Sept. 12, 1933. L. W. EGGLESTON ET AL 1,926,706

CONTROL DEVICE

Filed Feb. 10, 1931 2 Sheets-Sheet 1

Fig. 1.

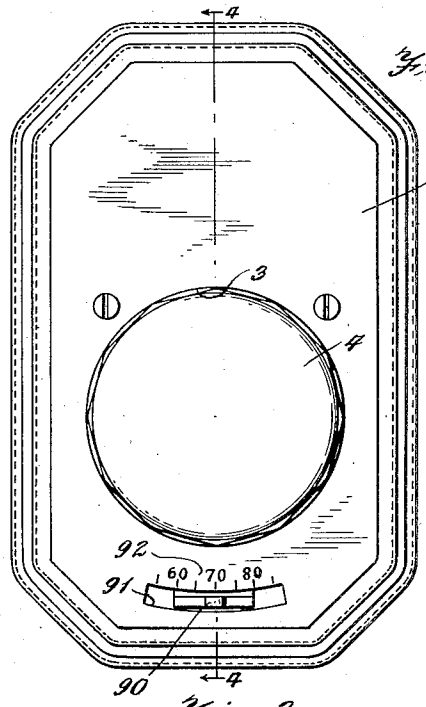



Fig. 2.

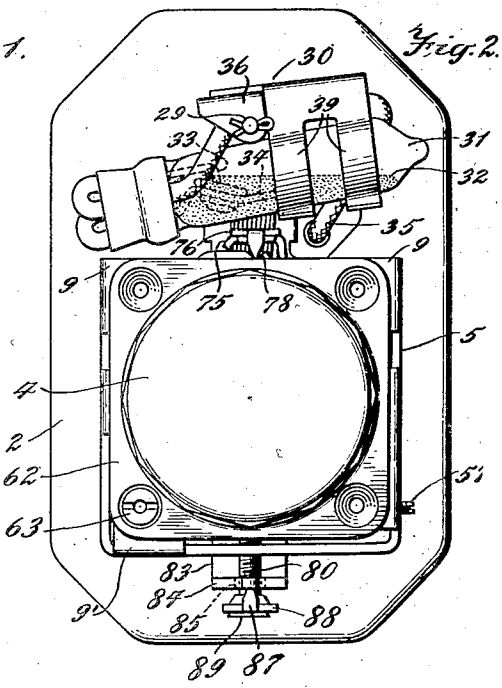



Fig. 3.

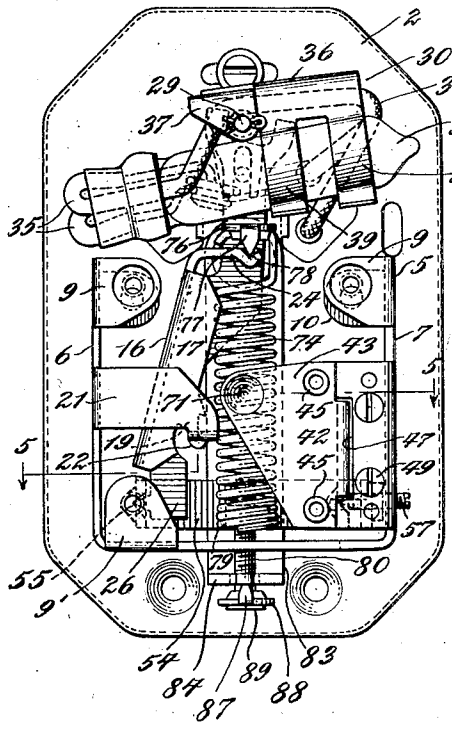
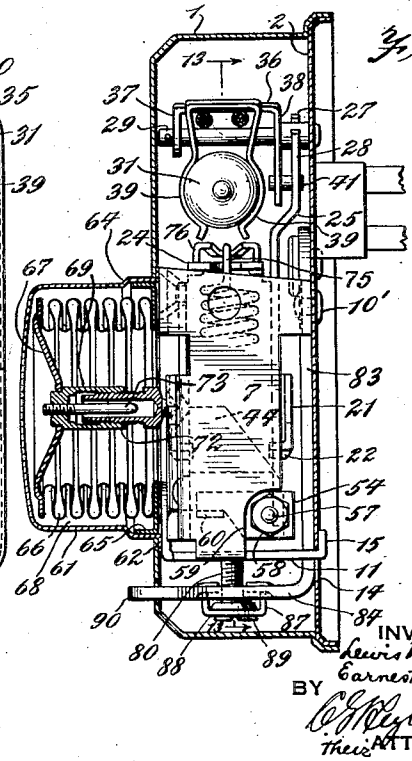



Fig. 4.




