June 7, 1932. P. F. SHIVERS 1,862,373

SNAP ACTION VALVE

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Fig. 2.

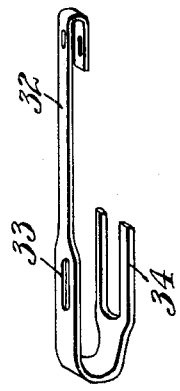


Fig. 1.

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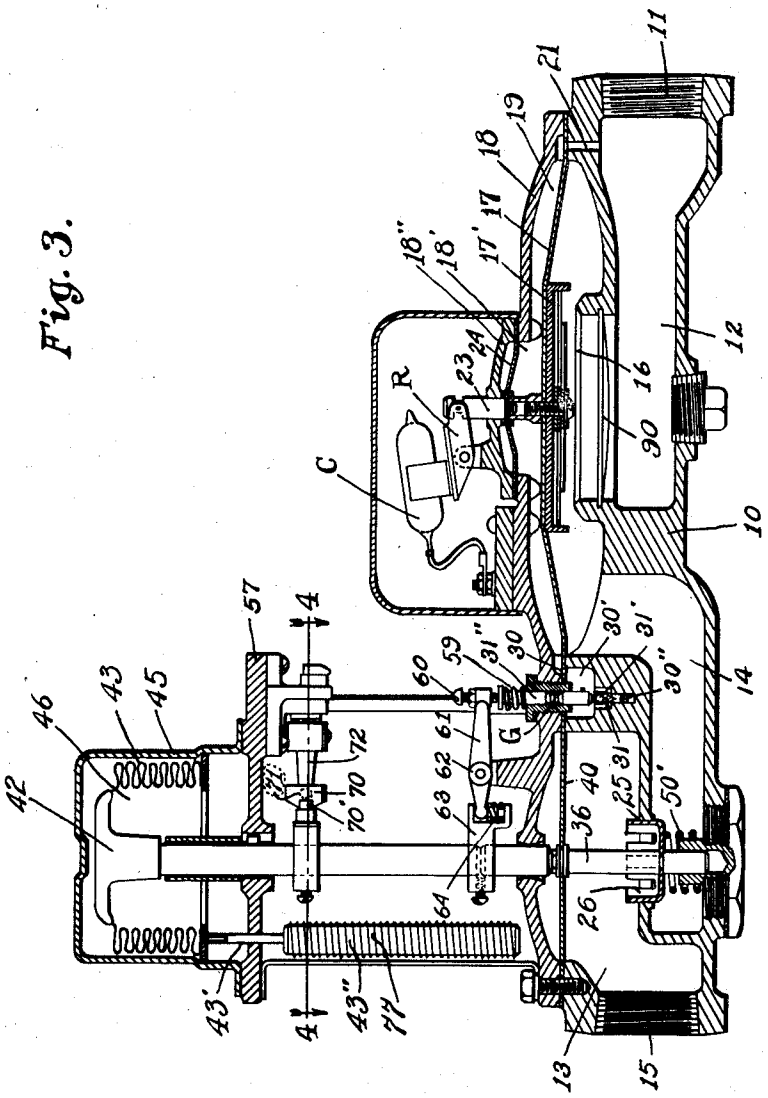
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SNAP ACTION VALVE

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Fig. 3.



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Fig. 4.

