Nov. 11, 1930. J. H. GRAYSON 1,781,328

THERMOSTAT VALVE STRUCTURE

Filed June 28, 1929 2 Sheets-Sheet 1

Fig. 1

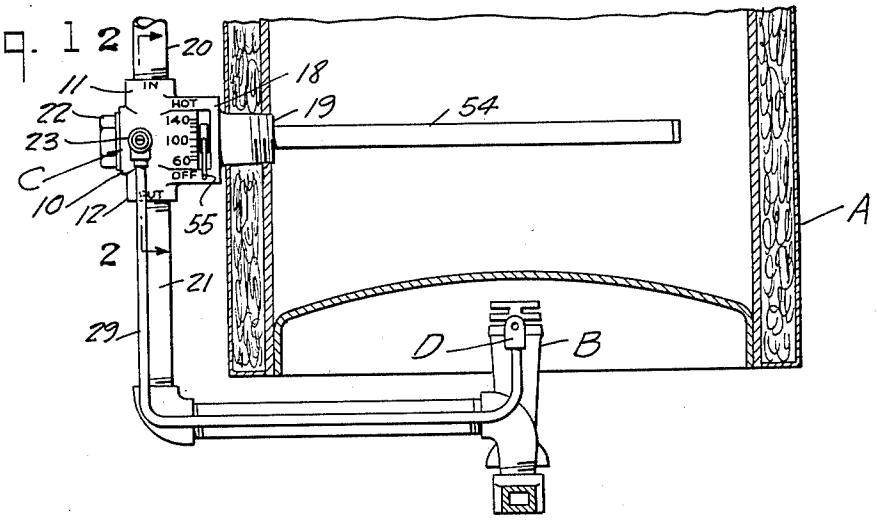

Fig. 2

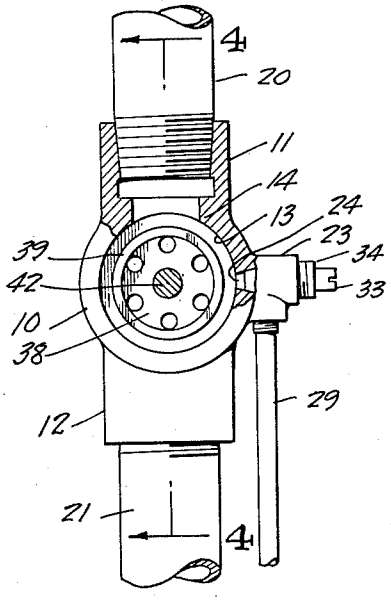

Fig. 3

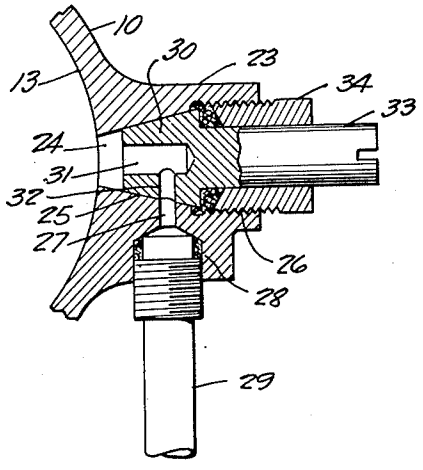

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Fig. 4

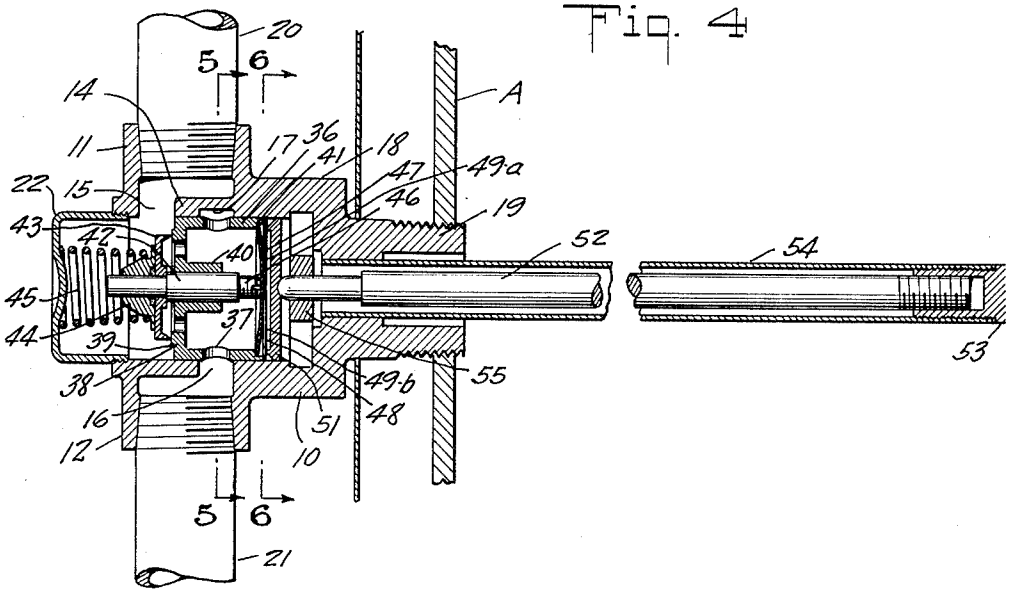


Fig. 5

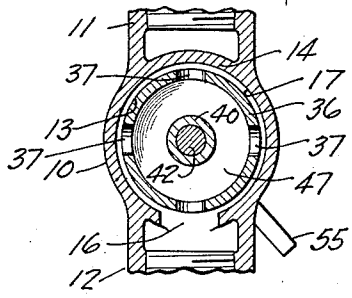


Fig. 6

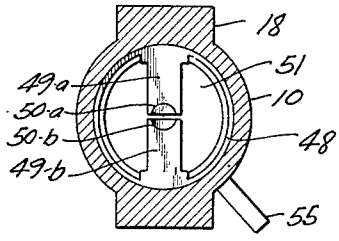
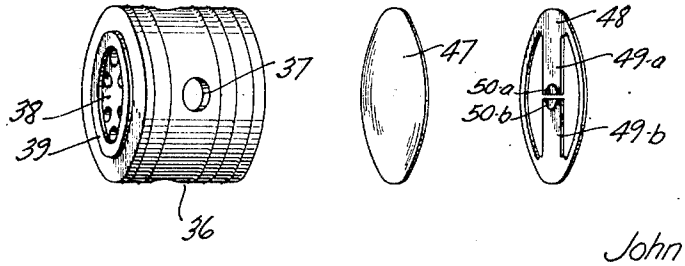


Fig. 7



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UNITED STATES PATENT OFFICE

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THERMOSTAT VALVE STRUCTURE

Application filed June 28, 1929. Serial No. 374,525.

This invention relates to thermostats such as are especially adapted to use with water heaters, oven regulators and like devices wherein a fluid fuel flow is controlled. It is especially adapted to the control of gaseous fuel. Such thermostats have been constructed with a casing serving as a housing for a valve and snap mechanism to actuate the valve.

The objects of this invention are to provide a thermostat of the character described which is compact; has a fuel valve and valve seat which is resistant to warping and corrosion; is easy of assembly and economical to manufacture; and wherein provision is made for direct connection thereto of the pilot burner service tubing.

These objects are accomplished by means of the embodiments of my invention illustrated in the accompanying drawings, in which:—

Fig. 1 is a vertical section through a fragment of a water heater showing the lower thereof provided with a main burner, a pilot burner and a thermostat control in elevation; Fig. 2 is a section as seen on the line 2—2 of Fig. 1; Fig. 3 is an enlarged view partly in section of the pilot burner connection; Fig. 4 is a section as seen on the line 4—4 of Fig. 2; Figs. 5 and 6 are sections as seen on the lines correspondingly numbered in Fig. 4; and Fig. 7 is a perspective view of the valve seat bushing snap action diaphragm disk and amplifier.

