Feb. 27, 1934. E. J. DILLMAN 1,949,371

CONTROL DEVICE

Filed April 11, 1928 2 Sheets-Sheet 1

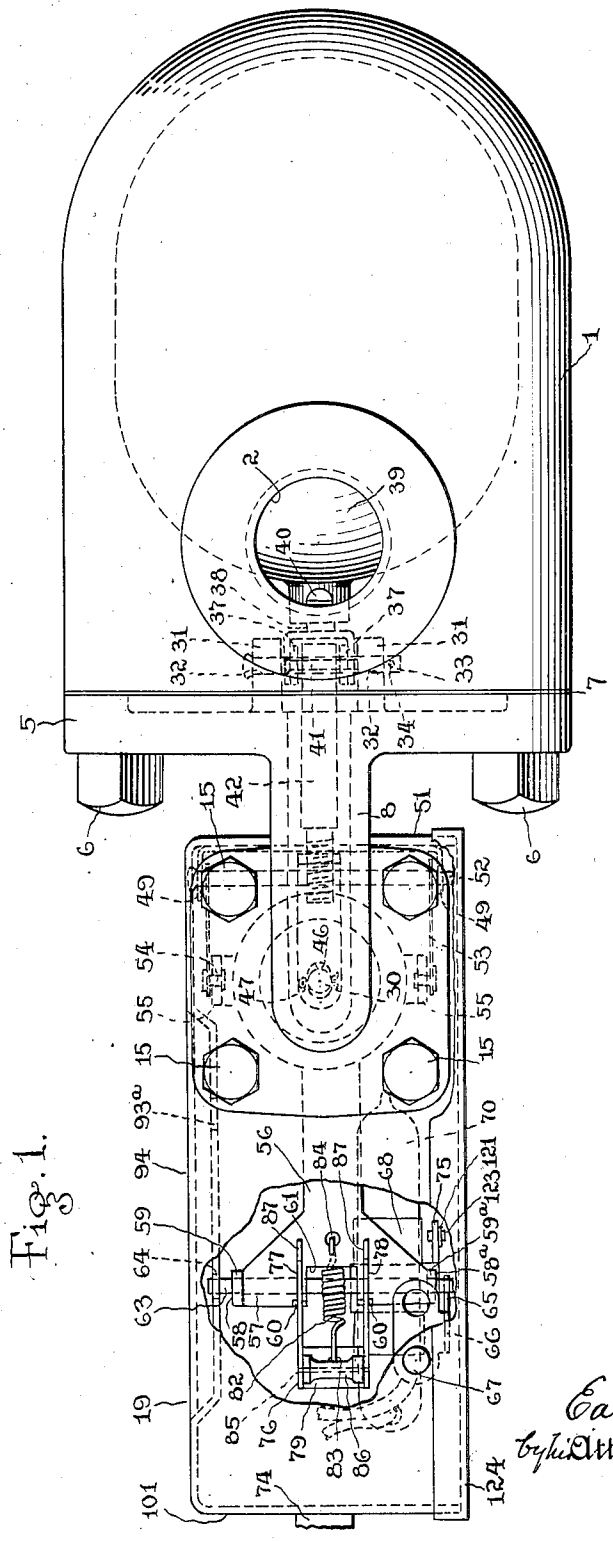

Fig. 1.

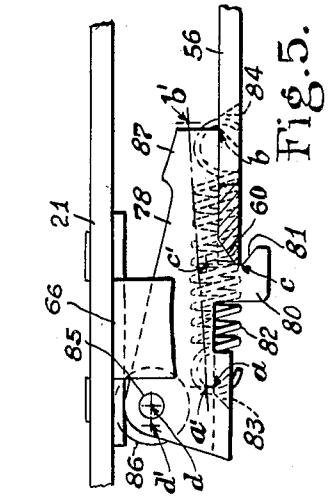

Fig. 5.

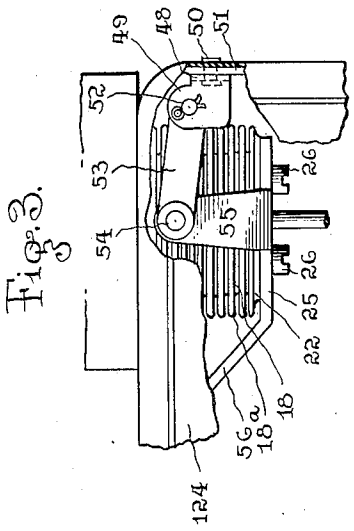

Fig. 3.

