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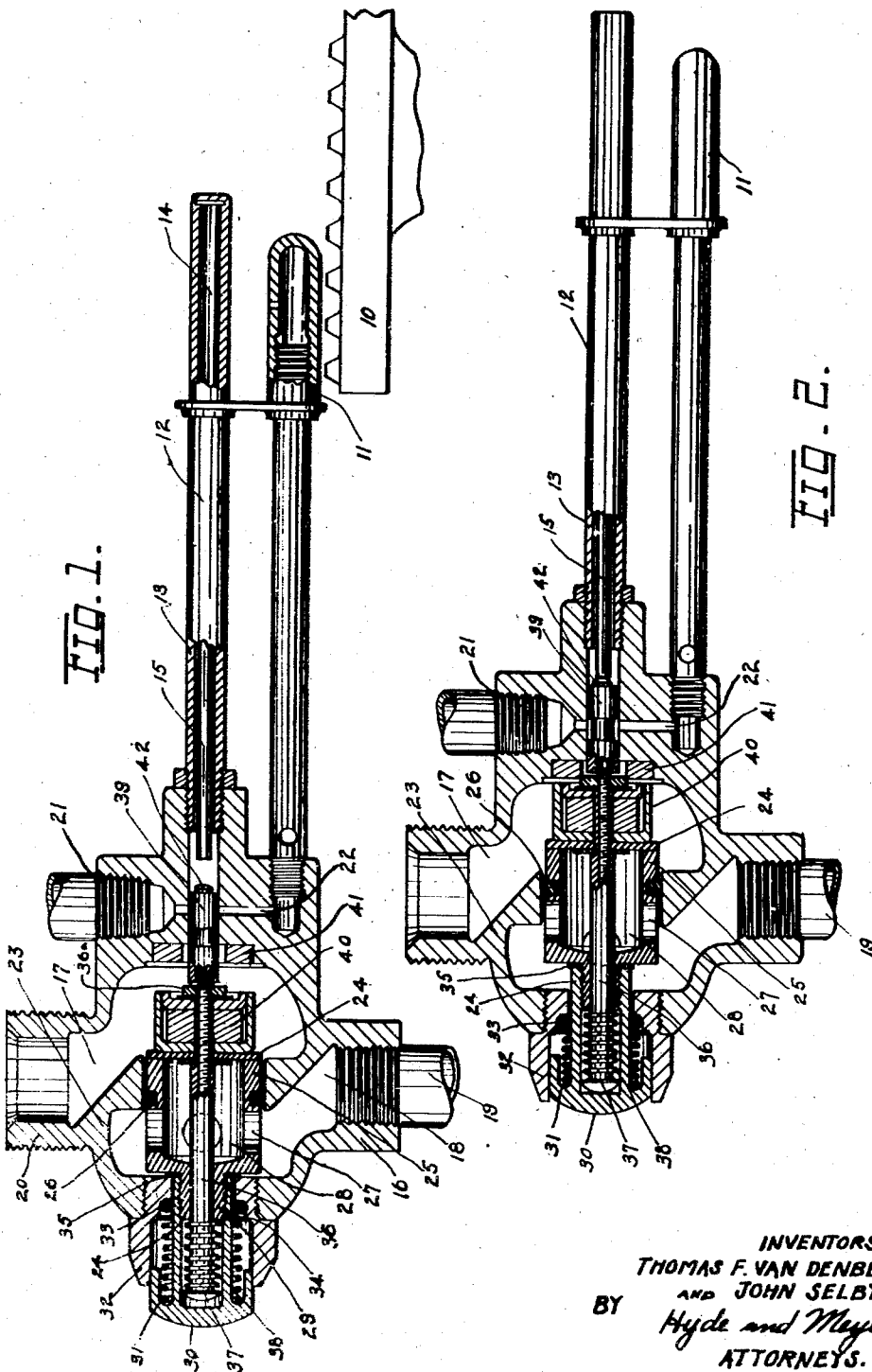
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VALVE CONTROL MECHANISM