It will be understood that although the invention is described herein as applied to a water heater, it is in no way limited to such application. The specific application disclosed herein is for illustrative purposes only.

Referring more particularly to Fig. 1, A indicates a heater tank having a bottom defining the upper wall of a heater chamber, in which is disposed a main burner B. The burner is supplied with gas by a pipe connected to a thermostat valve structure C. The pilot burner is indicated generally by D and has a service supply pipe connected to the thermostat valve control structure C. The present invention resides particularly in the thermostat valve control structure C.

The valve control comprises a body or casing 10 having an inlet extension 11 and an outlet extension 12 in alinement. A cylindrical bore 13 extends through the casing transverse to the line of the inlet and outlet.

A cylindrical wall 14 is provided for separating the inlet from the outlet and has an opening 15 communicating with the inlet and an opening 16 with the outlet. An annular recess is formed in the wall 14 and is marked 17. The body is provided with a yoke extension 18 having a cylindrical head 19 externally threaded to adapt it to be mounted in the shell of the tank A. The inlet and outlet extensions are tapped to receive respectively inlet and outlet pipes 20 and 21. The bore is also tapped at one end to receive a cap 22 which is preferably provided with flat sides so as to form a wrench hold. A protuberance or boss 23 is provided on the casing having a port 24 communicating with the inlet end of the bore 13. A conical seat 25 is formed in the port for a rotary valve plug. The outer end of the port 25 is enlarged as indicated by 26 and threaded to receive a closure plug 34. Extending laterally of the port 24 and communicating with the valve seat portion 25 is a passage 27 enlarged as indicated by 28 to receive a pilot burner service tube 29 leading to the pilot burner D. Loosely disposed in the seat 25 is a valve plug 30 having a central bore 31 communicating with the inlet chamber portion of bore 13 through port 24, and having a lateral opening 32 for registration with the passage 27. The seat and plug have a taper of approximately fourteen degrees, as it has been found that with this taper when the valve plug is forced, it will remain in the set position. A stem 33 is provided on the plug and extends through the bore in a closure plug 34 so that the valve plug may be turned and the amount of gas supplied to the pilot burner controlled thereby. The enlarged portion 26 of the port has threaded therein the closure plug 34. Stem 33 has a kerf for reception of the blade of a screw driver so that the valve plug may be turned.

The simplicity of the structure is apparent. Only the thermostat valve control is inserted in the gas line to the main burner. It is not necessary to break the line in order to place fittings of any nature for the pilot burner pipe with the present invention.

The casing is preferably made of cast brass. Disposed in the bore 13 is a valve seat bushing 36. This bushing is preferably formed of rolled brass which is more dense and will not corrode with the various gases commonly used for fuel, as would cast brass. The bushing serves as a combination valve seat, valve stem guide and has annular shoulders for supporting the amplifier and a disk spring diaphragm. The bushing is preferably held in place by a pressed fit and has ports 37 registering with the recess 17 and with the outlet. The bushing has a ported web 38 extending across the inner end and is provided with a raised portion 39 so as to form a valve seat. A boss 40 is bored to form a valve stem guide. At the outer end of the bushing a ledge 41 is provided. The valve stem 42 is slidably mounted in the boss and is reduced in diameter to provide a shouler for a valve disk 43 to rest against. A follower 44 is slidably mounted on the reduced portion of the stem and has an outstanding flange serving as a seat for a compression spring 45 resting against the cap 22 at its other end. The compression spring acting against the follower 44 tends to hold the valve disk on its seat closing communication between the inlet and outlet sides of the casing. The valve stem has at its outer end an adjustable extension 46 which is threaded into the main body of the valve stem, so that the length of the valve stem may be adjusted. Mounted upon the shoulder 41 so as to loosely rest thereon is a valve disk diaphragm 47 formed of any suitable resilient material, such as a German silver alloy, spring bronze or material of such characteristics that it may be dished as shown and the center may be smoothed inwardly past said center and will snap over without any permanent set. Resting upon the outer end of the bushing is an amplifier 48 stamped from a single sheet to provide a ring and inwardly extending lever arms 49^a and 49^b. The free ends of the lever are indented to provide protuberances 50^a and 50^b for bearing upon the center of the snap disk 47. A follower plunger 51 has a rib disposed to bear upon the lever arms adjacent their fulcrum points. The plunger is a disk slidably mounted in the bore 13. A concavity is formed at the center thereof to receive a rod 52. This rod is preferably made of invar which is substantially free from contraction and expansion under temperature changes. It is adjustably mounted by means of a thread in a plug 53 secured to the outer end of a tube 54. The tube 54 is made of a material having a relatively high coefficient of expansion, such as copper, this tube is secured at its inner end in the head 19. Due to the difference in the coefficients of expansion of the rod 52 and the tube 54, expansion and contraction of the tube 54 will cause slight endwise movement of the rod 52. In order that the rod may be adjusted externally, I have shown affixed thereto a lever 55 extending through the opening in the yoke and arranged to be swung over a dial or scale marked on the valve casing body.