Inventor
Earnest J. Dillman
by his Attorney
E. J. Dillman

Feb. 27, 1934. E. J. DILLMAN 1,949,371

CONTROL DEVICE

Filed April 11, 1928 2 Sheets-Sheet 2

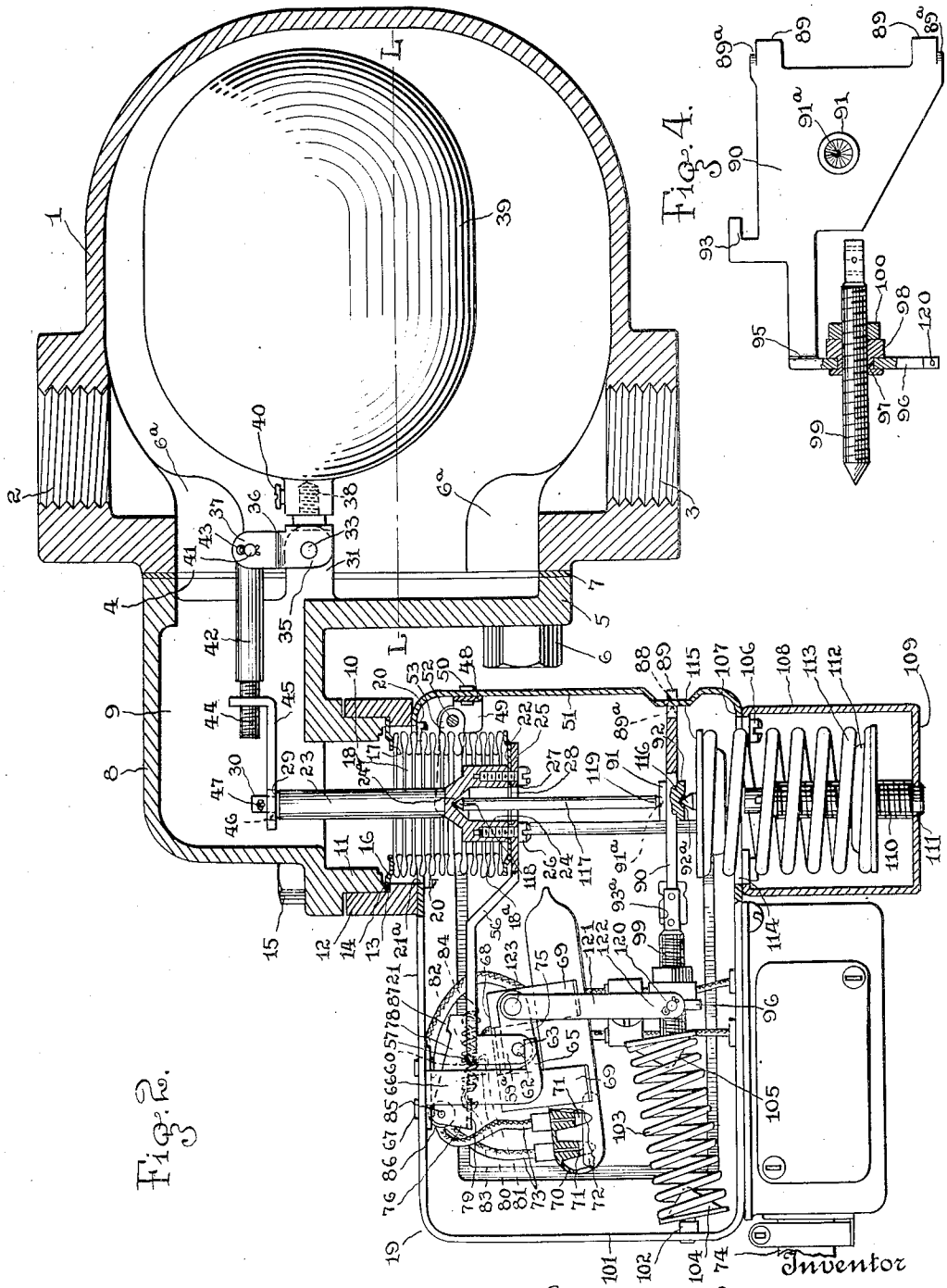

Fig. 2.

Fig. 4.

Inventor

Earnest J. Dillman

By his Attorney

C. J. Heylmun

Patented Feb. 27, 1934

1,949,371

UNITED STATES PATENT OFFICE

1,949,371

CONTROL DEVICE

Earnest J. Dillman, Detroit, Mich., assignor to American Radiator Company, New York, N. Y., a corporation of New Jersey

Application April 11, 1928. Serial No. 269,282

19 Claims. (Cl. 200—84)

My invention relates to new and useful improvements in control devices, and more particularly to such a device which is adapted to operate in response to a change in liquid level or to a change of fluid pressure, or to a change in both liquid level and fluid pressure.

