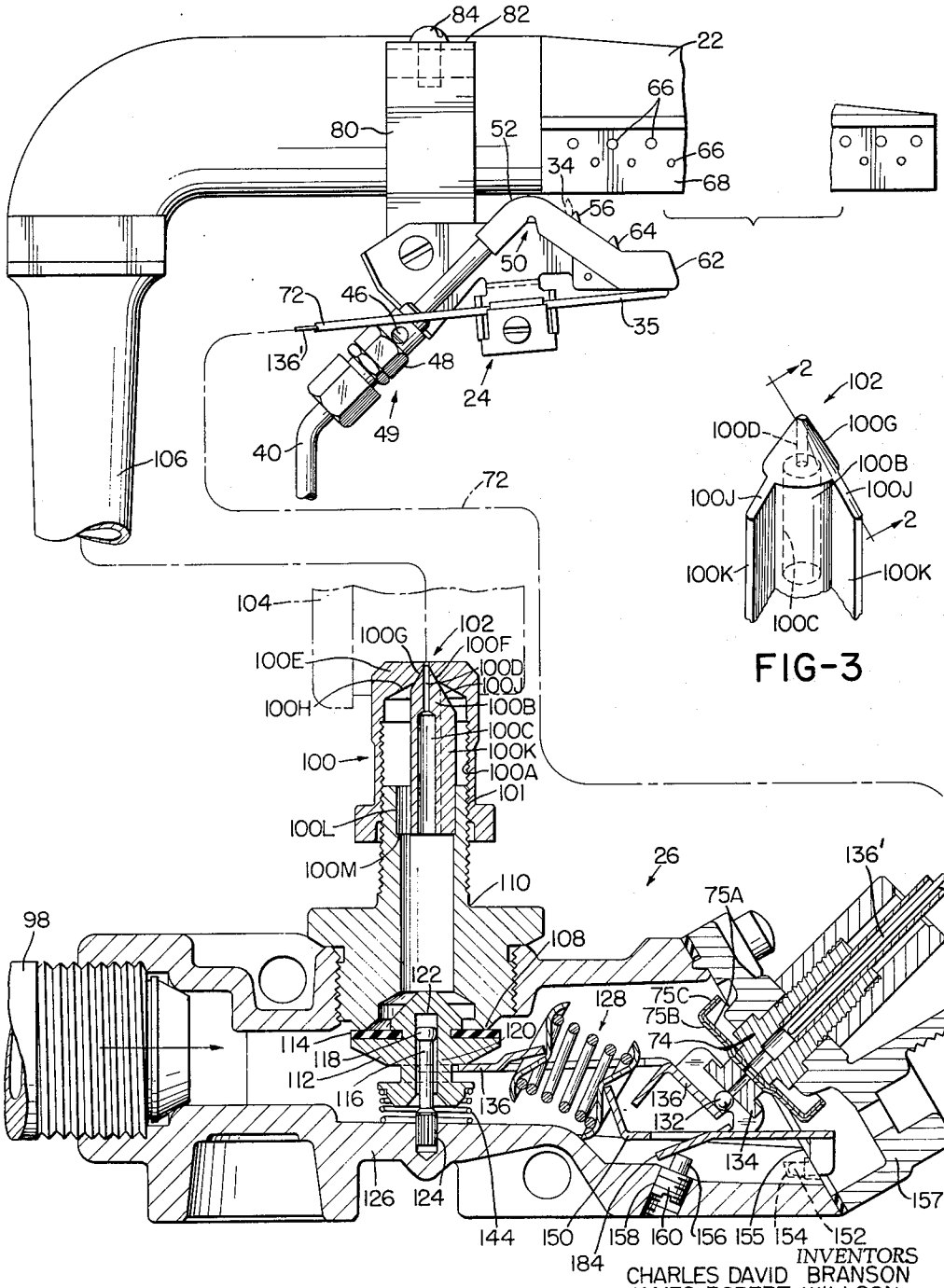


FIG-2

FIG-3

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BURNER VALVE CONSTRUCTION

Filed June 15, 1962 3 Sheets-Sheet 3

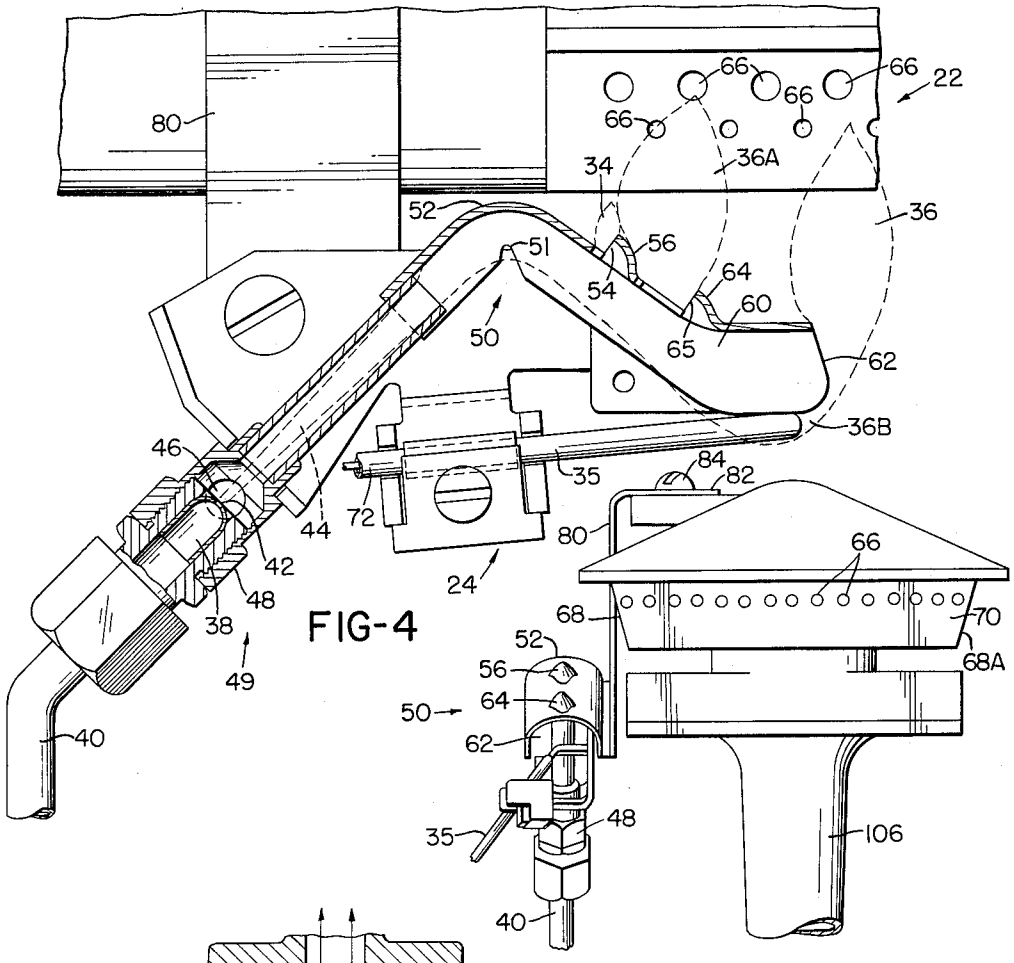


FIG-4

FIG-6

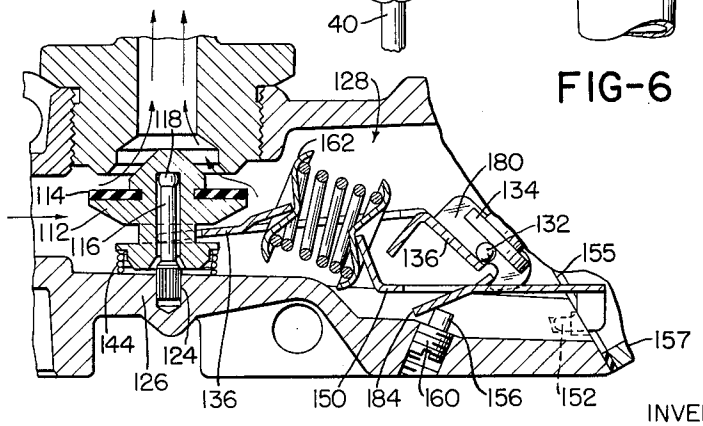


FIG-5

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United States Patent Office 3,233,830 Patented Feb. 8, 1966

