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CONTROL DEVICE

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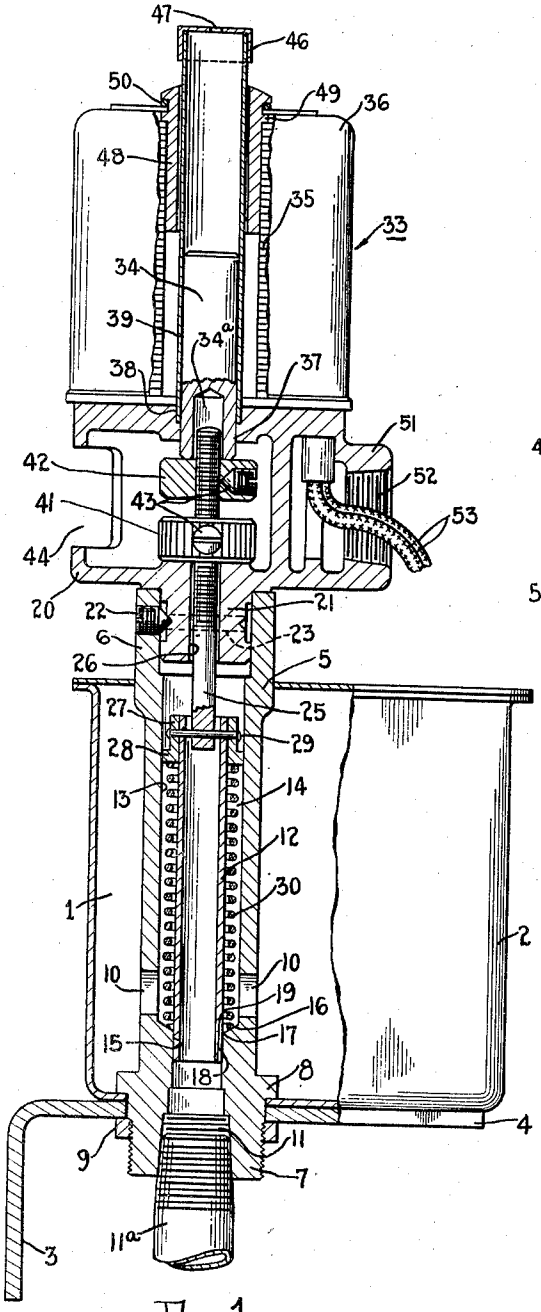


Fig. 1

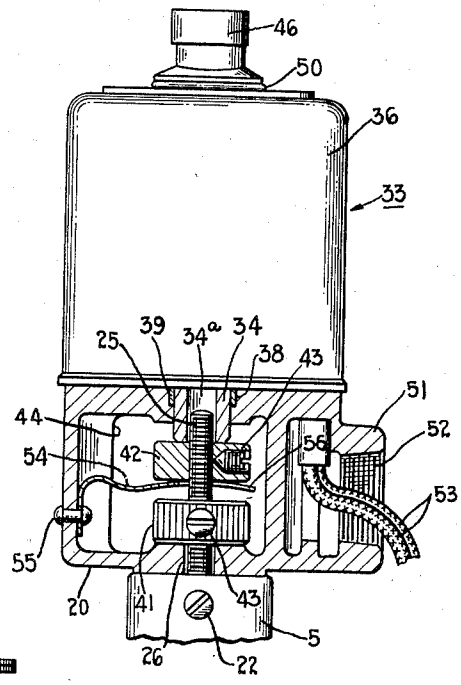


Fig. 2

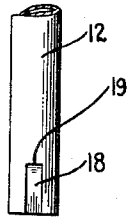


Fig 3

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CONTROL DEVICE

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5 Claims. (Cl. 137—139)

Our invention relates generally to control devices and more particularly to valves for controlling flow of fluid.

One of the objects of our invention is to provide a control device having a valve and having a new and improved adjustable stop means for limiting closing movement of the valve.

Another object of our invention is to provide a control device having a valve for controlling a port and having a new and improved adjustable stop means for limiting opening movement of the valve.