The device is particularly adapted, among other uses, such as pressure generating apparatus, for use with heating apparatus, operating, for example, to control blower fans or dampers, or a boiler heating means, when the water level in the boiler drops below a predetermined safe level, or when the steam pressure in the boiler rises above a predetermined desired pressure.

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 drawings, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, and wherein—

Figure 1 is a top plan view of the device, with a portion of the casing broken away to show certain of the elements of the device which are within the casing;

Fig. 2 is a view in side elevation, and partially in longitudinal vertical section, the front casing cover or closure member having been removed;

Fig. 3 is a detail in side elevation;

Fig. 4 is a plan detail partially in section, and

Fig. 5 is an enlarged detail view illustrating diagrammatically the relative positions taken by certain points of the device during operation.

Referring to the drawings by characters of reference, 1 designates a float chamber comprising a hollow casing having inlet ports 2, 3 which are preferably internally threaded. The ports 2, 3 may be connected, respectively, by suitable piping (not shown) to the steam space and to the water space of a heating or other boiler (not shown). One side of the chamber is open, as at 4, and receives a fitting or member 5 which closes the opening 4 and is secured to the chamber 1 by bolts 6 which are passed through the member 5 and threaded into bosses 6^a in chamber 1. A gasket 7 may be inserted between member 5 and the chamber 1 to seal the joint. The member 5 has a neck 8 which is hollow, having a substantially horizontal passage 9 which opens at one end into chamber 1 and at its other end opens downward into a vertical passage 10 through a flange 11. Surrounding this flange 11 is a collar 12 having an internal shoulder 13 which overlies the end 14 of flange 11, and which is secured to the flange by bolts 15 passed therethrough and screwed into collar 12. Between the shoulder 13 and flange end 14, is the external periphery of an annular supporting member 16 which is tightly clamped therebetween by the bolts 15 so as to prevent leakage at the joint. Sealed, as by solder, or the like, along the inner edge or circumference of the annular member 16, as at 17, is one end of a depending longitudinally expansible-collapsible element 18, preferably in the form of a resilient hollow cylindrical metal bellows having circumferential corrugations 18^a. Carried by the collar 12 is a hollow casing 19, preferably of substantially rectangular form and fixed thereto by screws 20, or the like. Through the top wall 21 of the casing 19, is an opening 21^a in line with vertical passage 10 to permit entrance of the bellows 18 therethrough into the casing 19. The free end of the resilient bellows or element 18 which projects into casing 19 has secured and sealed thereto along its circumference, as by solder, or the like, the periphery of an end closure disc or head 22. Mounted on the head 22 within the hollow bellows 18 is a plunger 23 having an axial recess 24 in its lower end. On the outer face of head 22 is a plate member 25 which is fixed to head 22 and rigidly connected to plunger 23 by means of bolts or screws 26 passed through the plate 25 and head 22 and screwed into the plunger 23 at the sides of the recess 24. The screws 26 also serve to tightly clamp and seal plunger 23 to the head 22 to prevent leakage at the joint. Through the plate 25 and head 22, respectively, are apertures 27, 28 in line with recess 24, and through which the recess opens into casing 19. The plunger 23 extends upward through vertical passage 10 into horizontal passage 9, where it has an upwardly facing shoulder 29 above which the end of the plunger is of reduced diameter, as at 30. From the fitting or member 5 a pair of spaced, substantially horizontal arms 31 extend into the chamber 1. Through the arms 31 are opposite openings 32 (see Fig. 1), which receives a pivot pin 33 secured therein in any suitable manner, as by a cotter-pin 34. Fulcrumed on the pivot pin 32 is a bell-crank lever 35, one of the arms thereof, as at 36, being preferably in the form of a yoke having substantially parallel legs 37, and the other of the arms being preferably in the form of a threaded pin 38. Threaded on pin 38 is a float 39 which may be in the form of a hollow metal casing, and which is secured on the pin 38 by a set screw 40, or the like. Through the yoke legs

37 is a pin 41 on which is journalled between the legs 37 one end of a bar or rod 42. The pin 41 may be fastened in position through the legs 37 by a cotter-pin 43, or the like, passed through the pin 41. Secured on the bar 42 for longitudinal adjustment by threaded engagement with the free end 44 of rod 42, is a connecting link 45. The free end of the link 45 has an elongated aperture 46 therethrough, which fits over the end 30 of plunger 23, the link laterally adjacent aperture 46 resting on shoulder 29. The link 45 is prevented from slipping upward off the plunger 23 by any suitable fastening means 47, such as a cotter-pin fixed through an aperture in the plunger 23 above the link 45.