Filed March 12, 1945

2 Sheets-Sheet 1



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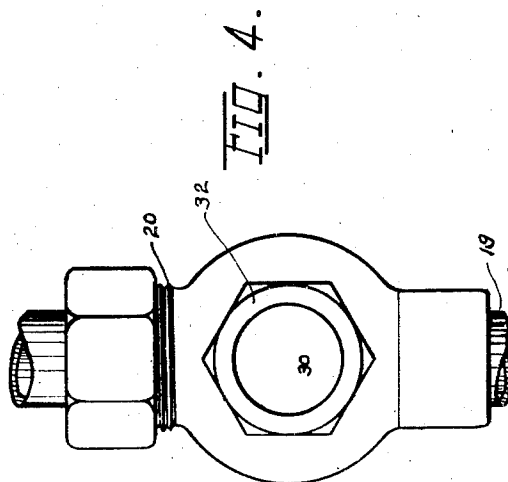
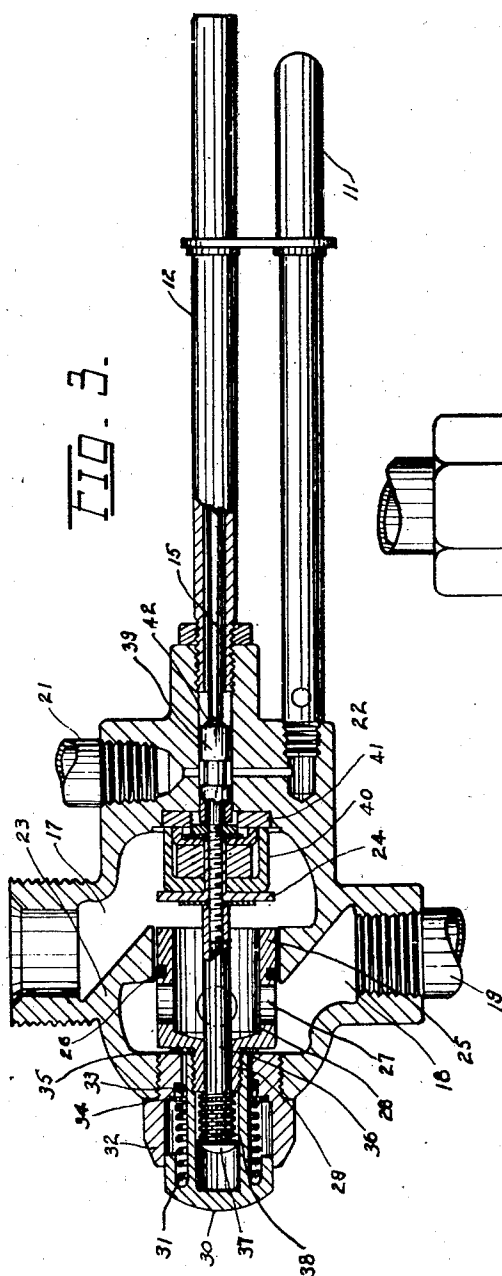
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VALVE CONTROL MECHANISM

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This invention relates to valve control mechanism, and more particularly to safety pilot valve mechanism, such as is used for controlling the flow of gas to the gas burner of a hot water heater, a furnace or like device.

One object of the invention is to provide improved valve control mechanism including valve and seat members both of which are movable, the valve seating in the direction of gas flow, together with reset means for advancing said members to cocked position and for releasably maintaining the valve in open or operative position while permitting the seat to retire.

Still another object is to provide such control mechanism in which the maintaining means includes a couple comprising cooperating mated permanent magnet and keeper members, together with means for advancing them into contacting and holding position, and condition responsive means for forcing them apart to release the valve, upon appropriate variation in the condition to which the valve mechanism is responsive.

Another object is to provide improved valve mechanism of this kind in which both the valve and its seat are independent of and form no part of the usual integral cross wall of the valve body which separates the supply and discharge chambers, which wall here serves merely as a guide for their motion to and fro.

Further objects of the invention in part are obvious and in part will appear more in detail hereinafter.

Referring to the drawings, which represent one of many suitable embodiments of the invention.

Fig. 1 is a longitudinal sectional elevation, showing the parts in the valve closed or "off" position;

Fig. 2 is a similar view, illustrating the reset button pushed in to advance or cock the parts ready for production of maintaining effect;

Fig. 3 is a similar view, illustrating all parts in their final or valve open position; and

Fig. 4 is an end view from the left in Fig. 1.