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CONTROL DEVICE

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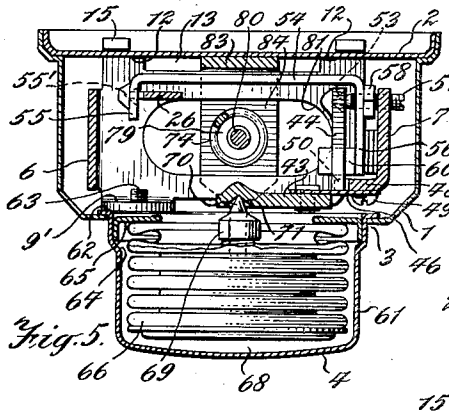


Fig. 5.

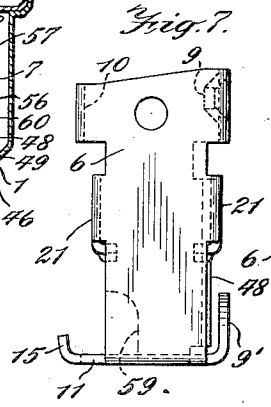


Fig. 7.

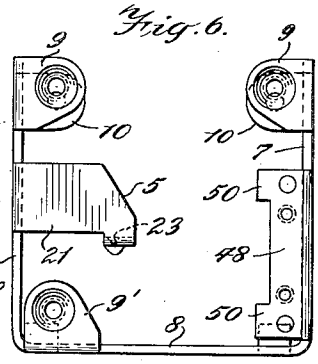


Fig. 6.

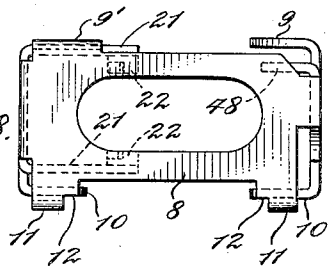


Fig. 8.

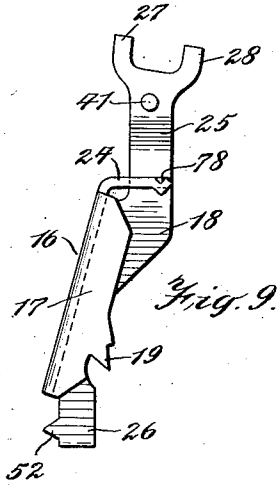


Fig. 9.

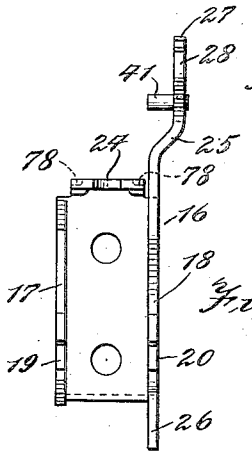


Fig. 10.

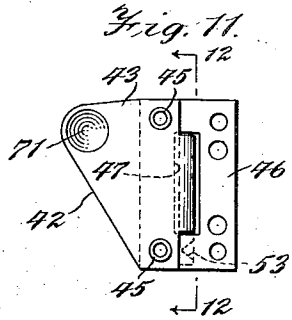


Fig. 11.

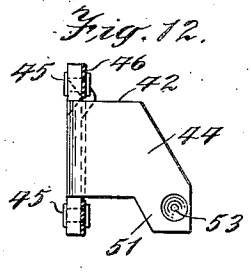


Fig. 12.

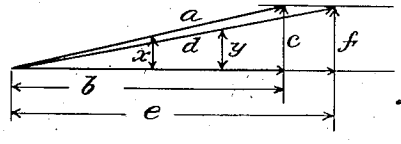


Fig. 14.

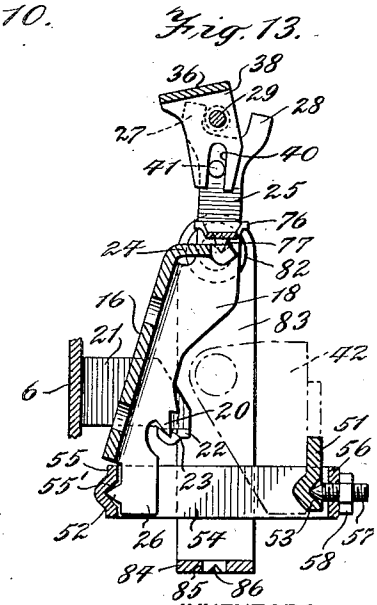


Fig. 13.

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# UNITED STATES PATENT OFFICE

1,926,706

## CONTROL DEVICE

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Application February 10, 1931. Serial No. 514,787

24 Claims. (Cl. 200—140)

Our invention relates to new and useful improvements in control devices, and has for an object the provision of automatic means operable in response to variation in a fluid characteristic, such, for example, as a pressure, temperature or hygrometric condition to regulate or control a mechanism or device, such, for example, as electric switch means, or the like.

Another object is to provide a device which is compact, of simple construction, and efficient in operation.