Within the casing 19 is a supporting bracket 48 having substantially parallel spaced arms 49 which is secured, as by rivets 50, or the like, to the end wall 51 of casing 19 adjacent bellows 18. Through the arms 49 is a pin 52 on which are journalled spaced links 53 of substantially equal length. These links 53 extend to substantially diametrically opposite points at the front and the rear of the bellows 18 where each is pivoted respectively by pins 54 to one of a pair of upwardly extending arms 55 carried rigidly by the front and rear edges, respectively, of the plate member 25.

Also rigidly carried by member 25 and preferably integral therewith, is a lever arm member 56 which extends longitudinally of the casing 19 and away from the end wall 51 thereof. Depending from each side edge of the lever arm member 56 at the free end 57 thereof and at opposite points, as at 58, 58a, is an operating and supporting member 59, 59a. The free end terminal edge of the arm member 56 is beveled at laterally spaced points to form spaced knife edges or fulcrums 60 between which the member 56 is recessed, as at 61, for a purpose to be described. Through each of the depending members 59, 59a is a bearing opening 62 through which is passed a rod 63 which extends beyond each of the supporting members, and at its rear end projects through a stop opening 64, while the forward end projects over a hook member 65 carried by a support 66 fixed by rivets, or the like, as at 67, to the top wall 21 of the casing. Journalled on the rod 63 between the members 59, 59a, is a rockable frame member 68 having one or more pairs of depending clamping fingers 69, preferably in the form of spring clips. Supported by the clips 69 is an electric contact make-and-break device 70, preferably a mercury switch comprising a sealed glass tube having internal contacts 71 and a globule of mercury 72 which, when the tube 70 is oscillated about the rod 63, will flow into and out of engagement with the contacts 71 to make or break a circuit. The contacts 71 are connected to suitable circuit leads 73 which preferably run from the casing 19 through a conduit 74. Carried by the frame member 68 is an actuating member comprising an arm or lever 75 which extends longitudinally of the frame member and lies in a substantially vertical plane.

On the free end 57 of the lever arm member 56 is supported a lever 76, preferably in the form of a yoke having substantially parallel vertical arms 77, 78 connected by a base 79 which is normally substantially horizontal. Depending from each yoke arm 77, 78 is a lug 80 having a notch 81 in which the knife edges 60, respectively, seat to provide a fulcrum or pivotal point on which the lever 76 may rotate. Between the lever 76 and the arm member 56, is a resilient expansible-collapsible or tension means or member 82, preferably a coil spring, having its ends secured respectively to the lever yoke base 79 and the arm member 56 adjacent the inner edge of the recess 61, preferably by passing the ends of the spring 82 through holes 83, 84, respectively, in the base 79 and member 56. The spring means 82 lies partially within the recess 61 which permits free movement of the member 56 and means 82 relative to each other. Above the base 79 at one end of lever 76, is a pin 85 which is fixed through the yoke arms 77, 78, and on this pin 85 is journalled a roller 86 of such diameter that, when the member 56 is in its normal position of rest, Fig. 2, and the yoke arms 77, 78 are in engagement with the upper surface of the member 56, the roller 86 will engage the top wall 21 of the casing. At the ends and on the upper edge of the yoke arms 77, 78 which overlie the arm member 56, are stops 87 adapted to contact the top wall 21 to limit upward movement of lever 76 or counter-clockwise rotation thereof on the knife edges 60. As the center line of the spring 82 in its normal position, Fig. 2, is above the contact point, namely, the knife edges 60 between the lever 76 and the lever arm member 56, the spring will be tending to break the members 76 and 56 downward at point 60, but due to the bearing of the knife edge 60 on the lower edge of the notches 81 and the contact of yoke arms 78 with arm member 56, the further breaking downward of the members under the action of the spring 82 beyond the position of Fig. 2, is prevented. Further downward movement of the contact point between lever 76 and arm member 56 is also prevented by rod 63 engaging stop hook 65 and by the fulcrum support roller 86 engaging the top casing wall 21.