3,233,830

BURNER VALVE CONSTRUCTION

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Filed June 15, 1962, Ser. No. 202,789
7 Claims. (Cl. 236—99)

This invention relates to an improved burner valve construction.

A feature of this invention provides a burner valve construction in which the closing spring action on the valve increases in strength as the valve moves toward its valve seat and decreases in strength as such valve moves away from its valve seat.

Another feature of this invention provides a substantially snap-action by the combined action of a local vaporizing thermostatic action in a liquid line to a thermostatic motor in combination with a spring action on the valve which increases in strength as the valve closes and the thermostatic vapor condenses, and which spring action decreases in strength as said portion of thermostatic liquid vaporizes to receive a quick yielding impulse to open said valve as the liquid vaporizes.

Another feature of this invention provides a lever and spring construction acting on a valve in a manner to apply an increasing valve closing torque as the valve moves toward its valve seat and vice-versa.

Another object of this invention is to provide a burner valve construction having one or more of the features herein disclosed.

Another object of this invention is to provide a system for burner operation having one or more of the features herein disclosed.

Other objects are apparent from this description and the accompanying drawings in which:

FIGURE 1 is a diagrammatic representation of a burner system embodying this invention.

FIGURE 2 is a diagrammatic representation, on enlarged scale, of a part of the main gas burner, the pilot burner, the burner gas valve, and the thermostatic control for the gas valve.

FIGURE 3 is a perspective view of the needle construction for the discharge conduit of the burner gas valve.

FIGURE 4 is an enlarged longitudinal vertical cross section of the pilot burner construction.

FIGURE 5 is a view of a portion of FIGURE 2 with the valve in open position.

FIGURE 6 is an end view of the main gas burner and pilot burner.

FIGURE 7 is an enlarged cross section of the valve actuating means shown in FIGURE 2 taken from the opposite side.

FIGURE 8 is a top view of the valve actuating lever.

FIGURE 9 is a top view of the supporting fulcrum lever.

FIGURE 10 is an enlarged view of the fulcrum construction.

Certain words indicating direction, relative position, etc. are used in this application for the sake of brevity and clearness. However, such words are not intended as limitations and apply only to the illustrations in the drawings. The actual constructions used may have different directions, relative positions, etc. Words such as "vertical," "horizontal," "upper," "lower," etc. are types of words which are used in this manner.

Referring first to FIGURE 1, an oven **20** may be provided with a main gas burner **22**, a pilot construction **24**, a main burner gas valve construction **26**, a gas supply pipe **28**. A thermostatic control construction **30** may

have a thermostatic bulb **32** in the oven **20** which causes said thermostatic control construction **30** to control the heating action of the burner **22** to produce desired temperatures in the oven **20**. A main gas valve **33** may control the flow of gas to the system shown in FIGURE 1.

The pilot construction **24** may be of a character such that it produces a stand-by pilot flame **34**, FIGURE 4, incapable of igniting the burner **22**, and an igniting flame **36** capable of igniting the burner **22**.

The stand-by pilot flame **34** is incapable of heating the thermostatic bulb **35** sufficiently to cause such bulb **35** to cause gas to be supplied to the main burner **22** by the gas valve **26**. The flame **36** is of such size, or construction, or shape, that it is capable of heating the thermostatic bulb **35** to cause gas to be supplied to the burner **22** by the valve **26** so the burner may be ignited by the igniting flame **36**.

The pilot construction **24** may include a nozzle **38**, which receives gas from the pipe **40** and discharges it through an orifice **42** in sufficient quantity to produce the stand-by flame **34** under one type of control, and to produce the igniting flame **36** under a different type of control.