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, we have fully and clearly illustrated a preferred embodiment of our invention, in which drawings—

Figure 1 is a view in front elevation of the device of our invention, with the casing or cover member in place;

Fig. 2 is a view in front elevation with the cover member removed;

Fig. 3 is a view in front elevation with certain pressure-responsive mechanism removed to show the underlying structure;

Fig. 4 is a view in vertical central section on the line 4—4 of Fig. 1, but with certain of the elements in side elevation;

Fig. 5 is a view in horizontal section on the line 5—5 of Fig. 3;

Figs. 6, 7 and 8 are, respectively, front, side or end, and bottom plan detail views of a frame or supporting member;

Figs. 9 and 10 are front and side detail views of a lever member;

Fig. 11 is a detail front view of a lever member and the support therefor;

Fig. 12 is a view on the line 12—12 of Fig. 11;

Fig. 13 is a detail view in section on the line 13—13 of Fig. 4, with certain parts removed to show underlying structure, and

Fig. 14 is a diagram of forces.

Referring to the drawings by characters of reference, 1 designates a casing or cover member which cooperates with a base or plate member 2 to enclose certain operating mechanism, and which has an aperture 3 therethrough, preferably circular, through which projects a pressure-responsive operating means 4. Secured to the front face of the plate or base member 2, the normal operative position of which is substantially vertical, is a frame member 5, shown in detail in Figs. 6, 7 and 8. The member 5 is preferably substantially U-shaped in front elevation, having spaced substantially parallel and vertical arms or supporting members 6, 7 which lie in planes transverse to the plane of member 2, and which are joined by a bottom cross-member 8. At the upper ends of the members 6, 7 and projecting inwardly toward each other from the front and rear edges thereof, are apertured, substantially parallel and vertical ears or flanges 9, 10, the rear flanges 10 being rigidly secured to the member 2 by rivets or the like 10'. Extending rearwardly from the member 8 and in the plane thereof are arms 11 which are stepped to provide rearwardly facing shoulders 12 and a transverse slot 13 between members 8 and 2, the shoulders bearing against the front face of member 2 and the arms 11 extending through base member slots 14 and being turned over, as at 15, against the rear face of member 2 to clamp member 5 thereto. Extending upwardly from the front edge of cross member 8 adjacent member 6, is an apertured ear or flange 9' substantially in the vertical plane of flanges 9, and for a purpose to be described. Carried by the member 6 is a lever or operating member 16, preferably at its mid-portion being somewhat inclined to the vertical and of substantially channel form, having side members or flanges 17, 18 provided with downward directed, substantially horizontally alined fulcrum supports 19, 20, respectively, which preferably terminate in knife edges (see Figs. 9 and 10). The member 16 is preferably positioned between spaced, substantially parallel and horizontal arm members 21 which extend laterally from the front and rear edges of member 6 substantially midway of the height thereof and toward member 7, the members 21 having horizontally opposed supporting flanges 22 in the top faces of which are alined substantially V-shaped notches or recesses 23 which receive the knife edge supports 19, 20, respectively, and serve to support pivotally the member 16. At the upper end of the channeled mid-portion is a substantially horizontal spring engaging or supporting arm 24, preferably integral with member 16 and formed by a bent over extension of the channel web or base. The side member 18 extends substantially vertically above and below the channeled mid-portion, as at 25, 26, respectively, the upper portion 25 terminating in a bifurcated end having spaced, upwardly extending arms 27, 28 lying in a plane substantially parallel to member 2 and serving as stop means for a purpose to be described. Projecting from

and substantially normal to the front face of member 2 is a shaft or pivot pin 29 which is rigid with the member 2 and positioned between and cooperable with the arms 27, 28.

Mounted on the shaft 29 for actuation by the lever or operating member 16, is a control means 30, preferably an electric switch means and of the mercury tube type comprising a sealed glass envelope or tube 31 containing a globule of mercury 32 cooperable with electrodes or contact terminals 33, 34 to make and break circuit or contact therebetween upon tilting or rocking movement of the tube. Extending from the terminals 33, 34 are flexible electric leads or conductors 35 which may be connected to any means or mechanism to be controlled, such for example as a relay or a motor or the like. The means 30 includes a carrier member 36 having depending apertured flanges 37, 38 through which the shaft 29 extends and having depending cooperable spring fingers or members 39 between which the tube 31 is tightly held and supported. The flange 38 which lies adjacent and substantially parallel to the front face of the upper lever portion 25 has a substantially vertical slot 40 therethrough, preferably open at its bottom end, the slot receiving the free forward end of a pin 41 rigid with and projecting from the lever portion 25 so that the pin and slot serve to connect operably the member 16 and the means 30. Since the pin and slot connection is below the shaft 29, the means 30 will move reversely to movement of member 16, i. e., referring to Fig. 3, clockwise movement of member 16 will cause counterclockwise movement of means 30, and vice versa.