Through the end wall 51 of casing 19 and below bracket 48, are spaced apertures 88 in a substantially horizontal plane, which receive spaced end fingers 89 of a lever plate 90. Adjacent each finger 89 is a knife edge 89a which bears on the inside face of wall 51 and serves as a fulcrum for the lever 90. On the top and bottom faces, respectively, of lever 90 and directly beneath a conical socket 24a at the inner end of the recess 24 in plunger rod 23, are socket members 91, 92 having conical sockets 91a, 92a, respectively. At one side the lever 90 has a stop lug 93 which projects through an aperture 93a in the rear wall 94 of casing 19 to limit the vertical swing or movement of the lever 90 on its fulcrum 89a. At its free forward edge 95 the lever has a lateral arm 96 having an opening 97 therethrough, in which is fixed an internally threaded sleeve 98 through which is adjustably threaded a pin 99 having a lock nut 100 (see Fig. 4). Fixed to the other end wall 101 of casing 19 and projecting into the casing, is an abutment member 102 which is substantially in a vertical plane through the longitudinal axis of pin 99, and preferably slightly below a horizontal plane through the knife edges or fulcrum point 89a. Between the abutment member 102 and the pin 99 is a spring 103, preferably of the coil type, which is under compression and has follower cups 104, 105 at either end, in which are respectively seated the member 102 and the pin 99.

Secured, as by screws 106, or the like, to the underside of the bottom wall 107 of the casing 19, and directly beneath the bellows 18, is a spring support 108, preferably in the form of a hollow casing having a bottom end wall 109. Vertically

below the socket 24a in plunger 23 is a vertically threaded pin 110 which is fixed in the end wall 109, as at 111. Threaded on pin 110 for vertical adjustment is a spring seat member 112. Supported on the member 112 is a resilient compression member 113, preferably a coil spring which extends upward through an opening 114 in the bottom casing wall 107. At its upper end the spring 113 has a follower member 115 with a centrally positioned pin 116 which seats in the conical socket 92a of lever 90. A suitable thrust member 117 is positioned between and has its opposite ends 118, 119, respectively, seated in the socket 24a of plunger 23, and the socket 91a of lever 90.

At the outer or free end of the lateral arm 96 of lever 90, is a pivot pin 120, on which is pivotally supported an upwardly extending supporting and operating member or link 121. The link 121 may be secured on pin 120 by means of a cotter-pin 122, or the like, passed through the pin 120. The upper free end of link 121 laterally contacts or overlies the rigid arm 75 of frame member 68 and is pivotally secured thereto by a bearing pin 123. The casing 19 may be closed by a suitable cover member 124.

The operation of my device is as follows, and will be described first as it acts in response to change of water level in the sytem and chamber 1, and second, as it acts in response to change of fluid pressure in the system and chamber 1:

