July 22, 1952 W. F. JACKSON 2,604,266

COMBINED THERMOSTAT AND AUTOMATIC PILOT CONTROL

Filed June 11, 1949 2 SHEETS—SHEET 1

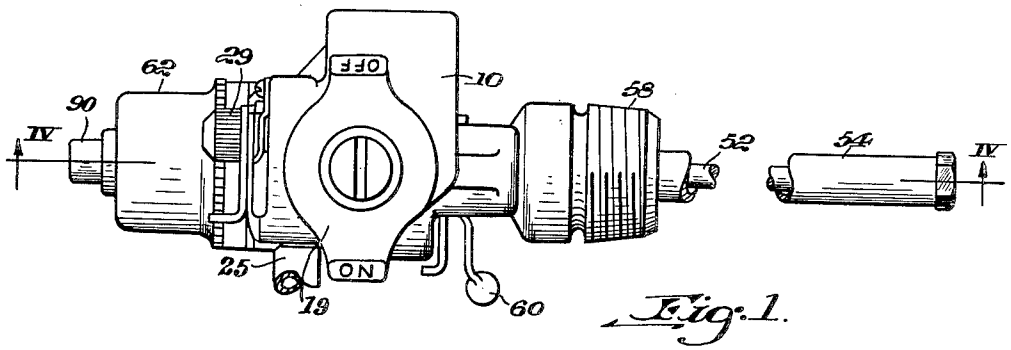


Fig. 1.

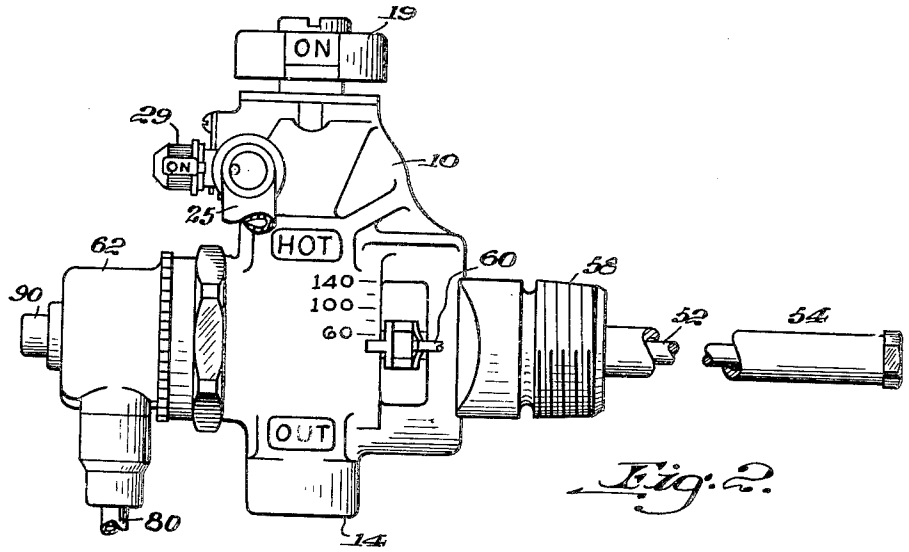


Fig. 2.

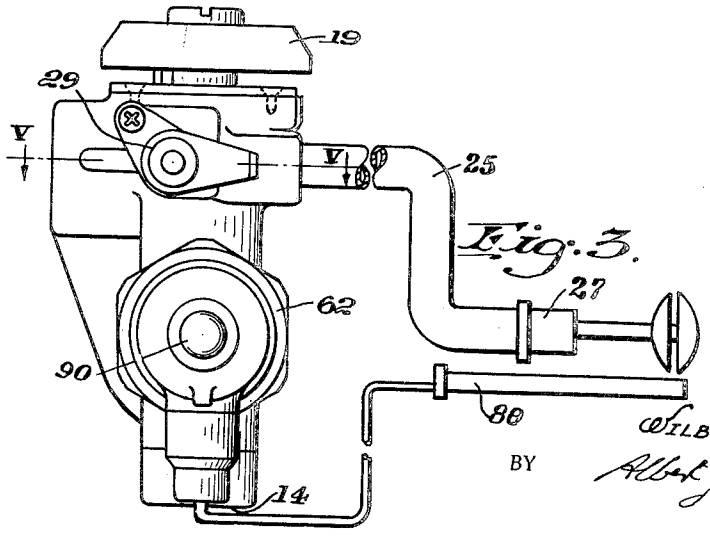


Fig. 3.