Carried by the supporting member 7 is a lever or motion transmitting member 42, preferably of the bell-crank type having transverse arms 43, 44, the lever being supported or fulcrumed on a substantially vertical axis for pivotal movement or swing in a substantially horizontal plane. The arm 43, which normally lies substantially parallel to the plane of member 2, extends above and below the arm 44 which normally extends from the side edge of arm 43 adjacent member 7 rearwardly toward member 2. Secured rigidly to the rear face of arm 43, as by rivets 45, is a substantially rectangular hinge member 46 having a vertical slot or aperture 47 therethrough, through which the lever arm 44 projects freely. The member 46 is preferably of resilient sheet metal, such as spring bronze. Extending laterally toward member 6 from the front edge of and rigid with member 7, is a vertical flange 48 which contacts with the rear face of and is rigidly secured to the hinge member 46, as by screws or the like 49. The flange 48 is preferably formed integral with member 7 and is preferably substantially coextensive in height or length with member 46, the flange 48 being substantially U-shaped and having arms 50 which straddle the lever arm 44 and terminate substantially at the side edge of arm 43 (see Figs. 5 and 6). The free end of the rearwardly extending arm 44 terminates substantially in the plane of the lower lever end portion 26 and has a depending end portion 51. On the outer side edge of portion 26 is a pointed pivot or fulcrum member 52 extending toward member 6 and which is substantially horizontally alined with a conical socket or bearing recess 53 in the outer side face of portion 51 and toward member 7. The lever members 16 and 42 are interconnected by a link or connecting bar member 54 which lies to the rear thereof and has at its ends forwardly extending arms of flanges 55, 56 which embrace the lever portions 26, 51. In the inside face of arms 55 is a substantially conical socket or recess 55′ which receives the pivot member 52. Adjustably threaded through the arm 56 is a bearing pin 57 having a pointed end which seats in the recess 53 and is preferably provided with a lock nut 58, the member 7 being recessed or cut away, as at 59, to provide clearance for and access to the pin 57 which is provided with an end slot for screw driver adjustment. The arm 56 preferably extends forward of the depending lever portion 51 and has a lateral flange 60 which lies beneath the arm 44 for cooperation with the bottom edge thereof to limit and substantially prevent turning or rotation of the link member clockwise of Fig. 4. The free end of arm 44 serves as a stop to limit turning of the link member counterclockwise of Fig. 4.

The operating means 4 is responsive to pressure and cooperates with the lever member 42 to actuate the means 30. The means 4 comprises a casing or substantially cup-shaped container 61 having at its rim a lateral surrounding flange 62 which overlies and is rigidly secured to the ears or flanges 9, 9′, as by screws 63 or the like. The container 61 which forms the outer wall of a thermostatic bulb has adjacent its rim an internal annular shoulder 64 on which seats an annular supporting member 65 sealed to the container, and to the inner periphery of which is secured and sealed, as by solder, a resilient element 66, preferably a substantially cylindrical, circumferentially corrugated, expansible-collapsible metal member or bellows. The element 66 extends into the container and has sealed to the free inner end thereof a head or end wall 67 which provides an hermetically sealed chamber 68 around the element 66 and within the container. Through the head 67 is a substantially centered aperture in which is secured and sealed a two part hollow post or plunger 69 which extends concentrically within the element beyond the container rim and has a conical tip or pointed end 70 which seats in a recess or socket 71 in the front face of the lever arm 43. The parts of the plunger 69 are sleeved one within the other and adjustably screw-threaded together, as at 72. Within the plunger is a filling tube 73 which opens into chamber 68 through an axial hole in which the tube 73 is secured in the base of the plunger, the plunger serving as a protecting cap for the tube. The chamber 68 is charged with a suitable volatile liquid through the tube 73 which is then sealed by solder or other means.

The force exerted by the operating means 4 is controlled by a resilient means 74, preferably a coil spring which opposes or resists the pressure in the chamber 68 and the operation of the means 30 thereby. The spring 74 is provided at its upper end with a hook portion 75 which is hooked over a bearing member 76 having depending legs 77 terminating in knife edges which seat in spaced bearing recesses 78 in the top face and at the free end of the lever arm 24. At its lower end the spring 76 which depends between the link 54 and lever arm 43 has secured therein a nut member 79 through which is adjustably threaded a depending screw member 80 which extends downward through an opening 81 in the cross member 8. Secured to the member 2 substantially in the plane of arm 24 and at a normal to the centerline of spring 74 is a circular bearing member 82 on which is journaled for pivotal oscillatory movement an adjustment lever 83 which extends

downward through the slot 13. Beneath the cross member 8 lever 83 has a forwardly extending, substantially horizontal arm 84 having an aperture 85 therethrough, through which the screw member 80 freely extends. On the under face of arm 84 and at diametrically opposite points across the aperture 85 are bearing recesses 86 in which seat the legs 87, which preferably terminate in knife edges of a bearing member 88 against the underface of which the head 89 of screw 80 abuts, the screw 80 passing through an aperture in member 88. The screw head 89 is preferably slotted to permit adjustment of screw 80 to vary the tension exerted by spring 74 on lever 16. The lever arm 84 has at its free end a forwardly extending finger or pointer 90 which projects through an arcuate slot 91 in the cover member 1, and by which the angle of application of the force of spring 74 on lever 16 may be manually regulated. The cover member may be provided with a scale 92 adjacent slot 91 and cooperable with the finger 90 to indicate the setting of the device or the temperature at which the control means 30 will be actuated. The screw 80 serves to anchor the lower end of spring 74.