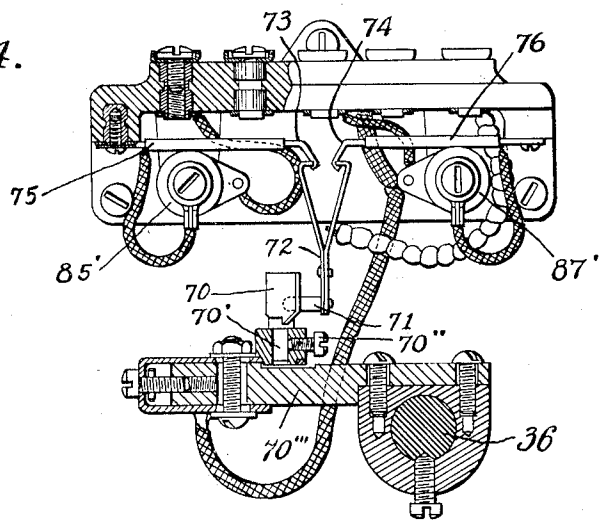
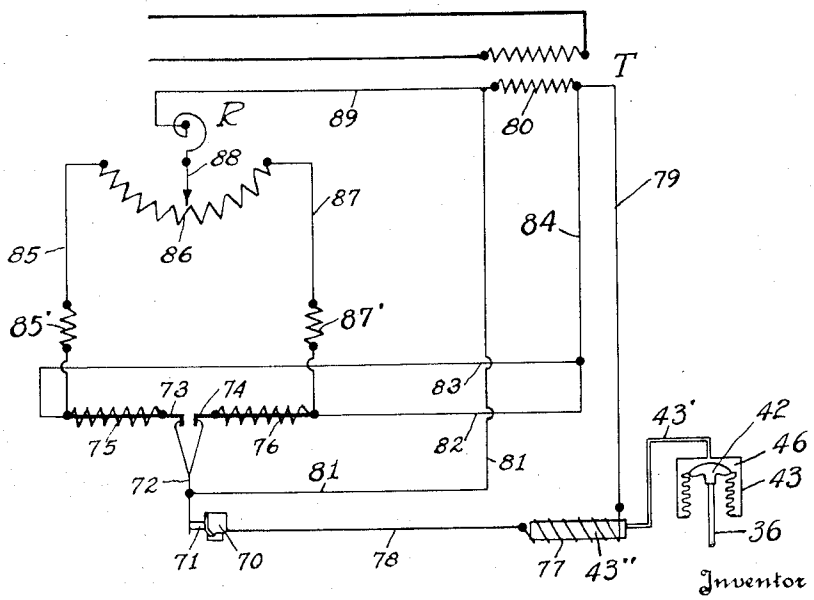


Fig. 5.



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Patented June 7, 1932 1,862,373

UNITED STATES PATENT OFFICE

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SNAP ACTION VALVE

Application filed June 17, 1931. Serial No. 544,979.

The object of my invention is to produce an automatic valve structure embodying independently movable induction and eduction flow-controlling members wherein the eduction flow-controlling member is responsive to variable control conditions and the induction flow-controlling member, under the influence of supply pressure, is suddenly fully opened after the eduction flow-controlling member has been moved from its minimum-flow position and the eduction flow-controlling member is suddenly fully closed when the eduction flow-controlling member approaches minimum-flow position. The positioning of the eduction flow-controlling member may be either in response to varying conditions closely adjacent the valve structure or conditions at a remote point, as will be explained.

Fig. 1 is a medial section of an embodiment of my invention with the parts in flow-stopping position;

Fig. 2 is a perspective of the carrier for the automatic bleed-valve;

Fig. 3 a medial section of another embodiment of my invention provided with remote-control means;

Fig. 4 a section, on a larger scale, on line 4—4 of Fig. 3, and

Fig. 5 a wiring diagram of the form shown in Figs. 3 and 4.

The device has been primarily designed as an automatic control for flow of fuel gas but it will be readily understood that it may have many other uses within the scope of the invention.

In Figs. 1 and 2 of the drawings 10 indicates a main chambered body having an inlet 11, an induction passage 12, an eduction chamber 13, an intermediate passage 14, and an outlet 15.

Passage 12 terminates at its inner end in a seat 16 for the induction flow-controlling member 17 which is a diaphragm held in place by a cap 18 which forms, over the diaphragm, a pressure chamber 19. The diaphragm 17 is biased toward seat 16 by a weight 20. Leading from passage 12 to chamber 19 is a bleed-passage 21, flow through which may be adjusted by needle valve 22.

The intermediate passage 14 communicates with the space beneath diaphragm 17 and with the eduction chamber 13 through a valve passage 25 with which is associated the eduction flow controlling element 26 which, in the drawings, is shown as a slotted element sleeved in passage 25. It is to be understood that other forms for this flow-controlling element may be used without departing from my invention.

A bleed passage 30 forms a communication between chambers 19 and 13, and flow through this passage is controlled by a bleed-valve 31 actuated in synchronism with the eduction flow-controlling element 26.

Valve 31 is threaded through one end of a spring bar 32 which is slotted at 33 near its other end, which end is turned back and forked at 34 so as to straddle into a circumferential groove 35 formed in the stem 36 connected to element 26. Valve 31 is so adjusted in bar 32 that it will seat to close passage 30 when element 26 is in a desired minimum-flow position.

One wall of chamber 13 is formed by a diaphragm 40 held in place by a ring 41 and stem 36 is passed through and secured to this diaphragm, the diaphragm thus forming a fluid-tight packing for the stem.