INVENTOR.
WILBUR F. JACKSON.

BY Albert J. Henderson

his ATTORNEY.

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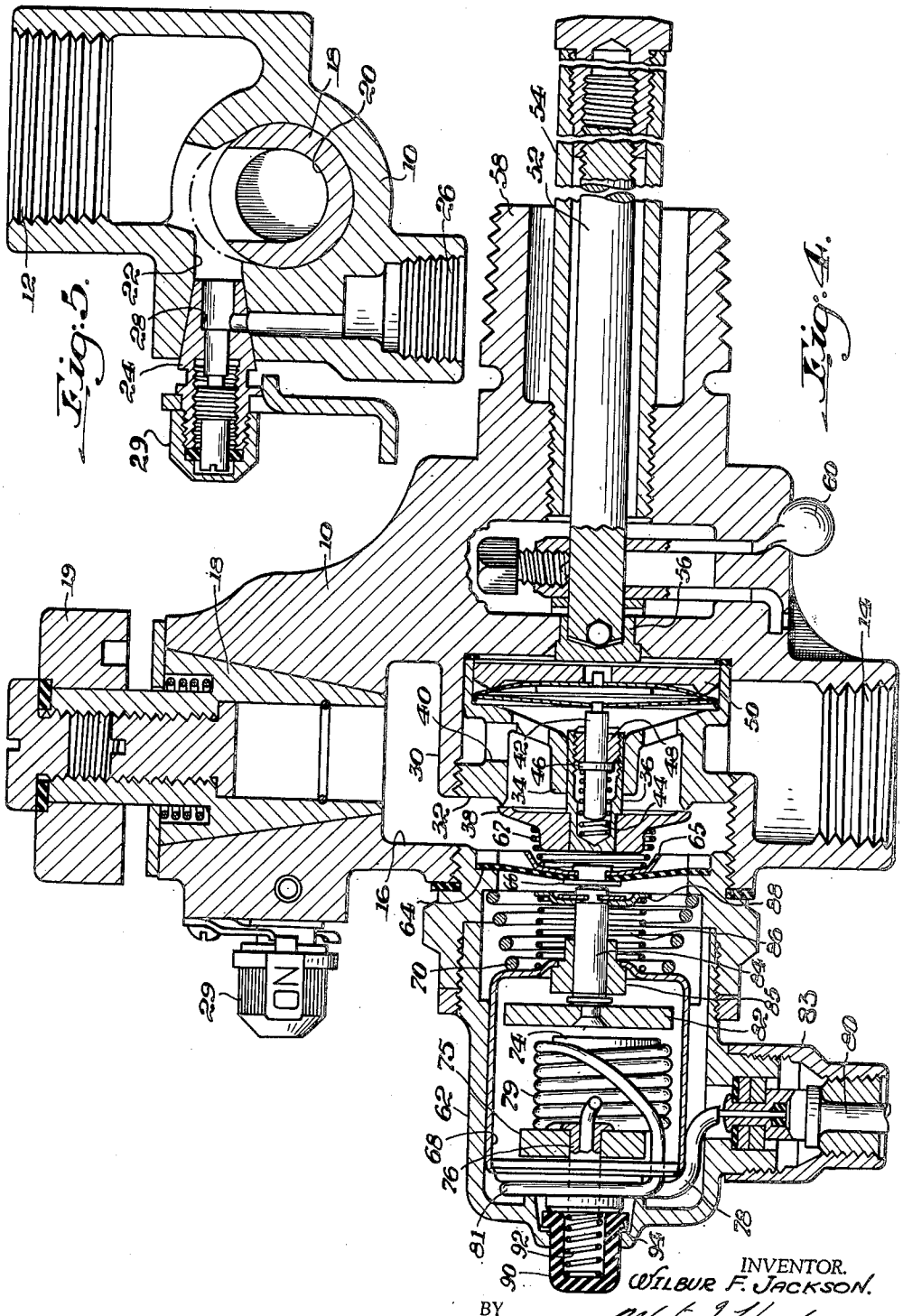


Fig. 5.

Fig. 4.

INVENTOR.
WILBUR F. JACKSON.
BY
Albert J. Henderson
his
ATTORNEY.