The gas is discharged from the orifice **42** as a jet **44** which entrains a quantity of atmospheric air entering through one or more orifices **46** in the side of connector **48**.

When the stand-by flame **34** is to be produced, the gas entering the nozzle **38** is of limited quantity and pressure so that only a small amount of gas and air are fed to the shield **50**. The shield **50** may be inverted channel-shaped in cross section, and may have a downwardly open elbow **52** which guides the gas and air mixture to the first pilot burner aperture **54** through which the limited amount of gas and air pass and form the stand-by pilot flame **34**. The aperture **54** may be provided with a small hood **56** which aids in controlling the formation of the flame **34**.

The stand-by calibrating valve **58**, FIGURE 1 may be adjusted so that the standby pilot flame **34** is a small blue flame, and the small blue flame is the calibration indicator to show that the pilot flame has been adjusted to the desired size.

The production of the standby pilot flame on top of the shield **50** prevents undesired heating of the thermostatic bulb **35** during the standby conditions.

The hood **50** has a downwardly slanting channel **60** with an open end **62** and one or more additional small hoods **64**, and igniting flame apertures **65**. The construction is such that when a larger quantity of gas is fed through the nozzle **38**, by the thermostat construction **30**, then the igniting flame **36** is produced, which burns at **36**, **36A** and **36B** as gas and air mixture are fed under the small hood or hoods **64**, and out of the end **62**, and these igniting flame portions are sufficiently high to ignite the burner gas which is discharged through the burner orifices **66**. If desired, the orifices **66** may be slightly downwardly slanted along the side **68** of the burner. The end **70** of the burner **22** may also be provided with orifices **66** which carry the ignition to the other similar side **68A** of the burner.

The igniting flame **36** burns at **36B**, under the end of the hood **50**, so that the flame **36B** heats the bulb **35** either by direct contact, or because of close proximity, so that a portion of the liquid mercury, or other thermostatic fluid in the bulb **35**, has its liquid phase changed to a gaseous phase to produce a quickly increasing thermostatic fluid pressure in the thermostatic fluid enclosure of which the bulb **35** is a part. The tube **72** and thermostatic motor **74** form the remainder of the thermostatic fluid enclosure.

When the igniting flame **36**, **36A** and **36B** ceases to be produced, the channel-shaped shield or hood promotes

the upward flow of cooling air in contact with the thermostatic bulb 35 to cause quick cooling action of the bulb 35. The notches 51 at the elbow 50 promote this cooling action.

The bulb 35 is connected by a tube 72, which forms a part of the thermostatic fluid enclosure, and which is connected to the thermostatic motor 74, in the burner gas valve construction 26, to cause burner gas to be supplied by the burner gas valve construction 26 to the burner 22 in response to temperatures produced by the burner 22, as elsewhere further described. The size of the igniting flame 36, 36A and 36B may be regulated by an igniting flame regulating valve 76, FIGURE 1.

The construction is such that when the temperature in the oven 20, as produced by the burner 22, is below a selected level, the thermostatic bulb 32 causes the thermostatic construction 30 to feed an igniting flame producing amount of gas through the igniting gas pipe 78, FIGURE 1. The pipe 78 is connected to the pilot burner pipe 40. This causes the large igniting flame 36, 36A and 36B to be produced in the pilot construction 24. This heats the pilot thermostat bulb 35, which in turn actuates or expands the thermostatic motor 74 and causes burner gas to be fed by the burner gas valve construction 26 to the burner 22.

This heats the oven 20 until the temperature in the oven 20 reaches the desired maximum, at which time the thermostatic bulb 32 causes pilot gas to cease to be fed through the pipe 78, which in turn causes the igniting pilot flame 36, 36A and 36B to cease to be produced. This permits the pilot bulb 35 to cool and thereby restore the thermostatic fluid to the liquid phase throughout the fluid enclosure, and to cause the burner gas valve construction 26 to cease feeding burner gas to the burner 22.