The outer end of stem 36 is connected to head 42 of a bellows 43 which, by ring 44, is sealed into an inverted cup 45 to form a chamber 46 for the reception of a volatile liquid which may be introduced through a passage 47 formed through head 42 and sealed by a valve 48.

A spring 50, acting upon the outer end of stem 36 biases element 26 toward maximum-flow position and rests upon an adjustable abutment plate 51. Plate 51 is provided with radial fingers 52 which project through slots 53 in cup 45 and take into a thread 54 formed in a nut 55 journalled upon cup 45.

The cup 45 is clamped upon ring 41 by screws 56.

The operation is as follows:—A sufficient quantity of volatile fluid is sealed in chamber 46 to cause element 26 to be forced to mini-

mum-flow position, against the action of spring 50 when the air surrounding cup 45 is at or above a predetermined temperature and valve 31 is so adjusted that it will close passage 30 when element 26 is in minimum-flow position. Under these conditions supply pressure, bleeding through passage 21, will accumulate in chamber 19 and diaphragm 17 will seat upon seat 16 and shut off in-flow through said seat.

Upon drop of temperature surrounding chamber 46 below a predetermined value, spring 50 will move element 26 in opening direction and valve 31 will lift from its seat so as to permit flow from chamber 19. When the pressure in chamber 19 has been sufficiently bled the supply pressure will lift diaphragm 17 fully from seat 16 and by that time the element 26 will have been sufficiently opened to insure a possibility of sufficient flow through passage 25 to maintain an adequate fire.

Upon rise of temperature surrounding chamber 46 the fluid therein will expand to force element 26 toward minimum-flow position and before there has been enough restriction of passage 25 to reduce outflow to a point where the fuel might back-fire, valve 31 will be seated and pressure in chamber 19 will accumulate to a point where diaphragm 17 will suddenly drop to fully closed position.

In Figs. 3, 4 and 5 of the drawings, 10 indicates the main hollow body having an inlet 11, an inlet chamber 12, an outlet chamber 13, an intermediate passage 14, an induction valve seat 16 interposed between chamber 12 and passage 14, and an eduction valve passage or seat 25 interposed between passage 14 and outlet chamber 13.

Overlying seat 16 is the diaphragm 17 which carries the induction valve 17′ on its under surface. One wall of chamber 13 is formed by diaphragm 40 which may be integral with diaphragm 17. The diaphragms are held in place by a cover plate 18 which forms a pressure chamber 19 over diaphragm 17.

The induction valve 17′ has a stem 23 projected through the cover plate 18 and, in order to avoid packing, is associated with diaphragm 24 covering a suitable opening 18′ in cover plate 18 and held in place by a supplemental cover plate 18″.

The projected end of stem 23 may be associated, if desired, with a rocking carrier R upon which may be mounted a mercury tube contactor C, of well-known form, for the control of a desired electric circuit which may be utilized for the control of apparatus to be synchronized with the operation of the structure which forms the subject of the present application.

The bleed passage 21 leads from the inlet chamber 12 through diaphragm 17 into chamber 19 and a bleed passage 30 leads from chamber 19 into a bleed valve chamber 30′ having a waste outlet 30″ controlled by a needle valve 31 which, in order to insure proper seating with its seat, is connected by a ball and socket joint 31′ with a stem 31″ projected through cover 18 and normally urged to valve opening position by a spring 59. Stem 31″ may be conveniently packed gas tight by grease retained in annular grooves G.

Associated with passage 25 is the modulating eduction valve 26 carried by stem 36 and normally urged upwardly to closed or minimum-flow position by spring 50′. Stem 36 has a gas tight association with diaphragm 40 and is projected outwardly through cover 18 and at its outer end is connected to the movable head 42 of the pressure bellows 43 mounted within a cup 45 to form the pressure chamber 46 in communication, through tube 43′ with a capsule 43″. Cup 45 and its associated parts are carried by a support 57 which, in turn, is suitably supported either upon cover 18 or in fixed relation thereto.

Engaging the outer end of stem 31″ is a temper screw 60 carried in one end of a lever 61 pivoted at 62 on cover 18 and at its other end engaged by a fork 63 carried by stem 36. A spring 64 is interposed between the fork 63 and lever 61 so that the needle valve 31 will not be injured by excess movement of stem 36.