The control device may be connected by suitable piping (not shown) to the interior of a boiler above and below the normal water level respectively by means of the inlet ports 2, 3. When the water in the system is at its normal level, which is somewhere above the chamber 1, the float 39 will be immersed in the water and will be tending to rise in the chamber 1; but due to the pin 63 engaging or abutting the hook member 65, the float 39, and therefore the plunger 23, lever arm member 56 and device 70, will be held in the position of Figs. 2 and 5. If due to evaporation or leakage, or any other cause, the water in the system and chamber 1 drops, say, to the line L—L, then the float 39 will become free floating and will exert neither an upward nor a downward force. Now, should the water level drop below the line L—L, it will drop relative to the float which is maintained or held in the position of Fig. 2 by the resistance of the bellows 18 and the downward component of force of the spring 82 until the water level has dropped sufficiently to cause the downward force exerted by the increasing weight of the float to become equal to the combined resistance of bellows 18 and the component of force of spring 82. The forces are now in equilibrium and any further drop in water level will create a condition of unbalance and the float will move downward. This initial movement of the float after it has become free floating, will act through bell-crank lever 35, rod 42, and link 45, to pull the upper end 30 of member 23 to the right of Fig. 2, or rotate the member 23 clockwise on its fulcrum pins 54 to exert a lateral thrust; but in order for member 23 to so move, the float must overcome the combined resistance offered by bellows 18 and by the downward component of force of spring 82. In the present embodiment, the bellows 18 is in effect a coil spring which must be compressed longitudinally along one side and expanded longitudinally along the other side, in order for the float to move downward. The tension spring 82 is acting not only to pull the lever 76 and the arm member 56 into contact with each other at the knife edge 60 or point *c*, but is also, because it is acting at an acute angle on the arm member 56, exerting a downward component of its force on the arm member 56, tending to rotate the arm member 56 counterclockwise on its fulcrum 54, as above described, and therefore this downward component of force acts with the resistance of the bellows 18, since arm member 56 is rigid with member 23, to buoy up the float or resist its dropping with the water level. When the arm member 56 is moved upward, or has clockwise rotation on its fulcrum 54 due to downward movement of the float 39, the spring 82 will be expanded or stretched as the holes 83, 84 or points *a* and *b* move further apart, and the point of contact *c* between lever 76 and arm member 56 approaches the center line *a*—*b* of the spring 82, and therefore its tension will be increased. It is to be noted, however, that as the contact point *c* moves upward, the angle of application of the spring 82 on the arm member 56 will be decreased or become more acute, and the downward component of force of the spring 82 upon the lever arm 56 will decrease. This decrease in the component of force is evident from the fact that for small angles, such as that between the spring 82 and the arm member 56, the sine of the angle is proportional to the angle and therefore the reduction of the component of force exerted by the spring is proportional to the reduction of the angle. The rate of decrease in the resistance of the component of force exerted by spring 82 to movement of the float 39 is greater than the rate of increase of resistance of the bellows spring 18 to movement of the float 39, so that the combined resistance offered by springs 82 and 18 decreases on downward movement of the float 39. As the float moves downward, it will sink lower in the water of chamber 1 and therefore the downward or actuating force exerted by the float will decrease; but the combined resistance offered by springs 82 and 18 decreases at a greater rate than the decrease of the downward or actuating force of float 39. It is therefore apparent that as the weight of the float reaches the predetermined value which is slightly in excess of the combined resistance of springs 18 and 82, it will overcome the combined spring resistances and start to move arm member 56 upward; but since the resistance to movement of the float decreases coincident with the beginning of movement of the float, and since this decrease in resistance is at a greater rate than the decrease in actuating force due to the sinking of the float in the water of chamber 1, then the arm member 56 will move upward quickly and sharply with substantially a snap action through its complete range of movement, carrying with it the lever 76 which turns in a counterclockwise direction on its fulcrum support 86, until the stops 87 on lever 76 abut the top casing wall 21. In order that the arm member 56 may move upward, the lever 76 is provided with a moving pivot or fulcrum support in the form of the bearing pin 85 having its axis of rotation designated *d* and roller 86, for the point of contact between lever 76 and arm member 56 must follow the arc inscribed by the contact point *c* as the lever arm member 56 rotates on its fixed center 54, and therefore the fulcrum support roller 86 must move along the top casing wall 21 and to the left as point *d'* of Fig. 2. As the lever arm member 56 moves up quickly and sharply, it lifts the operating mem-

bers 59, 59a and rod 63 which are fast to frame member 68, and since the member 68 is pivoted at 123 on support 121 which cannot move further upward, due to stop 93, therefore the switch device 70 will be rocked or tilted sharply with a snap action in a clockwise direction on pin 123 to flow the globule 72 quickly away from contacts 71 to break the circuit through leads 73. It is to be understood that this snap action occurs without the contact point *c* between lever 76 and arm member 56 crossing the center line *a*—*b* of the spring 82, it being due solely to the resisting force exerted by the combined resistance of the spring 82 and bellows 18 decreasing at a greater rate than that at which the actuating force exerted by the float decreases as it sinks in the water upon downward movement. This operation of my device whereby a snap or quick action is obtained without an overcenter movement is graphically illustrated in Fig. 5. As the arm 56 moves upward through its complete range of movement, which is determined by engagement of stop 87 with the underside of wall 21, the points *a*, *b*, *c* and *d* will be in the position designated by *a'*, *b'*, *c'* and *d'* respectively, and since the center line of spring 82 has moved upward to the new position *a'*—*b'*, the upward movement of point *c* will not have carried the toggle point *c* overcenter, the point *c'* designating the toggle contact point *c* when the arm 56 has reached its limit of upward movement.