The tube 54 extends into the tank and is in contact with the water therein. Upon lowering of temperature in the tank, tube 54 contacts and moves rod 52 toward the plunger 51, exerting pressure upon the lever arms 49^a and 49^b. The movement is amplified by the levers and transmitted to the center of the snap disk 47. Assuming the latter is in the position shown in Fig. 4, sufficient movement of the rod 42 will cause the center of the disk to be snapped over dead center, the movement of the disk being finally completed by its resiliency. The disk acts upon the valve stem 42 against the action of compression spring 45 and opens the valve port in the bushing so as to place the inlet and outlet pipes in communication. Gas is supplied to the main burner and is lit by the pilot burner. As the temperature rises in the tank, the tube 54 expands and moves rod 52 away from the plunger. Pressure upon the snap disk is relieved whereupon it is restored by its own resiliency to the position shown in Fig. 4, the valve disk 43 closing and shutting off the gas.

The bushing 36 can be easily and accurately machined and pressed into place without distortion. It is formed of a material which is resistant to corrosion and warping. It forms the valve stem guide, the valve seat and a shoulder for snap disks or the amplifier.

What I claim is:—

1. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing connecting said inlet and outlet, a bushing inserted in said bore dividing said casing into an inlet chamber and an outlet chamber connected respectively to said inlet and said outlet, a valve seat provided in said bushing for communication of said inlet and outlet chambers, a gas valve controlling the ports in said seat, said bushing having a ledge at its outer end adapted for seating thereon of a valve actuator.

2. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing transverse to said inlet and outlet, a bushing inserted in said bore dividing said casing into an inlet chamber and an outlet chamber connected respectively to said inlet and said out-

let, a valve seat provided in the inner end of said bushing for communication of said inlet and outlet chambers, a poppet gas valve controlling the ports in said seat and having a stem, a boss in the inner end of said bushing having a bore extending therethrough to form a guide for said stem, said bushing having a ledge at its outer end adapted for seating thereon of a valve actuator.

3. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing transverse to said inlet and outlet, a bushing having a transverse wall, said bushing being inserted in said bore and dividing said casing into an inlet chamber and an outlet chamber connected respectively to said inlet and said outlet, a valve seat provided in said wall for communication of said inlet and said outlet chambers, a poppet gas valve controlling the ports of said seat having a stem, a shoulder at the outer end of said bushing, a snap disk loosely seated on said shoulder and adapted to engage said stem to operate said valve, a rim on said bushing beyond said shoulder, an amplifier seated on said rim having inwardly extending lever arms to engage said snap disk at their free ends, and means to swing said levers mounted on said casing.

4. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing transverse to said inlet and outlet, a bushing having a transverse wall inserted in said bore dividing said casing into an inlet chamber and an outlet chamber connected respectively to said inlet and said outlet, valve ports in said wall for communication of said inlet and outlet chambers, a poppet gas valve controlling said ports having a stem, a shoulder at the outer end of said bushing, a snap disk loosely seated on said shoulder and adapted to engage said stem to operate said valve, a rim in said bushing beyond said shoulder, an amplifier seated on said rim having inwardly extending lever arms to engage said snap disk at their free ends, a follower plunger slidably mounted in said bore, and having a bearing on said arms adjacent their fulcrums, and thermally operated means to move said plunger and thereby to swing said levers.

5. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing transverse to said inlet and outlet, an annular web disposed between said inlet and outlet having offset lateral openings communicating respectively with said inlet and said outlet, a bushing inserted in said bore and having a transverse wall disposed between said opening and dividing said casing into an inlet chamber and an outlet chamber, an annular internal recess in said web, openings in the circumferential wall of said bushing communicating with said recess, valve ports in said wall for communication of said inlet and outlet chambers, a poppet gas valve controlling said ports having a stem, a shoulder at the outer end of said bushing, a snap disk loosely seated on said shoulder and adapted to engage said stem to operate said valve, a rim on said bushing beyond said shoulder, an amplifier seated on said rim having inwardly extending lever arms to engage said snap disk at their free ends, and means to swing said lever mounted on said casing.

6. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing transverse to said inlet and outlet, an annular web between said inlet and outlet having offset lateral openings communicating respectively with said inlet and said outlet, a bushing inserted in said bore and having a transverse wall disposed between said opening and dividing said casing into an inlet chamber and an outlet chamber, an annular internal recess in said web, openings in the circumferential wall of said bushing communicating with said recess, valve ports in said wall for communication of said inlet and outlet chambers, a poppet gas valve controlling said ports having a stem, a ledge at the outer end of said bushing, and a valve actuator mounted on said ledge and adapted to engage said stem to operate said valve.

7. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing transverse to said inlet and outlet, an annular web between said inlet and outlet having offset lateral openings communicating respectively with said inlet and outlet, a bushing inserted in said bore and having an inner wall disposed between said openings and dividing said casing into an inlet chamber and an outlet chamber, an annular internal recess in said web, openings in the circumferential wall of said bushing communicating with said recess, valve ports in said inner wall for communication of said inlet and outlet chambers, a poppet gas valve controlling said ports having a stem, a shoulder at the outer end of said bushing, a snap disk loosely seated on said shoulder and adapted to engage said stem to operate said valve, a rim on said bushing beyond said shoulder, an amplifier seated on said rim having inwardly extending lever arms to engage said snap disk at their free ends, a follower plunger slidably mounted in said bore and having a bearing for said

arm adjacent their fulcrums and thermally operated means to operate said plunger.

8. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a main burner, a bore extending through said casing connecting said inlet and outlet, a bushing having a transverse wall, said bushing being inserted in said bore dividing said casing into an inlet chamber and an outlet chamber connected respectively to said inlet and said outlet, a valve seat provided in said wall for communication of said inlet and said outlet chambers, a poppet gas valve controlling the ports of said seat and having a stem, a shoulder at the outer end of said bushing, a snap disk loosely seated on said shoulder and adapted to engage said stem to operate said valve, a rim on said bushing beyond said shoulder, an amplifier seated on said rim having inwardly extending lever arms to engage said snap disk at their free ends, and means to swing said levers mounted on said casing.

9. A thermostat valve control structure comprising a casing having an inlet for supply of gas, an outlet for a burner, a bore extending through said casing connecting said inlet and outlet, a bushing inserted in said bore dividing said casing into an inlet chamber and an outlet chamber connected respectively to said inlet and said outlet, said bushing having a port in the end thereof for communication of said inlet and outlet chambers, a poppet gas valve controlling said port and having a stem, a boss in said bushing having a bore extending therethrough to form a guide for said stem, an annular ledge disposed at the end of said bushing opposite to said port adapted for seating thereon of a valve actuator, a snap disk seated on said ledge and adapted to engage said stem to operate said valve and thermostatic means to operate on said snap disk.

In witness that I claim the foregoing I have hereunto subscribed my name this 20th day of May, 1929.

JOHN H. GRAYSON.