The operation of our device is as follows: The resistance or opposing force which the spring 74 exerts against movement of the control means 30 by the operating means 4 is set by the finger 90, movement of which swings the lower end of spring 74 to increase or decrease the angle of application of the spring force on lever member 16. Due to the fact that the spring 74 acts at an angle on the member 16, the force of the spring will be divided into components, one component of force acting longitudinally of the member 16 and not exerting any turning movement thereon, the other component of force acting to swing the lever and to resist operation of the means 4. Since the angle at which the spring acts on the member 16 is acute or small, the resisting component of force may be maintained substantially constant for all movement of member 16 within its range, or may be made to decrease upon decrease of the angle, because the variation in the resistance of the spring as it is elongated or contracts on movement of the member 16 is compensated by the variation in the angle at which the spring acts on member 16. This is graphically illustrated in Fig. 14. Assuming that the angle $x$ is the angle at which the spring is acting on member 16 in Fig. 3 when the means 4 is at rest, or exerting insufficient pressure to actuate means 30, then the line $a$ will designate the inherent force of the spring, the line $b$ the component acting lengthwise of the member 16, and the line $c$ the spring component acting to resist the means 4. When the pressure exerted by the means 4 becomes equal to the resisting component of spring 74, taking into consideration the multiplication of forces by the lever members 16 and 42 and the friction of parts, then the system will be in balance. If now there is any increase of force exerted by means 4, the member 16 will be moved counterclockwise of Fig. 3, the force being transmitted by plunger 69 through bell-crank lever 42 and link 54 to member 16. The initial movement of lever member 16 will decrease the angle $x$ and increase the force $a$, as the center line of spring 74 approaches the center of movement of member 16. Assuming that the initial infinitesimal increment of movement of member 16 produces between member 16, and the spring center line the new angle $y$, which in Fig. 14 is for the purpose of illustration grossly exaggerated, then the increased force of the spring will be represented by the line $d$, the component acting lengthwise of the member 16 by the line $e$, and the resisting component by the line $f$. Succeeding increments of movement of member 16 will cause equal changes of angle and equal changes in the components of force of spring 74. The force represented by line $f$ may be made to remain equal to the component $c$, or may be made less than the component $c$, since the force $f$ is dependent on the amount of elongation of the spring 74 for each increment of movement of member 16 which depends on the distance between the fulcrum of member 16 and the point of spring engagement therewith. An example, solely for the purposes of illustration, may employ a spring which will have an increase of resistance of say, substantially sixteen pounds per inch of elongation and a lever having the distance between its point of fulcrum support and the point of spring engagement therewith substantially one and five-tenths inches. Since the means 4 is a fluid pressure means, the plunger 69 will follow against lever 42, exerting substantially the same infinitesimal overbalancing pressure, which is the predetermined pressure at which the device is to operate, and since the component of force $f$ is preferably less than the component $c$ to compensate for the resistance of element 66 to collapse thereof, the force exerted by means 4 which will initiate movement of member 16 and means 30, will move means 30 completely through its range of movement. When the means 4 responds at the predetermined temperature for which the device has been set by the finger 90, the lever member 16 will be moved counterclockwise of Fig. 3, as above described, and the pin 41 engaged in slot 40 will rock or tilt the carrier member 36 clockwise of Fig. 3 about pin 29 to tilt the tube 31 and cause the mercury 32 to flow away from contacts 33, 34 to break the circuit therebetween. As the pressure within chamber 68 drops below the predetermined setting of the device, the spring 74 will act through member 16 and the pin and slot connection 40, 41 to tilt the tube 31 back into the position of Fig. 3 to make contact between 33, 34 by the mercury 32. Clockwise or contact breaking movement of tube 31 is limited by engagement of arm 28 with shaft 29, and counterclockwise or contact making movement of tube 31 is limited by engagement of arm 27 and shaft 29.

It may be noted that in our device provision is made for compensation at two points, so that we are enabled to provide an instrument which is compact and in which the desired compensation for efficient and sensitive operation is obtained. The double compensation is accomplished by the fact that movement of the lever 16 moves the center line of spring 74 closer to the center of rotation of lever 16 and simultaneously therewith moves the point of engagement between lever 16 and link 54 further away from the center of rotation of lever 16. This may be illustrated by the following equation:

$$F_1=\frac{A_1D_1}{E_1}$$

wherein:

$A_1$=total spring force in pounds.

$D_1$=lever arm in decimals of an inch of force $A_1$; i. e., perpendicular distance from center of rotation of lever 16 to point of engagement between spring and lever 16.

$F_1$=force in pounds to balance spring resistance.