The thermostatic motor 74 may include a pair of telescoped resilient cup-shaped diaphragms 75A and 75B, which are sealed together at the flanges 75C to form an expandable diaphragm for thermostatic motor 74 into which the liquid mercury is forced when the mercury in bulb 35 is vaporized.

A suitable bracket construction 80, of any desired shape, may be provided to hold the hood 50, the nozzle construction 49 which holds nozzle 38, and the bulb 35 adjacent to the burner 22. If desired, this bracket construction 80 may be secured by the flange 82 to the top of the burner by one or more screws 84.

The thermostatic control construction 30, FIGURE 1, may be of any suitable character capable of controlling the flow of igniting burner gas through the pipe 78 in response to the temperatures registered by the thermostatic bulb 32. A suitable knob 86 may be included, which adjusts the thermostat valve construction 88, so the construction 88 causes gas to be fed from the pipe 90 and gas supply 28, through the regulating valve 76 and pipe 78 to the pipe 40 and nozzle 38.

Standby pilot gas may be fed through standby pipes 92 and 94, and the standby flame regulating valve 58, to the pipe 40 and from thence to the nozzle 38. The regulating valve 58 may be supported on the thermostat casing 96, or the pipes 92 and 94, and valve 58 may be entirely separate and independent from the casing 96, as desired.

The thermostat control construction may feed standby gas continuously through the pipes 92, 94 and 40, as regulated by an adjustable orifice valve 58, so the standby flame 34 only is formed when no gas is fed through the pipes 90 and 78 when the thermostat valve 88 is closed by bulb 32 when the oven 20 is sufficiently warm. However, when the oven cools below a desired level, the bulb 32 opens the valve 88 and feeds a larger amount of gas through pipes 96, 78 and 40, and regulating valve 78 to produce the igniting flame 36, 36A and 36B.

The burner gas valve construction 26 may have a burner gas discharge connection 100, which has an adjustable orifice 102, which discharges the burner gas in the form of a jet stream past the well known gas and air mixing construction 104. The rate of discharge at the orifice 102 may be regulated by turning the gas connector 100, to cause the threaded construction 101 to regulate the jet 102, as desired.

The burner gas valve construction 26 may have a discharge valve seat connected in gas flow relationship to the burner 22, as by the connector 110, which discharges into the nozzle construction 100.

The jet construction 100 may include a lower passageway 100A which is threaded on the upper portion 101 of connector 110 and is adjustable up and down by said threaded construction.

A jet piece 100B has a larger bore 100C and the minimum flow passage 100D. The upper end 100E of construction 100 has an internal conical bore 100F which may seal against the upper conical end 100G to force all the gas through passage 100D.

The conical bore 100H is tapered so it does not seat against the upper slanting ends 100J of wings 100K so a tight seal may be formed at 100F.

The wings 100K are driven in the bore 100L and against the shoulder 100M.

The construction 100 may be turned to its lowest position to produce a minimum discharge through passage 100D or construction 100 may be adjusted upwardly by the threaded construction to produce a bypass between 100F and 100G so a larger amount of gas may be fed to the mixer 104.

A valve 112 may seat on the valve seat 108, and, if desired, may have a sealing disc 114 to engage the seat 108 in effective sealing relationship.

A guide pin 116 may have a head 118 to guide valve 112 through the medium of a cylindrical opening 120. The downward movement of the valve 112 may be limited by the end wall 122 of the opening 120 when the wall 122 engages the head 118. The pin 116 may be fluted and driven into the cylindrical opening 124 of the elongated tubular valve casing 126, to the proper level properly to limit the downward movement of valve 112.

The thermostatic motor 74 may have means to move the valve 112 toward said valve seat 108 when the igniting flame 36, 36A, 36B, or a similar flame, ceases to be produced. Such means may also move the valve 112 away from the valve seat 108 when such igniting flame 36, 36A and 36B is produced. This action is indirectly in response to the control of the ignition gas by the thermostatic bulb 32 and thermostat 30 in response to the temperature in oven 20. The action maintains the temperature in the oven 20, or other heated object, within selected temperature limits.