The device is also adapted to operate in response to fluid pressure, such, for example, as the steam pressure in a boiler. The steam pressure at which the device is to operate is determined by means of the adjusting spring 113 and the differential spring 103. The resistance of the spring 113 to downward movement of lever 90 may be adjusted by movable seat 112, and the resistance of the differential spring 103 may be adjusted by the threaded pin 99 to exert a desired upward component of force on lever 90. When the steam pressure acting on the head 22 of the bellows 18 becomes slightly greater than the combined upward force of the spring 113 and the effective component of force of spring 103 upon the lever 90, then the bellows will be expanded longitudinally to act through the thrust member 117 to move the lever 90 downward about its fulcrum 89a. As the lever 90 is forced downward, the upward component of force exerted by the spring 103 will be decreased, due to the decrease of the angle of application of the spring 103 on the lever 90. This upward component of force exerted by the spring 103 decreases at a greater rate than the increase of resistance of the spring 113, and therefore the combined upward force exerted by these springs upon the lever 90 will be decreased. Since the steam pressure acting on the bellows head 22 is a substantially constant force, and since the combined resistance offered by springs 103 and 113 to the force of the steam decreases with the initial movement of the bellows head, it is evident that the lever 90 will be moved downward quickly and sharply, and the lever 90 acting through its operating member 121, which is pivoted at 123 to the frame member 68, will tilt tube 70 upon its axis 63 to flow the globule of mercury 72 away from the contacts 71 and break the circuit through the leads 73. The operation of the springs 103 and 113 in resisting the movement of the plunger 23 is the same in theory as that of the spring 82 and bellows spring 18, and therefore the above description of the operation of springs 103 and 113 in response to fluid pressure is believed sufficient, in view of the detailed description of the action of spring 82 and bellows spring 18. As the bellows 18 expands it will tend to carry with it the arm member 56 and the frame supporting pin 63, and I therefore employ the support 66 and hook member 65 which extends beneath the pin 63, and have also passed pin 63 through stop opening 64 to prevent downward movement of pin 63 to insure proper operation of device 70 in response to fluid pressure.

The pivot pins 54 on which the arm member 56 rotates are carried by links 53 fulcrumed on a shaft 52, so that when the device 70 is operated by fluid pressure, it will be possible for the bellows 18 to expand and head 22 to move downward, which would not be possible if the pins 54 were fixed against vertical movement.

The switch device 70 may also be operated simultaneously by both the float 39 and fluid pressure acting on bellows head 22, if such conditions should simultaneously arise, and since the movement of the parts for such operation is apparent from the foregoing description, such simultaneous operation will not be described.

It is to be understood that I have shown and described my control device as operating an electric circuit make-and-break means for the purposes of illustration only, and that my control device may be employed with equal facility for operating other control means, such, for example, as a valve or the like, to control the flow of fluid in a fluid system.

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

1. In a device of the character described, rockable means, a pair of members for rocking and supporting said means and connected thereto, and stop means holding each of said members against movement in one direction, whereby each of said members serves as a rigid support for said means when said means is rocked by the other of said members.

2. In a device of the character described, a control means adapted to be moved to a plurality of positions, a pair of operating and supporting members connected to said means, one of said members serving as a fulcrum support for movement of said means by the other of said members to certain of said positions, and the said other member serving as a fulcrum support for movement of said means by said one member to certain of said positions, and each of said members having abutment means operable to limit movement thereof in one direction whereby the limited member will provide a rigid support for movement of said control means by the other of said members.

3. In a device of the character described, a rockable control means, a pair of operating and supporting members pivotally connected to said means, one of said operating and supporting members serving as a fulcrum for rocking movement of said means thereon by the other of said operating and supporting members, and the said other operating and supporting member serving as a fulcrum for rocking movement of said means by said one operating and supporting member, and each of said members having abutment means operable to limit movement thereof in one direction whereby the limited member will provide a rigid support for movement of said control means by the other of said members.

4. In a device of the character described, a pair of operating and supporting members, rockable

means having a fulcrum support on each of said members, a rod member having movement in a plurality of directions, said rod member having operative connections with each of said operating and supporting members, means to move said rod members in one direction to actuate one of said operating and supporting members to rock said rockable means on the other of said operating and supporting members, and means to move said rod member in another direction to actuate the said other operating and supporting member to rock said rockable means on said one operating and supporting member.

5. In a device of the character described, a rockable control device, an operating and supporting member pivoted to said device, a second operating and supporting member pivoted to said device, a lever connected to said first member and having a pivotal support, a lever connected to said second member and having a pivotal support, a thrust member connected to each of said levers, means to move said thrust member to actuate said second mentioned lever to rock said device on the pivotal support of said first operating and supporting member, and means to move said thrust member to actuate said first mentioned lever to rock said device on the pivotal support of said second operating and supporting member.

6. A device of the character described, comprising a float chamber, a float in said chamber, a resilient expansible-collapsible member sealing said chamber, a plunger fixed to said member, means operatively connecting said float and said plunger, a lever arm rigid with said plunger, a control device, and means interconnecting said control device and said arm for operation of said control device by said float.

7. A device of the character described, comprising a float chamber having an opening therethrough, a resilient expansible-collapsible member sealing said opening, a plunger fixed to said member, a float in said chamber having operative connection with said plunger, a lever fixed to said plunger, control means having a pivotal support, resilient means opposing movement of said lever, and means connecting said lever and said control means for operation of said control means by said float.