$E_1$=lever arm in decimals of an inch of force $F_1$; i. e., perpendicular distance from center of rotation of lever 16 to point of engagement between lever 16 and link 54.

and in which $A_1$, $D_1$ and $E_1$ vary on movement of lever 16, and the values of which may be so determined as either to maintain $F_1$ constant, irrespective of movement of lever 16 within its operating range, or to cause $F_1$ either to increase or to decrease. A particular example of the desired compensation effected by our device, as taken from such an operative device of our construction, is as follows:

(1) At minimum operating temperature setting, i. e., with spring 74 exerting a minimum resistance, lever 16 having been moved toward the left of Fig. 1—

(*a*) Force to initiate movement of lever 16,

$$F_1=\frac{15.83\times 0.139}{0.481}=4.57\#$$

(*b*) Force to balance spring resistance when lever has been moved through its complete range—

$$F_2=\frac{15.98\times 0.108}{0.519}=3.33\#$$

Compensation 1.24#, i. e., decreased force to balance spring resistance at beginning and end of lever movement.

(2) At intermediate operating temperature, i. e., with lever 16 positioned as shown in Figs. 1 and 3—

(*a*) as above

$$F_1=\frac{15.72\times 0.393}{0.481}=12.85\#$$

(*b*) as above

$$F_2=\frac{16.16\times 0.360}{0.519}=11.20\#$$

Compensation 1.65#

(3) At maximum operating temperature setting, i. e., with spring 74 exerting a maximum resistance, lever 16 having been moved toward the right of Fig. 1—

(*a*) as above

$$F_1=\frac{15.57\times 0.637}{0.481}=20.61\#$$

(*b*) as above

$$F_2=\frac{16.31\times 0.600}{0.519}=18.86\#$$

Compensation 1.75#.

It will be noted that the compensation is not uniform throughout the adjusting range. However, we have found, in practice, that the increased compensation upon increase from low to high temperature operation setting is desirable. The foregoing example is merely illustrative of an actual working embodiment of our invention and is not to be taken as a limitation of our invention as defined in the appended claims, as it is evident that other forces and lever arm lengths may be used without departing from the spirit and scope of our invention.

Although we have shown and described our device as operable by thermostatic or temperature responsive means, we do not limit ourselves to such means, as the device is equally operable in response to a force or pressure generated or resulting from other conditions or means.

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

1. A device of the character described, comprising a movable control means having a range of movement, a lever fulcrumed for movement in a substantially vertical plane, a lever fulcrumed for movement in a substantially horizontal plane, a substantially horizontally extending link interconnecting said levers and normally tending to rotate about its longitudinal axis, a stop member projecting from one end of said link and opposing rotation of said link, one of said levers having operative connection with said control means, means responsive to a fluid characteristic and operatively connected to the other of said levers whereby to move said control means, and means resisting movement of said control means.

2. A device of the character described, comprising a movable control means having a range of movement, a lever fulcrumed for movement in a substantially vertical plane, a lever fulcrumed for movement in a substantially horizontal plane, a substantially horizontal link pivotally engaging and operatively connecting said levers, said link normally tending to rotate about its longitudinal axis, a lateral flange on said link engaging the edge of one of said levers to limit rotation of said link, one of said levers having operative connection with said control means, means responsive to a fluid characteristic and operatively connected to the other of said levers whereby to move said control means, and means resisting movement of said control means.

3. A device of the character described, comprising a movable control means having a range of movement, a pair of levers having fulcrum supports, means operatively connecting said levers, one of said levers having operative engagement with said control means, means responsive to a fluid characteristic and having operative engagement with the other of said levers whereby to move said control means, a bearing member having knife edge engagement with said one lever, and spring means having one end fixed to said bearing member and having its other end anchored whereby said spring means resists operation of said control means by said responsive means.

4. A device of the character described, comprising a movable control means having a range of movement, a pair of levers, a resilient sheet metal hinge member, one of said levers being fixed to said member, means operatively connecting said levers, one of said levers having operative engagement with said control means, means responsive to a fluid characteristic and having operative engagement with the other of said levers whereby to move said control means, and spring means having one end fixed to the other of said levers and having its other end anchored whereby said spring resists operation of said control means by said responsive means.

5. In a device of the character described, a lever having a fulcrum support, a second lever having a fulcrum support, a link having flanges embracing said levers, said levers having knife-edge engagement with said flanges, means responsive to a fluid characteristic and acting on one of said levers, and resisting means acting on the other of said levers in opposition to movement thereof by said responsive means.

6. In a device of the character described, a lever having a fulcrum support, a second lever having a fulcrum support, a link having flanges embracing said levers and having an arm cooperable with one of said levers to prevent rotation of said link about its longitudinal axis, said levers having knife-edge engagement with said flanges, means responsive to a fluid characteristic and

acting on one of said levers, and resisting means acting on the other of said levers in opposition to movement thereof by said responsive means.

7. A device of the character described, comprising a control means, a shaft pivotally supporting said means for rocking movement, a lever operatively connected to said means and having means cooperable with said shaft to limit rocking movement of said control means, pressure responsive means acting through said lever to rock said control means, and means resisting operation of said control means by said pressure responsive means.

8. A device of the character described, comprising a control means, a shaft pivotally supporting said means for rocking movement, a lever operatively connected to said means and having a bifurcated end providing stop arms, said arms lying on opposite sides of said shaft and being cooperable therewith to limit rocking movement of said control means, pressure responsive means acting through said lever to rock said control means, and means resisting operation of said control means by said pressure responsive means.