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COMBINED THERMOSTAT AND AUTOMATIC PILOT CONTROL

Wilbur F. Jackson, Compton, Calif., assignor to Robertshaw-Fulton Controls Company, Greensburg, Pa., a corporation of Delaware

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8 Claims. (Cl. 236—21)

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This invention relates to combination controls for gaseous fuel burners wherein the temperature controlling device and the pilot cut-off both operate upon a single control valve. In this respect the device is similar to that disclosed in U. S. Patent No. 2,361,945 to W. F. Jackson wherein the automatic pilot control embodied thermomagnetic means responsive to extinguishment of the pilot flame for causing the control valve to close in the event it was being held open by the thermostat.

The present invention is characterized by a movable electromagnet which picks up its armature in response to energization by the thermoelectric device and returns to its initial position upon completion of this resetting operation. The single control valve is thus free to be moved between closed and open positions by the thermostat which may be of the rod-and-tube type operating through snap-action mechanism. However, when the pilot flame is extinguished and the thermoelectric device cools then the armature is released and returns under spring bias to its initial position. The return movement of the armature is in a path substantially coaxial with the valve member so that the latter is moved to closed position should the thermostat be holding it open.

The provision of the movable magnet reduces the number of parts required for safe operation during resetting. Moreover, the separate armature and control valve construction retains intact the majority of features found advantageous in prior devices of this general type. Among these may be mentioned the provision for automatic shut-off of the main burner fuel in the event of pilot flame failure; the single valve for dual control purposes which is not subjected to damage when the automatic shut-off occurs; the safeguard against sticking valves which may occur where a separate cut-off valve is provided and infrequently operated; and the safe-lighting feature provided by preventing flow of fuel to the main burner during the resetting operation.

In the accompanying drawings:

Fig. 1 is a plan view of the control device of this invention;

Fig. 2 is an elevation;

Fig. 3 is a side elevation;

Fig. 4 is an enlarged sectional view taken on the line IV—IV of Fig. 1; and

Fig. 5 is an enlarged sectional view taken on the line V—V of Fig. 3.

Main shut-off cock

Referring more particularly to the drawing the

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control device comprises a casing 10 provided at one end with a lateral inlet opening 12 for fuel and at the other end with an outlet opening 14 which is adapted to be connected by suitable piping with the main or heating burner of a water heater or other appliance (not shown).

A valve chamber 16 is positioned in the body 10 intermediate the inlet 12 and outlet 14 and passage of fluid, such as gaseous fuel, between the inlet 12 and the valve chamber 16 is under control of a main shut-off cock 18. As shown more clearly in Fig. 5, the shut-off cock 18 is provided with an angular port 20 which is movable upon rotation of the cock 18 by the usual knob 19 to open and close communication between the inlet 12 and the valve chamber 16.

Pilot shut-off cock

A pilot passage 22 communicates at one end with the inlet 12 adjacent the main shut-off cock 18 and the passage of fuel therein is under control of a pilot shut-off cock 24. An outlet 26 is provided in the body 10 for connection to a conduit 25 leading to the pilot burner of the appliance 27 when an angular port 28 in the pilot shut-off cock 24 is rotated therewith by the usual knob 29 to open position.

Control valve mechanism

A partition 30 projects from opposite walls of the valve chamber 16 and provides a support for an annular valve seat member 32 therein. An axial hollow boss 34 is formed within the annular valve seat 32 and provides a bearing for a hollow valve stem 36 for relative slidable movement thereof. A disc valve member 38 is mounted on the valve stem 36 for movement therewith between open and closed positions relative to the seat 32. The valve member 38 is normally biased toward the seat 32 by means to be described more fully hereinafter. Suitable ports 40 extend laterally through the valve seat 32 to provide communication between the valve chamber 16 and the outlet 14 when the valve member 38 is in open position.

The hollow valve stem 36 contains an override mechanism comprising a plunger 42 and biasing spring 44 which serves to urge a collar 46 on the plunger 42 into engagement with a bushing 48 closing the inner end of the hollow valve stem 36. The plunger 42 projects through the bushing 48 for operative engagement with a clicker mechanism of well-known form including a thrust element 50 which is biased within the annular valve seat 32 for imparting snap-action movement to the valve member 38.