Another object of our invention is to provide a new and improved control device having a reciprocal valve operable to move directly from one position to another to change the effective flow capacity of a port between adjustable valve operating limits so as to provide for obtaining various differentials in port capacity changes to accommodate different requirements.

Another object of our invention is to provide a control device of the above-mentioned character having a new and improved cooperative relation between the valve and its actuating means to insure desired controlling of a valve port.

The invention consists in the improved construction and combination of parts, to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing, to be taken as a part of this specification, we have fully and clearly illustrated our invention, in which drawing—

Figure 1 is a view shown partly in vertical cross section and partly in elevation of a control device embodying our invention;

Fig. 2 is a view shown partly in vertical cross section and partly in elevation of a modified form of our invention, and

Fig. 3 is a view of a portion of a valve member employed in the devices of Figs. 1 and 2.

The control devices shown in Figs. 1 and 2 are adapted, among other uses, for controlling flow by gravity of liquid fuel from a constant level chember 1 to a burner of a heating apparatus (not shown). The chamber 1 is defined by the walls of a hollow casing 2 and the casing and control device may be supported by a bracket 3 which preferably has a horizontal arm 4 on which the casing 2 rests. The control devices shown include a valve housing or casing 5 which is preferably tubular in shape and, as shown in Fig. 1, extends vertically through chamber 1 having opposite end portions 6 and 7 projecting above and below the top and bottom walls respectively of the casing 2. The top and bottom walls of the casing 2 and the arm 4 of bracket 3 are provided with aligned apertures to receive the valve casing 5. The valve casing 5 may be provided with an external annular flange or shoulder 8 adjacent its lower end for seating against the inner surface of the bottom wall of casing 2, and the lower end portion 7 of the valve casing may be externally threaded to receive a nut 9 by means of which the casings 5 and 2 and the bracket 3 may be tightly secured together.

The valve casing 5 may be provided in its side wall with one or more apertures 10 located at a suitable height above the bottom wall of the chamber 1, the apertures 10 providing communication between the interior of the constant level chamber 1 and the interior of the tubular valve casing 5. The lower end of the valve casing 5 may be internally threaded, as at 11, for connection to a liquid flow line 11a through which fuel may flow by gravity to a burner of a heating apparatus. Disposed within the tubular valve casing 5 there is a reciprocal valve member 12 which is preferably of the slide, or sleeve type valve and tubular in form so that it will be light in weight. The valve casing 5 has a bore 13 longitudinally thereof which is relatively larger than the diameter of the valve member 12 to provide an annular space, or chamber 14 therebetween, the bore 13 having a reduced portion 15 adjacent its lower end for slidably receiving a lower end portion of the valve member 12. Preferably the relatively larger bore 13 terminates slightly below the apertures 10 in casing 5 and tapers downwardly and inwardly, as at 16, intersecting the reduced bore portion 15 to provide a port, as at 17. In the side wall of the valve member 12 adjacent its lower end there is provided a vertically extending slot or port 18 which opens through the lower end of the valve member. The slot 18 is preferably a tapered slot, tapering from a relatively large cross sectional area at the lower end of the valve member 12 upwardly to a point, as at 19, at which it terminates or runs out of the side wall of the valve member 12. By reason of the tapered slot 18 the effective flow capacity through port 17 will depend upon the vertical position of the slot 18 relative to the edge formed by the intersection of the tapered bore 16 and reduced bore 15. Mounted on the upper end of the valve casing 5 there is a housing 20 which has a depending reduced portion 21 that fits into the upper end of the valve casing 5. The housing 20 is preferably secured to the valve casing 5 by a set screw 22 which screw threads through the side wall of

casing 5 and engages in an annular groove 23 in the reduced portion 21.