9. A device of the character described, comprising a movable control means having means to limit its movement, a lever fulcrumed intermediate its ends and operatively connected to said control means, spring means acting at such an acute angle on said lever at one side of said fulcrum that the component of force exerted by said spring means in opposition to movement of said lever is substantially constant as said lever is moved to decrease the angle between said lever and spring irrespective of increase in the inherent resistance of said spring means due to such lever movement, and pressure responsive means acting on said lever on the opposite side of said fulcrum, said responsive means acting upon a predetermined substantially constant pressure which will overbalance the opposing component of force of said spring means to initiate and cause movement of said control means to its limit of movement.

10. A device of the character described, comprising a movable control means having means to limit its movement, a lever fulcrumed intermediate its ends and operatively connected to said control means, spring means acting at such an acute angle on said lever at one side of said fulcrum that the component of force exerted by said spring means in opposition to movement of said lever is substantially constant as said lever is moved to decrease the angle between said lever and spring irrespective of increase in the inherent resistance of said spring means due to such lever movement, and thermostatic means acting on said lever on the opposite side of said fulcrum, said thermostatic means acting upon predetermined temperature to exert a substantially constant pressure which will overbalance the opposing component of force of said spring means to initiate and cause movement of said control means to its limit of movement.

11. A device of the character described, comprising a base member, a supporting member carried by said base member, a lever having substantially parallel longitudinally extending flanges, said flanges having bearing means pivotally supporting said lever on said supporting member, a control means fulcrumed on said base member, one of said flanges having a pin and slot engagement with said control means, said lever having a supporting arm, a bearing member fulcrumed on said arm, a spring having one end anchored and being secured at its other end to said bearing member, and means to actuate said lever.

12. A device of the character described, comprising a base member having spaced longitudinally extending substantially vertical supporting members rigid therewith, a lever carried by each of said supporting members, said levers being positioned in the space between said supporting members, means interconnecting said levers, a movable control means having operative connection with one of said levers, spring means opposing movement of said control means, and pressure responsive means operatively engaging the other of said levers and acting upon predetermined pressure to overcome said spring means and move said control means.

13. A device of the character described, comprising a base member having spaced supporting members rigid therewith, a lever carried by each of said supporting members, means interconnecting said levers, a movable control means having operative connection with one of said levers, spring means opposing movement of said control means, and means responsive to a fluid characteristic and rigidly mounted on said supporting members, said responsive means operatively engaging the other of said levers and acting upon predetermined pressure to overcome said spring means and move said control means.

14. A device of the character described, comprising a base member having spaced supporting members rigid therewith, a lever carried by each of said supporting members, means interconnecting said levers, a movable control means having operative connection with one of said levers, said one lever having an arm extending toward the other of said levers, spring means positioned between said levers and having one end anchored and at its other end engaging said arm and opposing movement of said control means by said one lever, and means responsive to a fluid characteristic and operatively engaging the other of said levers and operable to overcome said spring means and move said control means.

15. A device of the character described, comprising a base member having spaced substantially vertical supporting members rigid therewith, horizontally spaced substantially parallel arms carried by one of said members, a lever pivotally supported on said arms, a bell-crank lever pivotally supported by the other of said supporting members and having a substantially vertical axis, means interconnecting said first-named lever and one of the arms of said bell-crank lever, pressure responsive means rigidly mounted on said supporting members and having operative engagement with the other arm of said bell-crank lever, movable control means operatively connected to said first-named lever, and means opposing operation of said pressure responsive means.

16. A device of the character described, comprising a base member having spaced substantially vertical supporting members rigid therewith, horizontally spaced substantially parallel arms carried by one of said members, a lever pivotally supported intermediate its ends on said arms, a bell-crank lever pivotally supported by the other of said supporting members and having a substantially vertical axis, means interconnecting said first-named lever and one of the arms of said bell-crank lever, pressure responsive means rigidly mounted on said supporting members and having operative engagement with the

other arm of said bell-crank lever, movable control means operatively connected to said first-named lever, and spring means acting on said first-named lever and opposing operation of said pressure responsive means.

17. A device of the character described, comprising a base member having spaced substantially vertical supporting members rigid therewith, horizontally spaced substantially parallel arms carried by one of said members, a lever pivotally supported on said arms, a bell-crank lever pivotally supported by the other of said supporting members and having a substantially vertical axis, a bar member having substantially parallel opposed flanges embracing said levers, one of said flanges having engagement with said first-named lever and the other of said flanges having engagement with one of the arms of said bell-crank lever to interconnect said levers, pressure responsive means rigidly mounted on said supporting members and having operative engagement with the other arm of said bell-crank lever, movable control means operatively connected to said first-named lever, and means opposing operating of said pressure responsive means.