Temperature regulation

Thermostatic means for operating the valve 38 through the clicker disc mechanism is provided and, in this embodiment, consists of an element of the rod-and-tube type. The tube 54 of this thermostatic element is mounted at one end in the valve body 10 and has the rod 52 threadedly secured thereto at the opposite end. The inner end of the rod 52 is movable on the threaded connection for operative engagement with a slidable cap element 56 which is carried in the valve body 10. The opposite side of the cap element 56 engages with the thrust element 50 of the clicker mechanism for operating the same as will hereinafter be apparent. Suitable means for mounting the control in the water heater or other appliance is provided by an elongated boss 58 projecting from the body 10 around the rod-and-tube element 52, 54. The temperature at which the valve member 38 will be operated may be adjusted by means of the usual lever 60 carried by the rod 54 and manually operable for rotating the rod 52 relative to the tube 54 as previously explained. It will be understood that other well-known thermostatic devices may be substituted including the hydraulic or liquid type if desired.

Automatic pilot control

Thermoelectric means are provided for moving the valve member 38 to closed position in the event of extinguishment of the pilot burner flame and irrespective of the thermal condition of the thermostat. To this end, a magnet housing 62 is mounted on the body 10 on the side opposite the connection 58 and extending coaxially with the valve member 38. The interior of the magnet housing 62 communicates with the interior of the body 10 defined by the valve chamber 16 and a flexible sealing disc 64 extends across the interior of the housing 62 at its junction with the body 10 for closing the communication therebetween. Thus, passage of fluid from the valve chamber 16 to the magnet housing 62 is prevented. The sealing disc 64 carries a spring retainer 65 secured thereto by an axially located plug or rivet 66. A coil spring 67 is operative between the valve member 38 and the retainer 65 and serves to bias the valve member 38 toward the seat 32 as previously indicated.

A magnet cover 68 is mounted within the housing 62 for slidable movement therein toward and away from the sealing disc 64. The cover 68 is biased toward the outer end of the magnet housing 62 by a coil spring 70 operative between the cover 68 and the housing 62. An electromagnet comprising a horseshoe frame 74 is seated on its base 75 at one end of the cover 68 and is secured thereto by a hollow rivet 76 extending through these members. The usual winding 78 has one end secured in the hollow rivet 76 to provide a ground connection as will be apparent hereinafter. The winding continues in the form of a pair of coils 79 around the legs of the horseshoe magnet 74 although only one such coil is shown in the drawing. The opposite end of the winding 78 extends through a suitable aperture in the cover 68 to the exterior thereof and is formed into a loop 81 between the end face of the cover 68 and the adjacent end of the housing 62. The looped end is secured in a socket 83 for one end of a thermocouple 80, the opposite end of which provides a hot junction for exposure to the pilot burner flame.

An armature 82 is supported within the magnet cover 68 on an armature stem 84 and is separable from the pole faces of the magnet 74 during its movement between attracted and released positions. The armature stem 84 is slidably mounted in a hollow bearing member 85 on the cover 68 and projects therefrom into abutting engagement with the plug or rivet 66 on the seating disc 64. The armature 82 is biased to its released position by a coil spring 86 operable between the cover 68 and a retaining plate 88 carried on the projecting end of the armature stem 84. As the spring 86 is considerably stronger than the valve spring 67 sufficient force is exerted thereby on the valve member 38 to hold the same in its closed position relative to the valve seat 32 whenever the armature 82 is disengaged from the pole faces of the magnet 74. It should be observed, however, that the coil spring 70 is considerably stronger than the armature spring 86 for a purpose apparent hereinafter.

As is well known, the electrical energy generated by the thermocouple 80 responsive to heating by the pilot flame is insufficient to attract the armature 82 from its released position but is sufficient to hold the same in attracted position after the usual resetting operation has been conducted. Consequently, manual resetting means are employed to move the magnet 74 into engagement with the armature 82 and take the form of a resetting button 90 which projects from the magnet housing 62 and engages at its inner end with the rivet 76 on the magnet cover 68. A coil spring 92 is housed within the button 90 and engages at its inner end with the magnet cover 68 for biasing the button outwardly of the magnet housing 62. A head 94 is formed on the inner end of the button 90 for cooperation with a suitably flanged end of the magnet cover 62 to prevent ejection of the button 90 therefrom under bias of the spring 92.