While the invention may be employed for use in the control of various devices for producing heat, such as electric heaters, oil or gas burners employed in water heaters, furnaces or the like, for convenience, and in no sense of limitation, it has been illustrated as applied for use in the control of the gas supplied to the burner of a domestic hot water heater. Such a burner is illustrated conventionally at 10. Adjacent to it is a pilot burner, shown conventionally at 11, while adjacent to both the main and pilot burners, and sensitive to the temperature of either or both thereof, is a suitable thermostatic or thermally

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sensitive device, such as the two-element thermostat 12, including relatively expansible and non-expansible members, such as the outer tube 13, made of brass, copper or other relatively expansible material, and within which is located a rod 14 made of relatively non-expansible material such as "Invar" or an equivalent therefor. Relative motion of contraction and expansion is communicated to the control parts by a push rod 15, made of material similar to that of the tube, for the purpose of avoiding the effect of ambient temperature or variations therein, as will be readily understood.

The valve mechanism includes two valves, one 15 a main valve for controlling the supply of gas to the main burner, and the other a pilot valve for controlling the supply of gas to the pilot burner.

The valve mechanism comprises a hollow valve body 16 provided with supply and discharge chambers 17, 18, the latter communicating with the main burner 10 by way of a pipe 19 and the former being threaded at 20 for connection thereto of a pipe or conduit (not shown) coming from the gas supply source. Another pipe from said source may be connected to the valve body at 21 for supplying gas to a passage 22 by means of which it is conducted to the pilot burner 11.

The supply and discharge chambers 17, 18, are separated by the usual wall 23, here shown as integral with the casing or body. The flow of gas from the supply to the discharge chamber is controlled by the relative positions of a main valve 24, of disc form, cooperating with a seat on the end of a cylindrical or cup-shaped seat member 25, which works back and forth in and is guided by the walls of an opening in the cross wall 23, the joint between member 24 and the cross wall 23 being maintained tight by a sealing ring 26, may be what is called an O ring made of natural or synthetic rubber or other suitable material. Member 25 is open at its valve seat end; its cylindrical wall is provided with several, such as four, ports or openings 27 providing communication from the chamber 28 within the member 25 to the discharge chamber 18; while the opposite end of said member is provided with a reduced threaded extension 29 screwed into the shank of a reset cap or button 30 normally biased outwardly or toward retracted position by a compression spring 31. The shank of this button slides in an opening in a thimble 32 screwed into an opening in a wall of the valve casing, the joint between the button shank and thimble being maintained tight by an O ring 33 held in position

by a washer 34 against which bears one end of spring 31. A small lock washer 35 is usually inserted between the button shank and the stem of the valve seat member.

Within the threaded extension 29 of the valve seat member is slidably mounted a long rod 36 having a head 37 at its outer end engaged by a light compression spring 38 having a normal tendency to move the rod outwardly or to the left in Fig. 1. This rod carries the main valve 24 before referred to, and an extension of said rod beyond the valve, carries a pilot valve member 39, an annular channel of which may be moved into and out of registration with the pilot valve supply channel 22, for controlling the flow of gas to the pilot burner, as will be readily understood. This pilot valve is a loose fit on the rod, with slight movement thereon, both laterally and longitudinally, in order that the valve may be self-adjusting to the seat surface in or along which it slides. The relative motion between the valve and rod, however, indeed is so little as to be almost imperceptible—just enough to provide self-accommodation and nothing more, so that from the practical standpoint, insofar as valve operation is concerned, the two valves always move together.

The main valve and pilot valve, when moved to valve open position, may be releasably maintained in such position by any suitable means, here shown as consisting of the two members of a permanent magnet couple, consisting of cooperating mated permanent magnet and keeper members. One of the members of this couple is mounted to be movable with the main valve, while the other may also be movable but is here shown as stationary. Either member of the couple may be the one associated to move with the valve. In the form shown the magnet 40 is associated to move with the valve, by being secured to the rod 36 by the same nut 36a which secures the valve thereto. This permanent magnet 40 may be an Alnico or other equivalent magnet having high magnetic flux. The cooperating mate or keeper for the magnet is indicated at 41. It consists of a disc of iron rigidly and immovably mounted in a recess of the valve body, which of course is made of brass or other non-magnetic material.