The means to move the valve 112 may include a spring construction or means 128, FIGURE 7, acting to aid in moving the valve 112 toward the valve seat 108, and increasing the valve seating strength as the valve 112 moves toward the valve seat 108 and decreases in strength as said valve 112 moves away from said valve seat 108.

The construction is such that the valve 112 is quickly opened when a portion of the mercury in bulb 35 is vaporized and is quickly closed when the vaporized portion is cooled and condensed. This quick opening and closing of valve 112 is in response to the existence or non-existence of ignition flame 36, 36A, 36B, or similar control flame.

The thermostatic motor 74, tube 72 and bulb 35 form a thermostatic fluid casing which is heated by the igniting flame 36, 36A, and 36B. A portion of the thermostatic fluid in the thermostatic casing, such as in bulb 35, may change phase when it is heated by said igniting flame 36B or similar flame. For example, the bulb 35 and the tube 72 and the thermostatic motor 74 may contain mercury in liquid form at normal atmospheric temperature, and the fluid casing so produced by these members may be charged with liquid mercury through the opening 130,

FIGURE 7, after which the ball **132** may be welded to the opening **130**, on the motor head **134**, which is secured to the diaphragm **75B**.

A suitable wire **136'** may be placed in the tube **72** to reduce the amount of mercury used in the tube **72**, and may be chosen of such material, that it may compensate for the expansion and contraction of the tube **72** and liquid mercury due to surrounding temperatures, so such atmospheric temperature changes, and other temperatures which do not vaporize mercury (below 700° F. more or less) do not affect the valve **112**.

The portion of the thermostatic fluid, or mercury, which is in the bulb **35** may change phase. For example, the liquid mercury in bulb **35** may be vaporized at temperatures of 700° F., more or less, and the production of this vapor causes a quick and elastic movement of the ball **132** to produce an action which approaches a snap-acting opening and closing of the valve **112**, depending upon the change from liquid mercury to mercury vapor and vice-versa.

The valve moving means or spring construction **128** may include a valve actuating lever **136** having a lever fulcrum **138** and a valve actuating portion **140**, which are separated from each other. The thermostatic motor **74** has means, such as the ball **132**, to move the lever **136** and valve **112** toward and away from the valve seat **108**.

The spring construction **128**, may include a relatively strong compression spring **142** which cooperates with the lever **136** to move the valve **112** toward the seat **108**. The spring construction **128**, which may include the relatively strong spring **142**, with or without an additional relatively weak compression spring **144**, cooperates with the lever **136** to move the valve **112** toward the seat **108**. The spring construction **128** increases in valve seating strength as the valve **112** moves toward the valve seat **108** and decreases in strength as the valve **112** moves away from the valve seat **108**.

A lost motion notch **145** may be provided in valve **112** to permit the lever **136** to impart an additionally quick opening motion to the valve **112** as the mercury starts to vaporize.

A supporting fulcrum **146** cooperates with the lever fulcrum **138** to hold the lever **136** in pivoting position. The lever fulcrum **138** may be hook-shaped as at **148** and engages the knife edge of the stationary or supporting fulcrum **146**. The compression spring **142** pulls the hook type fulcrum **138** tightly against the stationary or supporting fulcrum **146**, in a rightward direction in FIGURES 7 and 10.

The supporting fulcrum **146** may be adjustable up and down, for example, to adjust and calibrate the opening and closing action of valve **112**. For example, the supporting fulcrum **146** may be carried by a fulcrum lever **150** which is adjustable to adjust the supporting fulcrum **146**.

The lever **150** may be pivoted by hooks **152** inserted in openings **154** in the valve casing end wall **155**. The lever **150** is adjustable by the pin **156**, which may be longitudinally adjusted, as by the threaded construction **158** which has a screw head **160**, for longitudinal engagement.

A suitable valve casing cover **157** may be bolted on the end wall **155** after the lever **150** has been positioned. The cover **157** may carry the thermostatic motor **74** so the ball **132** engages lever **136**.