8. In a device of the character described, a float chamber, a float in said chamber, a link having a fulcrum support, a rod pivoted on said link, means connecting said rod to said float, an arm member fixed to said rod, control means having a fulcrum support, and means connecting said arm member and said control means for operation of said control means by said float.

9. In a device of the character described, a float chamber, a float in said chamber, a link having a fulcrum support, a rod pivoted on said link, resilient means opposing movement of said rod, means connecting said rod and said float, an arm member fixed to said rod, control means having a fulcrum support, and means pivotally connecting said arm member and said control means for operation of said control means by said float.

10. A control device comprising a movable control means, an arm member connected to said means to move the same, a lever carried by said arm member, means urging said arm member and said lever into contact and exerting a component of force in opposition to movement of said control means, and means resisting movement of said arm member.

11. A control device comprising a movable control means, an arm member connected to said means to move the same, an abutment, a lever fulcrumed on said arm member and adapted to engage said abutment, and means tending to rotate said lever on said arm member and exerting a force in opposition to movement of said control means upon engagement of said lever and said abutment.

12. In a device of the character described, a casing comprising a float chamber, a float in said chamber, said casing having an opening, a thrust member projecting through said opening, means operatively connecting said float and said thrust member, a resilient expansible-collapsible member acting on said thrust member to oppose movement of said float, an arm member carried by said thrust member, a lever abutting said arm and having a fulcrum support, a control means, means connecting said arm member and said control means for operation of said control means by said float, and a resilient expansible-collapsible member connecting said arm member and said lever.

13. In a device of the character described, a casing comprising a float chamber, a float in said chamber, said casing having an opening, a thrust member projecting through said opening, means operatively connecting said float and said thrust member, a resilient expansible-collapsible member sealing said opening and acting on said thrust member to oppose movement of said float, an arm member carried by said thrust member, a lever abutting said arm and having a fulcrum support, a control means, means connecting said arm member and said control means for operation of said control means by said float, and a coil spring connecting said arm member and said lever and opposing movement of said float.

14. In a device of the character described, a float chamber, a float in said chamber, said chamber having an aperture, resilient means sealing said aperture, means connecting said float and said resilient means, said resilient means opposing movement of said float, an arm member fixed to said connecting means, resilient means operatively engaging said arm member and exerting a component of its force in opposition to movement of said float, the angle of application at which said second resilient means acts upon said arm member decreasing upon movement of said float whereby the component of force exerted by said second resilient means to movement of said float decreases, the decrease of the component of force of said second resilient means being greater than the increase of resistance of said first resilient means to movement of said float.

15. A control device comprising rockable means having a plurality of movable fulcrum supports on which said means may be rocked, a thrust member, means to support said member for longitudinal thrust and for rotatable lateral thrust, means connecting said member to one of said supports, means connecting said member to the other of said supports, means to impart longitudinal thrust to said member to actuate one of said supports to rock said control means on the other of said supports, and means to impart rotatable lateral thrust to said member to actuate the other of said supports to rock said control means on said one support.

16. A control device comprising a movable control means having a range of movement, actuating means connected to said control means to

exert a force to move said control means, the force exerted by said actuating means decreasing upon initial movement of said control means, and means exerting force throughout the range of movement of said control means to resist movement of said control means whereby said resisting means continually tends to return said control means to initial position by said actuating means, the resisting force decreasing upon initial movement of said control means at a greater rate than the decrease of said actuating force whereby said control means is moved quickly through its range of movement.

17. A control device comprising a movable control means having a range of movement, a float chamber, a float in said chamber connected to said control means to exert a force to move said control means, the force exerted by said float decreasing upon initial movement of said control means, resilient means exerting force throughout the range of movement of said control means to resist movement of said control means by said float whereby said resisting means continually tends to return said control means to initial position, the resisting force decreasing upon initial movement of said control means at a greater rate than the decrease in the force exerted by said float whereby said control means is moved quickly through its range of movement.

18. Electric switch mechanism comprising an electric switch, an actuating member therefor, float mechanism connected to said actuating member, and a sylphon device connected to said actuating member and operable independently of the float mechanism, each connection between said actuating member and the float mechanism and the sylphon device forming a movable fulcrum for the actuating member.

19. Electric switch mechanism comprising an electric switch, an actuating member connected to said switch, float mechanism having a connection with said actuating member, and a pressure operated switch actuating device having a connection with said actuating member at a point spaced from said first-named connection, the connection between said actuating member and the float mechanism and the connection between said actuating member and the pressure operated device forming fulcrums for operation of said actuating member.

EARNEST J. DILLMAN.