The operation of the control mechanism described is as follows:

Fig. 1 illustrates the parts in the inoperative or off position. The main and pilot valves are both closed. The magnet is spaced a material distance from the keeper. The inner end 42 of the rod or stem 36 is spaced from the end of the push rod 15. The parts are held in this position under the influence of the compression springs 31, 38, which are expanded to their maximum.

To set the burner in operation the operator applies a thumb to the reset cap 30 and pushes it in or to the right in Fig. 1 moving the parts to the position shown in Fig. 2. This motion is limited by engagement of the end 42 of the stem 36 with the end of the push rod 15. In this position the main valve 24 and seat member 25 have been moved to the right, but without motion relative to each other, so that the main valve remains closed. The pilot valve is open, because the annular channel member 39 now registers with the passage 22. While holding the reset button advanced, the pilot flame is ignited. This applies heat to the thermostat 12, expanding the copper tube thereof and permitting the inner rod 14 and the push rod 15 to move to the right in Fig. 2. Continued pressure of the thumb on the reset button causes

the rod 36 to follow such movement until finally the permanent magnet comes into actual contact with the keeper. The magnetic flux between the magnet and its keeper is so strong now that upon release of the reset button, the valve 24 is maintained in open position, but the seat 25 and reset button retire by motion to the left in Fig. 2, until the parts reach the position shown in Fig. 3.

In this position the main valve is now wide open and gas flows from the supply chamber 17 to the chamber 28 within member 25 and thence by way of ports 27 to the discharge chamber 18 and by way of pipe 19 to the burner, where the gas stream is ignited by the flame of the pilot burner.

If, at any time, the flames are extinguished as by a momentary heavy reduction in the gas supply, or as the result of a back draft, or for any other reason, the thermostat 12 immediately cools. The copper tube thereof contracts, with the result of moving the push rod 15 to the left in the drawings, thus forcibly separating the members of the magnet couple, the magnet moving to the left. As soon as the magnet is actually separated from its keeper, the spring 38 becomes effective and moves the stem 36 and all parts carried thereby, including the main and pilot valves, to the left, or to their original off positions, shown in Fig. 1. This operation closes both valves so that the supply of gas is entirely cut off, safeguarding the heater against the possibility of explosion or the like, and requiring another starting operation to put the device into operative condition, in the manner before described.

In this valve mechanism the main valve seats in the direction of flow of the gas to the main burner from the supply chamber 17 to the discharge chamber 18, or in a direction opposite to that of advance movement of the valve and seat to the valve maintaining position. The valve itself is housed within the supply chamber, and the seat member is movably guided within the usual cross wall of the valve body, but forms no part thereof. All of the valve and seat parts, including as well the magnet, the reset button and the springs, are capable of assembly as a single self-contained unit, capable of assembly on the bench and insertable into the valve casing by the simple act of screwing in the thimble 32. This thimble may have its external surface of non-circular say hexagonal shape, as shown, enabling it to be readily removed for purposes of repair, adjustment or replacement of parts.

Other advantages of the invention will be apparent to those skilled in the art.

What we claim is:

1. In combination, a hollow valve casing provided with fuel supply and discharge chambers, cooperating valve and seat devices both movably mounted in said casing and adapted in different relative positions to prevent or permit fuel flow from the supply to the discharge chamber, said devices being normally biased toward flow preventing relation with each other, reset means for advancing said devices while in flow preventing relation to a cocked position, a magnet couple including cooperating relatively movable mated permanent magnet and keeper members, one of said members being stationary and the other being movable and operatively associated with one of said devices for movement therewith, and thermally responsive means sensitive to the presence of heat produced by fuel flowing past said valve and including abutment means limiting advance reset motion of said movable member to a position close to but out of contact with its

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mate, said thermally responsive means being of such form and construction that when it is heated said abutment retires in the direction of advance movement of said reset means and permits said movable member to be further advanced into holding contact with its mate.

2. In combination, a hollow valve casing provided with fuel supply and discharge chambers, cooperating main valve and seat devices both movably mounted in said casing and adapted in different relative positions to prevent or permit fuel flow from the supply to the discharge chamber, said devices being normally biased toward flow preventing relation with each other, reset means for advancing said devices while in flow preventing relation to a cocked position, a magnet couple including cooperating relatively movable mated permanent magnet and keeper members, one of said members being stationary and the other being movable and operatively associated with one of said devices for movement therewith, a pilot valve movable with said movable member, and thermally responsive means sensitive to the presence of heat produced by fuel flowing past said pilot valve and including abutment means limiting advance reset motion of said movable member to a position close to but out of contact with its mate, said thermally responsive means being of such form and construction that when it is heated said abutment retires in the direction of advance movement of said reset means and permits said movable member to be further advanced into holding contact with its mate.