The compression spring **142** has a first spring part, such as one end **161** which engages the lever **136**, through the medium of a disc **162** which engages the lever **136** at a first spring fulcrum **164**.

A second spring part **166**, which may be the other end of the spring **142**, may engage a second spring fulcrum **168**, which is carried at the end of the lever **150**.

The spring fulcrums **164** and **168** are so located to produce a valve closing torque, as indicated by the dotted line **170** in FIGURE 7, which extends from the fulcrums **138** and **146** to the right angled intersection **172** with the extended line **174** from the spring fulcrums **164** and **168**.

The first spring fulcrum **164** swings about the arc **176** which is centered about the fulcrums **138** and **146**. The fulcrum **168** is stationary during the operation of the device and is movable only for adjustment purposes. Therefore, the extension line **174** moves toward the fulcrums **138** and **146** as indicated at **174A** as the valve **112** moves away from the valve seat **108**. Hence the intersection **172** likewise moves towards the fulcrums **138** and **146**, as indicated at **172A** as the valve **112** moves away from the valve seat **108**. The line **170** is indicative of the torque produced by the rightward pull of the line **174** (in FIGURE 7) due to the compression spring **142**. It produces a counter-clockwise torque about the fulcrums **138** and **146** which increases in length and strength as valve **112** moves toward the seat **108**, and decreases in length and strength as the valve **112** moves away from the valve seat **108**.

This increase in spring torque **170** as the valve **112** moves toward the valve seat **108** causes a quick closing movement of the valve. Conversely, the decrease in spring torque **170** as the valve moves away from the valve seat **108** causes the valve **112** to have a quick opening movement. This action is amplified by the resiliency of the mercury vapor in bulb **135**.

The supporting fulcrum **168** cooperates with the adjacent spring fulcrum and is adjustable by the pin **156** to calibrate the action of valve **112**. The fulcrum **168** is carried by the lever **150**, which is adjustable by the pin **156** about the fulcrums **152** to adjust the supporting fulcrum **168**.

The lever **50** is held in locked position by the thrust of the ball **132**, the openings **154**, and the pin **156**.

The lever **150** may be adjusted by the pin **156** to cause any relative movement between the line **174** and the fulcrums **138** and **146**. For example, it may be preferred to cause the extension line **174** to be at, or just slightly below the fulcrums **138** and **170** when the valve **112** is in the downward fully opened position **112A**, and to be a relatively long distance, such as at **172**, when the valve **112** is in the fully closed and full line position illustrated in FIGURE 7.

The lever **136** may be made of a stamping, such as shown in FIGURE 8. The lever **136** has extension shoulders **180** which carry a pair of hook fulcrums **138**, which act in unison against the pair of knife fulcrums **146**, shown in FIGURE 9. FIGURE 9 shows the lever **150** to be a relatively flat piece of metal with shoulders or hooks **152** carried by an extension **182**. The spring supporting fulcrum **168** is shown at the right end of FIGURE 9. A downward extension **184** is punched into the lever **150** to engage the pin **156**. A strengthening ridge **186** is formed to make the lever **150** rigid.

If desired, the spring **142** may have a spring strength of 6 pounds, more or less at its normal load. The spring **144** may be relatively weak, and may have a spring strength of 1.5 ounces, more or less, when at its normal load. The spring **142** therefore provides a very substantial upward push on the valve **112** when the valve closes. It is strongest in valve closing strength or torque when valve **112** is in the fully closed position as shown in full lines in FIGURE 7 and has a small valve closing torque when the valve **112** is open.

The parts which contact the mercury, if used, may be made of material which is not affected by the mercury. For example, the bulb **35**, tube **72**, wire **136** and the mercury contacting parts of motor **74** may be made of stainless steel, or the like.

It is thus to be seen that this invention provides new and useful pilot constructions, burner gas valve constructions, and combinations thereof. Also new and useful methods of control are provided.

In the fully closed position of the valve 112, and in the fully retracted position of the ball 132, not shown, the ball 132 is slightly spaced from the lever 136 to permit the full closing force of the spring 142 to act on the valve 112.