Operation

The control device is placed in operative condition by manual operation when the pilot burner is lighted and the valve member 38 is normally engaged with its seat 32. The main shut-off cock 18 and pilot cock 24 are both manually rotated to open position and fuel thereupon flows through the inlet 12 to the valve chamber 16 and to the pilot outlet 26. The fuel issuing from the pilot burner 27 is then lighted. The thermocouple 80 has its hot junction exposed to the pilot burner flame and thereupon becomes heated and develops sufficient current to energize the winding 78 of the electromagnet. The resetting operation is then conducted by manual pressure applied to the button 90 for moving the magnet cover 68 and magnet 74 jointly relative to the armature 82. During this movement the coil spring 70 is compressed, the bearing member 85 moves relatively to the stem 84 and the coil spring 86 is somewhat compressed as will be apparent. It will be observed that the winding 78 does not interfere with free movement of the magnet 74 due to the provision of the loop 81 which also eliminates any strain on the electrical connections. When this portion of the resetting operation is completed, the armature 82 is firmly engaged with the pole-faces of the magnet 74.

After the thermocouple develops sufficient current to energize the magnet 74, the reset button 90 is released and the bias of the spring 70 serves to retract the magnet cover 68 and the magnet 74 to their initial positions. However, the armature 82 is now carried along with the magnet 74 against the bias of the coil spring 86 which

remains somewhat compressed. The armature stem 84 can thus no longer exert a force on the rivet 66 carried by the sealing disc 64 so that the valve member 38 becomes freed for movement to open position relative to the valve seat 32.

It should be observed, however, that movement of the valve member 38 to open position cannot occur, due to the bias of the valve spring 67, until the thermostat 52, 54 is adjusted by manual operation of the lever 60 to a desired temperature setting and operation of the main burner is required by the thermal conditions sensed by the thermostat. The rod 52 exerts a force on the thrust element 59 and the clicker mechanism opens the valve member 38 against the bias of the valve spring 67. Flow of fuel from the inlet 12 through the valve chamber 16 and ports 40 in the valve seat 32 to the outlet 14 is now permitted and operation of the main burner in the usual manner can then occur. When the temperature sensed by the thermostat 52, 54 reaches that for which the adjustment has been set, then closure of the valve member 38 occurs under bias of the spring 67 and is permitted due to reverse positioning of the clicker mechanism as is well known to those skilled in the art. However, during this normal reciprocation of the valve member 38 in controlling flow of fuel to the outlet 14, the armature 82 remains engaged with the pole faces of the magnet 74.

In the event that the pilot burner is extinguished, then the thermocouple 80 ceases to generate current causing deenergization of the electromagnet and movement of the armature 82 away from the pole faces of the magnet 74. Such release of the armature 82 is due to the bias of the coil spring 86 and serves to bring the armature stem 84 into operative engagement with the rivet 66 carried by the sealing disc 64, thus causing closure of the valve member 38. As previously indicated, such closure can occur regardless of whether the thermostat 52, 54 is operating to hold the valve member 38 in open position due to provision of the override connection within the hollow valve stem 36. Thus, the bias of the override spring 44 is overcome upon release of the armature 82 due to the stronger bias exerted by the coil spring 86. The hollow stem 36 moves relatively to the plunger 42 during compression of the override spring 44 and without causing reverse operation of the clicker mechanism as in normal thermostatic operation.

It will be understood that many changes may be made in the details of construction and arrangement of parts to accomplish the purposes of this invention without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A control device comprising in combination, a movable electromagnet having an armature separable therefrom for movement between attracted and released positions, a valve member movable independently of said armature between open and closed positions and having operative engagement with said armature in said released position thereof, means for biasing said armature to released position to hold said valve member in closed position, thermoelectric means adapted for energizing said electromagnet but insufficiently to attract said armature from released position, resetting means operable for overcoming said biasing means and moving said electromagnet into engagement with said armature while maintaining said armature in operative engagement with said valve member, and

means effective upon completion of the resetting operation for retracting said electromagnet and causing movement of said armature out of operative engagement with said valve member to free the same for movement between said open and closed positions.

2. A control device comprising in combination, a movable electromagnet having an armature separable therefrom for movement between attracted and released positions, a valve body having a seat spaced from said electromagnet, a valve member movable independently of said armature between open and closed positions relative to said seat and having operative engagement with said armature in said released position thereof, means operative from one side of said seat for biasing said armature to released position to hold said valve member in closed position, yieldable actuating means operative from the opposite side of said seat for actuating said valve member between said closed and open positions while said armature is in said attracted position, thermoelectric means adapted for energizing said electromagnet but insufficiently to attract said armature from released position, resetting means operable for overcoming said biasing means and moving said electromagnet into engagement with said armature while overcoming said yieldable actuating means and holding said valve member in closed position, means effective upon completion of the resetting operation for retracting said electromagnet and causing movement of said armature out of operative engagement with said valve member to free the same for movement to open position by said actuating means.