A contact plate 70 is carried by a pin 70′ journalled on an arm 70‴ attached to stem 36 and is held at any desired angle to the axis of stem 47 by set screw 70″. Cooperating with plate 70 is a contact terminal 71 carried by an arm 72 which is supported upon the adjacent ends of two independently movable bi-metallic blades 73 and 74 provided respectively with heating coils 75 and 76. Differential movements of blades 73 and 74 will cause terminal 71 to move toward and from plate 70 while equal simultaneous movements of said blades will merely shift terminal 71 in a plane parallel with plate 70.

Associated with capsule 43″ is a heating coil 77 one end of which is connected by wire 78 with plate 70 and the other end of which is connected by wire 79 with one end of the secondary 80 of transformer T, said end also being connected by wires 82, and 83, respectively through wire 84, with blades 74 and 73. Terminal 71 is connected by wire 81 with the other end of the secondary coil 80. One end of heating coil 75 is attached to blade 73 and the other end connected by wire 85 through resistance 85′ with one end of a coil 86, the other end of which is connected by wire 87 through resistance 87′ with one end of the heating coil 76, the other end of which is attached to blade 74. Coil 86 is contacted by the bi-metallic thermally-responsive blade 88 of a room thermostat R, said blade

being connected by wire 89 with secondary 80.

The parts are shown in Fig. 3 in the positions occupied when there is nearly a minimum of desired flow through the structure, bleed valve 31 is just off its seat so that pressure flowing through bleed passage 31 into chamber 19 is bleeding through bleed passage 30—30″ and the eduction valve 26 is being held in its position by the pressure within chamber 46, that pressure being produced as a result of the heating of the contents of capsule 43″ by the current flow through the heating coil 77. Under these conditions of operation, very slight movements of the eduction valve 26 in opening direction, due to heating of capsule 43″, will separate plate 70 from terminal 71, thus deenergizing coil 77. This permits a slight relaxation of pressure in chamber 46, whereupon contact is re-established between terminals 70 and 71, causing a re-heating of capsule 43″ and re-establishment of pressure through chamber 46, so that, so long as blade 88 remains in any position of adjustment a uniform pressure condition is substantially maintained in chamber 46 to hold the eduction valve 26 very close to a position corresponding to the setting of blade 88. A shifting of blade 88 upon coil 86 will vary the amount of current apportioned to the two heating coils 75 and 76, thus varying the temperature response of the two blades 73 and 74, thereby shifting terminal 71 toward or from plate 70 so that the above-described balanced relationship between said terminals 70 and 71 can only be re-established by an appropriate shifting of stem 36 axially to reposition the eduction valve 26 in accordance with the new setting of the blade 88. When the eduction valve 26 closely approaches its minimum flow position, needle valve 31 will be seated so as to block bleeding from chamber 19, whereupon, pressure accumulating in chamber 19 from bleed passage 21, will suddenly close valve 17′ upon seat 16, thus cutting off flow to and through passage 25.

Valve 17′ will not again open, as already described, until the eduction valve 26 has been sufficiently opened to open valve 31 and permit the accumulated pressure in chamber 18 to bleed out through passage 30.

The structure may be guarded against the entry of undesirable matter by a fine screen 90 (Fig. 3). The valve 26, it will be noticed, is not depended upon for actual stoppage of flow but is a modulating valve which is positioned to accurately determine the volume of flow through the structure whereas the element which has been termed the induction valve (17 in Fig. 2 and 17′ in Fig. 3) is depended upon for stoppage of flow under the influence of pressure accumulated within the chamber 19. It is more convenient, therefore, that the induction valve be placed at the inlet side of the structure and the modulating valve or eduction valve placed at the discharge side of the structure, as shown in the drawings, but it will be readily understood that this arrangement might be easily reversed by an appropriate re-arrangement of the bleed passages and that in such a reversal the structure would be an equivalent of the forms shown in the drawings. The claims therefore are to be interpreted in the light of that fact.

The adjustability of valve 13 in its carrier 32, in the form shown in Fig. 1, and the adjustability of the temper screw 60 in lever 61, in the form shown in Fig. 3 permits adjustment of the rate of bleeding in chamber 19, thereby determining the minimum flow condition of the structure.