The valve member 12 includes a stem 25 which extends vertically upward through a bore 26 in the reduced portion 21 and projects into housing 20. Fitted over the tubular portion of the valve member 12 adjacent its upper end there is a tubular member 27 having at its lower end an external annular flange 28 whose outer periphery slidably engages the wall of bore 13 for guiding the reciprocal valve member, the valve stem 25 being guided in the bore 26. The tubular guide member 27, the valve member 12, and the stem 25 may be provided with aligned apertures for receiving a pin 29 for connecting the guide member, valve, and stem together. A coil spring 30 surrounds the valve member 12 in bore 13 and has its upper end abutting the lower end of the guide member 27 and its lower end abutting the tapered wall 16 of the valve casing 5, the spring 30 being operable to urge the valve member upward or in a valve opening direction.

Mounted on the upper end of the housing 20 there is a solenoid 33 for actuating the valve member 12. The solenoid 33 comprises a movable core or armature 34 surrounded by a coil 35 preferably enclosed in a casing 36. Through the top wall of the housing 20 there is a centrally disposed aperture or bore 37 which is substantially in alignment with the valve member 12 and through which the lower end of the armature 34 is adapted to extend, as shown, when the solenoid coil 35 is deenergized. An upper end portion of the bore 37 is of enlarged diameter, as at 38, to receive a lower end portion of a tubular member 39 which fits therein with the inner wall surface of the tubular member being flush with the wall of bore 37. The tubular member 39 extends vertically through the center of coil 35 and the armature 34 is disposed for sliding reciprocal movement within the tubular member. The valve stem 25 is preferably threaded for receiving a pair of separately and manually adjustable stop members 41 and 42 which are carried by stem 25 within housing 20. The adjustable stop member 41 is adapted to engage the inner bottom wall of the housing 20 to limit downward, or closing movement of the valve member 12, while the adjustable stop member 42 is adapted to engage the inner upper wall of the housing 20 for limiting upward or opening movement of the valve member 12. The stop member 42 is also engaged by the armature 34 when the armature descends to move the valve member 12 toward closed position. The armature 34 is provided with a recess or bore 34a in its lower end which extends longitudinaly of the armature and which is adapted to loosely receive an upper end portion of the valve stem 25, the bore 34a being of sufficient depth so that the lower end of the armature 34 will always be engageable with the stop member 42. Each of the adjustment members 41 and 42 may be provided with a set screw 43, engageable with stem 25 to prevent rotation of the adjustment members relative to the stem, after the adjustable stop members have been positioned as desired. In the side wall of the housing 20 there is provided an opening 44 through which access may be had to the adjustment members 41 and 42. It will be understood that the valve member 12 and adjustment members 41 and 42 may be rotated as a unitary structure, if necessary, in order to bring the heads of the set screws 43 so that they face toward and are easily accessible through the opening 44 in the housing 20.

In the present instance an upper end portion of the tubular member 39 projects above the top wall of the solenoid casing 36 and is closed by a cap member 46 which has an aperture 47 for the escape of air to atmosphere from the tubular member 39 when the armature 34 moves upwardly. Extending downwardly from the top wall of the solenoid casing 36 there is a sleeve member 48 which surrounds the tubular member 39. The sleeve member 48 has an annular flange 49 which abuts the underside of the top wall of the solenoid casing 36 and is secured to the casing by a resilient ring member 50 which fits in a circumferential groove in the sleeve member 48 and bears against the outer top wall of the casing 36. The housing 20 has a tubular boss 51 defining an outlet 52 for lead wires 53 which connect the coil 35 to a suitable source of electric current, and in the lead wires 53 there may be provided a manual switch (not shown) for controlling the circuit of the solenoid 33.

The operation of the device shown in Fig. 1 is as follows: When the solenoid 33 is energized the armature 34 will be raised permitting the spring 30 to move the valve member 12 upward, or in a valve opening direction, until the stop member 42 engages the inner top wall surface of the housing 20. Upward movement of the valve member 12 increases the effective flow capacity of port 17 and the effective flow capacity of the port, during the time that the solenoid remains energized, will be determined by the position of the adjustable stop member 42 on the valve stem 25. When the solenoid 33 is deenergized the armature 34 will descend and exert the force of its weight, through engagement with stop member 42, to overcome spring 30 and move valve member 12 downwardly or in a valve closing direction, until the stop member 41 engages the inner face of the bottom wall of housing 20. If desired, the stop member 41 may be adjusted so that when the solenoid is deenergized the slot 18 will be moved entirely within bore 15 and flow through port 17 stopped. Also, the adjustment member 42 could be adjusted, if desired, so that when the solenoid 33 is energized the valve member 12 will be moved to a position permitting full capacity flow through port 17. Between the extremes of closed position and full capacity position of the valve member 12 it will be seen that any maximum and minimum flow capacity of port 17 can be obtained by adjustment of the stop members 41 and 42.