18. A device of the character described, comprising a base member having laterally spaced supports, a lever fulcrumed on one of said supports for movement substantially parallel to said base member, control means movable with and upon movement of said lever, a bell-crank lever fulcrumed on the other of said supports and having one arm extending substantially parallel to said base member, said levers being positioned in the space between said supports, said bell-crank lever being fulcrumed for movement in a substantially horizontal plane, means operatively connecting the other arm of said bell-crank lever to said first-named lever, means responsive to a fluid characteristic and acting through said one arm to move said control means, and means exerting a predetermined resistance to movement of said control means by said responsive means.

19. A device of the character described, comprising a base member having laterally spaced supports, a lever fulcrumed intermediate its ends on one of said supports for movement substantially parallel to said base member, control means operatively connected to one end of said lever, a bell-crank lever fulcrumed on the other of said supports and having one arm extending substantially parallel to said base member, said levers being position in the space between said supports, said bell-crank lever being fulcrumed for movement in a substantially horizontal plane, means operatively connecting the other arm of said bell-crank lever to the other end of said first-named lever, means responsive to a fluid characteristic and acting through said one arm to move said control means, and means exerting a predetermined resistance to movement of said control means by said responsive means.

20. A device of the character described, comprising a base member having spaced supporting members rigid therewith, horizontally spaced substantially parallel arms carried by one of said members, a lever pivotally supported intermediate its ends on said arms, a bell-crank lever pivotally supported by the other of said supporting members and having a substantially vertical axis, means interconnecting said first-named lever and one of the arms of said bell-crank lever, supporting means rigid with said base member, means responsive to a fluid characteristic and carried by said supporting means, said responsive means having operative engagement with the other arm of said bell-crank lever, movable control means operatively connected to said first-named lever, and spring means acting on said first-named lever and opposing operation of said responsive means.

21. A device of the character described, comprising a base member having spaced supporting members rigid therewith, a lever pivotally supported on one of said members, a bell-crank lever pivotally supported by the other of said supporting members and having a substantially vertical axis, means interconnecting said first-named lever and one of the arms of said bell-crank lever, supporting means on said base member, a housing carried by said supporting means and overlying said bell-crank lever, said housing having a resilient wall, means operatively connecting said wall and the other arm of said bell-crank lever whereby fluid pressure in said housing may move said first-named lever, movable control means operatively connected to said first-mentioned lever, and spring means acting on said first-named lever and opposing operation of said control means.

22. A device of the character described, comprising a base member, substantially parallel spaced longitudinally extending supporting members rigid with said member and extending transversely thereto, one of said supporting members having substantially parallel spaced arms extending toward the other of said supporting members, said arms having oppositely positioned alined bearing recesses, a lever positioned between said arms and having spaced bearing points seating in said recesses, a flange projecting from said other supporting member toward said arms and spaced from said base member, a bell-crank lever fulcrumed intermediate its ends on said flange, pressure responsive means rigidly secured to and mounted on said supporting members, said bell-crank lever having one arm extending toward said base member and having its other arm positioned between said base member and said responsive means, means operatively connecting said responsive means to said other bell-crank lever arm, a link operatively connecting said one bell-crank lever arm and said first-named lever, a movable control means operatively connected to said first-named lever, and a spring resisting operation of said control means.

23. A device of the character described, comprising a base member, substantially parallel spaced longitudinally extending supporting members rigid with said member and extending transversely thereto, one of said supporting members having substantially parallel spaced arms extending toward the other of said supporting members, said arms having oppositely positioned alined bearing recesses, a lever having substantially parallel flanges positioned between said arms, said flanges having spaced bearing points seating in said recesses, a flange projecting from said other supporting member toward said arms and spaced from said base member, a bell-crank lever fulcrumed intermediate its ends on said last-named flange, pressure responsive means rigidly secured to and mounted on said supporting members, said bell-crank lever having one arm extending toward said base member and having its other arm positioned between said base member and said responsive means, means operatively connecting said responsive means to said other bell-crank lever arm, a link operatively connecting said one bell-crank lever arm and said first-

named lever, a movable control means operatively connected to said first-named lever, and a spring positioned between said supporting members and resisting operation of said control means, said spring having one end anchored and having its other end engaging said first-named lever.

24. A device of the character described, comprising a base member, substantially parallel spaced longitudinally extending supporting members rigid with said member and extending transversely thereto, one of said supporting members having substantially parallel spaced arms extending toward the other of said supporting members, said arms having oppositely positioned alined bearing recesses, a lever positioned between said arms and having spaced bearing points seating in said recesses, said lever having a supporting arm extending transversely thereto, a flange projecting from said other supporting member toward said arms and spaced from said base member, a bell-crank lever fulcrumed intermediate its ends on said flange, pressure responsive means rigidly secured to and mounted on said supporting members, said bell-crank lever having one arm extending toward said base member and having its other arm positioned between said base member and said responsive means, means operatively connecting said responsive means to said other bell-crank lever arm, a link operatively connecting said one bell-crank lever arm and said first-named lever, a movable control means operatively connected to said first-named lever, a bearing member fulcrumed on said lever supporting arm, and a spring having one end secured to said bearing member and resisting operation of said control means.

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