I claim as my invention:

1. A valve structure comprising a main body having an inlet and an outlet, an induction flow-controlling element and an eduction flow-controlling element interposed in the order named between the inlet and the outlet, a pressure chamber having bleed communication with the inlet and so arranged that accumulated pressure therein will move the induction flow-controlling element to flow-stopping position, a bleed passage leading from said pressure chamber, and a bleed valve connected to and moved by the eduction flow-controlling member to close said last-mentioned bleed passage when the eduction flow-controlling member is closely adjacent its minimum-flow position.

2. A valve structure comprising a main body having an inlet and an outlet, an induction flow-controlling element and an eduction flow-controlling element interposed in the order named between the inlet and the outlet, a pressure chamber having bleed communication with the inlet and so arranged that accumulated pressure therein will move the induction flow-controlling element to flow-stoppage position, a bleed passage leading from said pressure chamber, a bleed valve connected to and moved by the eduction flow-controlling member to close said last-mentioned bleed passage when the eduction flow-controlling member is closely adjacent its minimum-flow position, and temperature-responsive means acting upon the eduction flow-controlling element to adjust its flow-controlling position.

3. A valve structure comprising a main body having an inlet and an outlet, an induction flow-controlling element and an eduction flow-controlling element interposed in the order named between the inlet and the outlet, a pressure chamber having bleed communication with the inlet and so arranged that accumulated pressure therein will move the induction flow-controlling element to flow-stopping position, a bleed passage leading from said pressure chamber, a spring arm carried by the eduction flow-controlling

member, and a bleed valve carried by said arm in position to block said last-mentioned bleed passage when the eduction flow-controlling member is closely adjacent its minimum flow-controlling position.

4. A valve structure comprising a main body having an inlet and an outlet, an induction flow-controlling element and an eduction flow-controlling element interposed in the order named between the inlet and the outlet, a pressure chamber having bleed communication with the inlet and so arranged that accumulated pressure therein will move the induction flow-controlling element to flow-stopping position, a bleed passage leading from said pressure chamber, a spring arm carried by the eduction flow-controlling member, a bleed valve carried by said arm in position to block said last-mentioned bleed passage when the eduction flow-controlling member is closely adjacent its minimum flow-controlling position, and temperature-responsive means acting upon the eduction flow-controlling element to adjust its flow-controlling position.

5. A valve structure comprising a main body having an inlet and an outlet, an induction valve-seat and eduction valve seat interposed in the order named between the inlet and outlet, a diaphragm adapted to close the induction seat and backed by a pressure chamber having an outlet bleed and an inlet bleed communication with the inlet, a bleed-valve coordinated with the outlet bleed, an eduction valve coordinated with the eduction valve seat, and a connection between the bleed valve and eduction valve to seat the bleed valve on approach of the eduction valve to its minimum-flow position.

6. A valve structure comprising a main body having an inlet and an outlet, an induction valve-seat and eduction valve seat interposed in the order named between the inlet and outlet, a diaphragm adapted to close the induction seat and backed by a pressure chamber having an outlet bleed and an inlet bleed communicating with the inlet, a bleed valve coordinated with the outlet bleed, an eduction valve coordinated with the eduction valve seat, a connection between the bleed valve and eduction valve to seat the bleed valve on approach of the eduction valve to its minimum-flow position, and temperature responsive means acting upon the eduction valve to adjust its flow-controlling position.

7. A valve structure comprising a main body having an inlet and an outlet, an induction valve-seat and eduction valve seat interposed in the order named between the inlet and outlet, a diaphragm adapted to close the induction seat and backed by a pressure chamber having an outlet bleed and an inlet bleed communicating with the inlet, a bleed valve coordinated with the outlet bleed, an eduction valve coordinated with the eduction valve seat, and a spring arm carried by the eduction valve and supporting the bleed valve to seat the bleed valve on approach of the eduction valve to its minimum-flow position.

8. A valve structure comprising a main body having an inlet and an outlet, an induction valve-seat and eduction valve seat interposed in the order named between the inlet and outlet, a diaphragm adapted to close the induction seat and backed by a pressure chamber having an outlet bleed and an inlet bleed communicating with the inlet, a bleed valve coordinated with the outlet bleed, an eduction valve coordinated with the eduction valve seat, a spring arm carried by the eduction valve and supporting the bleed valve to seat the bleed valve on approach of the eduction valve to its minimum-flow position, and temperature-responsive means acting upon the eduction valve to adjust its flow-controlling position.

In witness whereof, I have hereunto set my hand at Wabash, Indiana, this 3d day of June, A. D. one thousand nine hundred and thirty-one.

PAUL F. SHIVERS.