The control device shown in Fig. 2 is similar in construction to that of Fig. 1, but differs therefrom in that it has a leaf spring 54 instead of a coil spring 30 for moving the valve member in a valve opening direction, and the spring 54 is disposed within the housing 20. The leaf spring 54 may be secured at one end to the side wall of housing 20 by a rivet 55, the other or free end portion of the spring 54 preferably being bifurcated, as at 56, to receive the stem 25. The free end portion of the leaf spring 54 is preferably disposed between the adjustment members 41 and 42 and abuts the underside of the adjustment member 42.

What we claim and desire to secure by Letters Patent of the United States is:

1. In a control device, a casing having a port for flow of liquid, a reciprocal valve member in said casing cooperable with said port to control flow therethrough and having a vertically extending externally threaded stem, said valve member being operable to change the effective flow capacity of said port, means for actuating

said valve member including electrically operated means disposed above said stem, a stop member adjustably screw threaded on said stem and operable to limit movement of said valve member in a valve closing direction to determine the effective flow capacity of said port, a second stop member adjustably screw threaded on said stem above said first-named stop member and operable to limit movement of said valve member in a valve opening direction to determine the effective flow capacity of said port, said electrically operated means being loosely disposed relative to said valve member and being operable to descend and engage said second-named stop member and move said valve member in said valve closing direction.

2. In a control device, a casing having a port for flow of fluid, a reciprocal valve member in said casing controlling said port and having a vertically extending stem, said valve member being operable to change the effective flow capacity of said port, electrically operated means disposed above and for actuating said valve member, a stop member carried by said valve member and operable to limit movement of said valve member in a valve closing direction to determine the effective flow capacity of said port, a second stop member carried by said valve member above said first-named stop member and operable to limit movement of said valve member in a valve opening direction to determine the effective flow capacity of said port, said electrically operated means being loosely disposed relative to said valve member and being operable to descend and engage said second-named stop member and move said valve member in said valve closing direction.

3. In a control device, a casing having a port for flow of fluid, a valve member cooperable with said port to control flow therethrough and having a stem, said valve member being operable to change the effective flow capacity of said port, automatically operated means for actuating said valve member, a stop member adjustably carried by said stem and operable to limit movement of said valve member in a valve closing direction to determine the effective flow capacity of said port, a second stop member adjustably carried by said stem, said second-named stop member being operable to limit movement of said valve member in a valve opening direction to determine a second effective flow capacity of said port, said automatically operated means being loosely disposed relative to said valve member and being operable to descend and engage one of said stop members and move said valve member in said valve closing direction.

4. In a control device, a casing having a port for flow of fluid, a reciprocal valve member in said casing controlling said port and having a vertically extending stem, said valve member being operable to change the effective flow capacity of said port, electrically operated means disposed above and for actuating said valve member, a stop member carried by said valve member and operable to limit movement of said valve member in a valve closing direction to determine the effective flow capacity of said port, a second stop member carried by said valve member above said first-named stop member and operable to limit movement of said valve member in a valve opening direction to determine the effective flow capacity of said port, said electrically operated means being loosely disposed relative to said valve member and being operable to descend and move said valve member in said valve closing direction.

5. In a control device, a casing having a port, a reciprocal valve in said casing to control said port, a pair of spaced stop members in said casing and carried by said valve, means cooperable with said stop members to limit movement of said valve in opposite directions, means to move said valve in one direction, and a leaf spring having one end thereof secured to said casing and having the opposite end thereof interposed between and acting on one of said stop members to move said valve in the opposite direction.

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