3. A control device comprising in combination, a valve body having inlet and outlet passages for fluid and a valve seat, a valve member movable between open and closed positions relative to said seat for controlling fluid flow through said passages, a magnet housing carried by said body on one side of said seat, a movable electromagnet in said housing having an armature separable from said electromagnet for movement between attracted and released positions independently of said valve member, yieldable means operative between said electromagnet and said armature on one side of said seat for biasing said armature to released position to hold said valve member in closed position, yieldable actuating means operative from the opposite side of said seat for actuating said valve member between said closed and open positions while said armature is in said attracted position, thermoelectric means adapted for energizing said electromagnet but insufficient to attract said armature from released position, resetting means reciprocable relative to said housing for overcoming the first said yieldable means and moving said electromagnet into engagement with said armature while maintaining said armature in operative engagement with said valve member to overcome said actuating means and hold said valve member in said closed position, second yieldable means operative between said housing and said electromagnet for retracting the latter upon completion of the resetting operation and thereby causing movement of said armature out of operative engagement with said valve member, and means operative from the opposite side of said seat for actuating said valve member to open position when the same is freed by said armature.

4. A control device comprising in combination, a valve body having inlet and outlet passages for fluid and a valve seat, a valve member

movable between open and closed positions relative to said seat for controlling fluid flow through said passages, a magnet housing carried by said body on one side of said seat and communicating with the interior of said body, flexible sealing means between said body and housing for closing said communication therebetween, said sealing means being movable independently of said valve member and being biased away from said valve member, a magnet cover mounted for slidable movement in said housing, an electromagnet carried by said cover for movement therewith and having an armature separable from said electromagnet for movement between attracted and released positions, an armature stem projecting through said cover into operative engagement with said sealing means, first spring means between said cover and projecting end of said stem for biasing said armature to released position and said sealing means into operative engagement with said valve member for holding the same in closed position, thermoelectric means adapted for energizing said electromagnet but insufficiently to attract said armature from released position, resetting means reciprocable relative to said housing and operable on said cover for overcoming said first spring means and moving said electromagnet into engagement with said armature, and second spring means operative between said housing and said cover for retracting said electromagnet upon completion of said resetting operation and thereby causing movement of said sealing means out of operative engagement with said valve member.

5. A control device as claimed in claim 4 having actuating means operative from the opposite side of said seat from said first spring means for actuating said valve member to open position when the same is freed by said movement of said sealing means, said actuating means including a yieldable connection adapted to be overcome by said resetting means during said resetting operation and by said first spring means while said armature is in said released position.

6. A control device as claimed in claim 5 wherein said actuating means includes a thermostat and said yieldable connection includes an override connection between said thermostat and said valve member, said override connection including yieldable means incapable of resisting movement of said valve member to closed position upon movement of said armature to released position irrespective of the thermal condition of said thermostat.

7. A control device comprising in combination, a valve body having inlet and outlet passages for fluid and a valve seat, a valve member movable between open and closed positions relative to said seat for controlling fluid flow through said passages, a magnet housing carried by said body on one side of said seat and communicating with the interior of said body, flexible sealing means between said body and said housing for closing said communication therebetween, a magnet cover mounted for slidable movement in said housing, an electromagnet carried by said cover for movement therewith and having an armature separable from said electromagnet for movement between attracted and released positions, an armature stem projecting through said cover for operative engagement with said sealing means, first spring means between said cover and said projecting end of said stem for biasing said armature to released position and said sealing means into operative engagement with said valve member for holding the same in closed position, thermoelectric means adapted for energizing said electromagnet but insufficiently to attract said armature from said released position, resetting means reciprocable relative to said housing and operable on said cover for overcoming said first spring means and moving said electromagnet into engagement with said armature, and second spring means operative between said housing and said cover for retracting said electromagnet upon completion of said resetting operation and thereby causing movement of said armature out of operative engagement with said valve member.

8. A control device as claimed in claim 7 having yieldable actuating means operative from the opposite side of said seat from said first spring means for actuating said valve member to open position when the same is freed by said last named movement of said armature, said actuating means being adapted to be overcome by said resetting means during said resetting operation and by said first spring means while said armature is in said released position.

WILBUR F. JACKSON.

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