3. Valve mechanism of the character described, comprising a hollow valve casing having fuel supply and discharge chambers, cooperating valve and seat devices both movably mounted in said casing and arranged by their relative positions to control fuel flow from the supply to the discharge chamber, a magnet couple comprising cooperating permanent magnet and keeper members one of which is stationary and the other of which is movable and is operatively associated with one of said devices for movement therewith, reset means for simultaneously advancing said movable member and said devices while the latter are in valve closed relation with each other, stop means for limiting such advance motion to a position in which said members are close to but out of contact with each other, condition responsive means for causing said stop means to retire in the direction of advance movement of the reset means and thereby permit said movable member to be further advanced into contact with its mate, whereby, upon release of the reset means said one device is held in its advance position, and means biasing the other of said devices toward retracted position.

4. Thermostatic valve control mechanism of the character described, comprising valve means including cooperating valve and seat devices, both of which are movable, thermally responsive means sensitive to heat produced by fuel flowing past said valve means, a magnet couple including cooperating mated permanent magnet and keeper members one of which is stationary and the other of which is movable, biasing means tending to retract said movable couple member and said valve and seat devices, reset means for advancing said devices while engaged in valve closed position and said movable couple member to a position in which said member is close to but out of contact with its mate, said thermally responsive means when cold limiting advance of the movable couple member and being effective when heated by the

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fuel to permit further advance of the movable couple member into contact with its mate, whereby upon reduction in its temperature said thermally responsive means applies force to the movable couple member to separate it from its mate.

5. Control valve mechanism of the character described, comprising a hollow valve body having fuel supply and discharge chambers, a magnet couple including mated permanent magnet and keeper members one of which is fixedly mounted in the supply chamber and the other of which is movable, valve means controlling fuel flow from the supply to the discharge chamber, said valve means including a valve movable with the movable member and a chambered valve seat member cooperating therewith and having a chamber communicating through the valve opening with the supply chamber and also communicating with the discharge chamber, biasing means tending to retract the valve seat member to valve open position, and reset means for advancing the valve and valve seat members in closed relation and with them the movable couple member into operating position with the members of the magnet couple in holding contact.

6. Control valve mechanism of the character described, comprising a hollow valve body having fuel supply and discharge chambers, a magnet couple including mated permanent magnet and keeper members one of which is fixedly mounted in the supply chamber and the other of which is movable, valve means controlling fuel flow from the supply to the discharge chamber, said valve means including a valve movable with the movable member and a chambered valve seat member cooperating therewith and having a chamber communicating through the valve opening with the supply chamber, and also communicating with the discharge chamber, biasing means tending to retract the valve seat member to valve open position, reset means for advancing the valve and valve seat members while in closed relation and with them the movable couple member into operating position with the members of the magnet couple in holding contact, and thermally responsive means sensitive to flame produced by fuel flowing past the valve and adapted when the flame is extinguished to apply pressure to the movable couple member to both forcibly separate it from its mate and initiate valve closing movement.

7. In combination, main and pilot valves each including valve and seat members, the two valve members being connected and being biased to move together toward valve closed position, one seat member being stationary and the other movable, and a magnet couple including cooperating mated permanent magnet and keeper members one of which is connected to said valve members to move therewith and the other of which is stationary.

8. In combination, main and pilot valves each including valve and seat members, the two valve members being connected and being biased to move together toward valve closed position, one seat member being stationary and the other movable and biased toward a retracted position, a magnet couple including cooperating mated permanent magnet and keeper members one of which is connected to said valve members to move therewith and the other of which is stationary, reset means for advancing the two valve members and the movable seat member, and thermally responsive means sensitive to flame produced by fuel flowing past said pilot valve and operatively as-

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sociated with the movable couple member for preventing or permitting holding contact thereof with its mate, dependent upon the temperature to which said thermally responsive means is subjected.

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The following references are of record in the file of this patent:

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