The dotted line position of lever 136 in FIGURE 7 is not its lowest position when the valve 112 is fully opened. Such lowest position is below the dotted line showing. Also the line 174 approaches the fulcrums 138 and 146 to a position closer than 172A when the valve 112 is in fully open position. Hence the counterclockwise torque of lever 136 is less than the torque at 172A when valve 112 is in fully open position.

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

What is claimed is:

1. A burner gas valve construction controlling the flow of burner gas for a burner comprising: an elongated tubular valve casing with a gas inlet at a first valve casing end, with a thermostatic motor receiving opening at a second valve casing end, and with a gas burner connector receiving opening in said casing intermediate said casing ends; a valve guide pin insertable in said valve casing in alignment with said connector receiving opening; a burner gas valve slidably carried by said guide pin and having a lever receiving lost motion notch; a gas burner connector inserted in said connector receiving opening and having a valve seat opened and closed by said burner gas valve; a valve actuating lever in said casing with one lever end portion engaging said lost motion notch, with the other lever end portion having a valve lever fulcrum adjacent said motor receiving opening and with an intermediate lever portion having a movable spring fulcrum; a fulcrum lever in said casing having a normally stationary lever supporting fulcrum engaging said valve lever fulcrum adjacent said motor receiving opening, having a hook construction at one end engaging a hook receiving construction at said second valve casing end and having a normally stationary spring fulcrum at the other end; a compression spring means having end portions respectively engaging said spring lever fulcrum and said stationary spring fulcrum; an end cover removably secured to said second valve casing end and covering said motor receiving opening; and a thermostatic motor carried by said cover and engaging said valve actuating lever to operate said valve actuating lever in combination with said spring means to move said valve toward and away from said valve seat.

2. A valve construction according to claim 1 in which a spring means is provided around said guide pin between said valve and said casing which is relatively weaker than said first named spring means.

3. A valve construction according to claim 1 in which a calibration pin is provided in said casing and movably actuating said fulcrum lever to adjust said normally stationary lever supporting fulcrum.

4. A valve construction according to claim 1 in which said connector receiving opening is transversely larger than said valve and guide pin.

5. A valve construction according to claim 1 in which said thermostatic motor includes a pair of telescoped resilient cup-shaped diaphragms sealed together and connected to a tube which forms part of a thermostatic fluid enclosure, said diaphragms having openings aligned with said tube and closed by a motor head having an opening closed by a ball which contacts and moves said valve actuating lever.

6. A valve construction according to claim 1 in which said valve has a cylindrical opening, receiving said guide pin, said cylindrical opening having an end wall which engages the end of said guide pin and limits the opening movement of said valve.

7. A burner gas valve construction controlling the flow of burner gas for a burner comprising: an elongated tubular valve casing having a gas inlet at a first casing end, a thermostatic motor receiving opening at a second casing end, and a gas burner connector receiving opening in said casing intermediate said ends; a valve guide pin inserted in an opening in the wall of said casing opposite said connector receiving opening; a gas burner connector inserted in said connector receiving opening and having a valve seat aligned with said guide pin; a burner gas valve having an axial opening slidably receiving said guide pin, having a sealing disc opening and closing said valve seat, and having an intermediate lever receiving lost motion notch; a valve actuating lever in said casing with one end portion engaging said lost motion notch, with the other end portion having a valve lever fulcrum adjacent said motor receiving opening, and with an intermediate movable spring fulcrum; a fulcrum lever in said casing having a normally stationary lever supporting fulcrum engaging said lever fulcrum and having a hook construction at one end held in said casing adjacent said second casing end, and having a normally stationary spring fulcrum at the other end; compression spring means having end portions respectively engaging said spring lever fulcrum and said stationary spring fulcrum, and a casing cover removably secured to and covering said opening at said second casing end; and a thermostatic motor carried by said cover and engaging said valve actuating lever to operate said spring construction and said valve to open and close said valve seat with spring strength which increases as said valve closes and decreases as said valve opens.

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