June 16, 1936. L. W. EGGLESTON ET AL 2,044,729

CONTROL DEVICE

Filed March 6, 1933

Fig. 1.

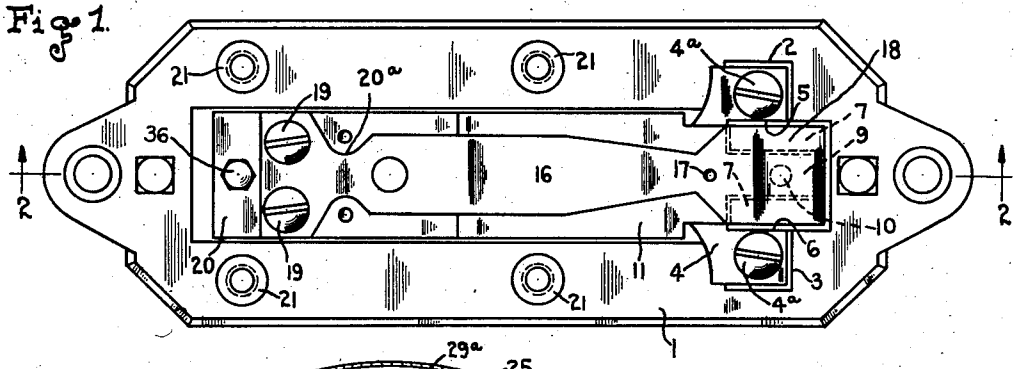


Fig. 2

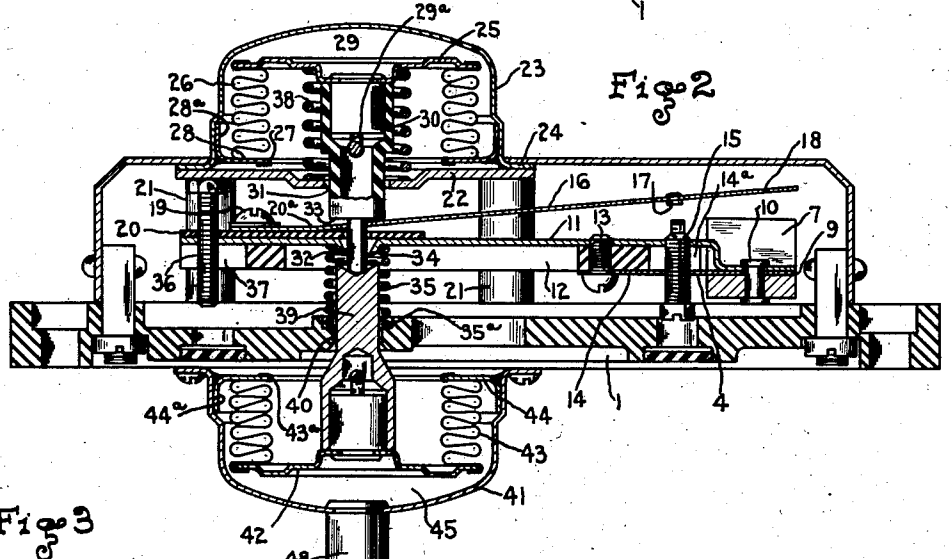
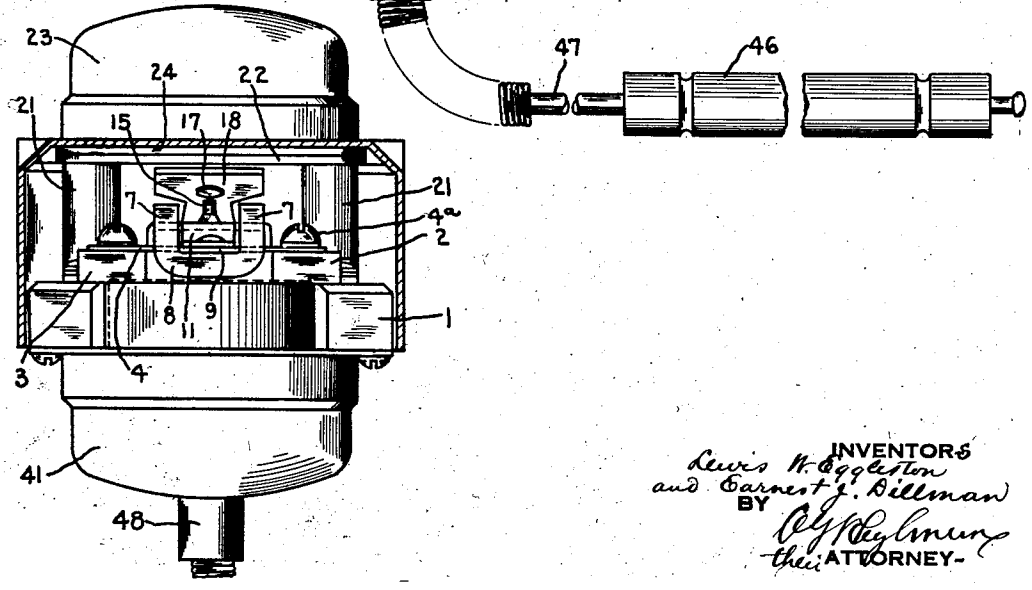


Fig. 3



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UNITED STATES PATENT OFFICE

2,044,729

CONTROL DEVICE

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6 Claims. (Cl. 200—83)

Our invention relates to new and useful improvements in control devices, and more particularly to a device responsive to temperature for controlling an electric circuit, for example.

An object of our invention is to provide a control device having a temperature responsive actuating means, the operation of which is regulated or controlled in accordance with variation in a characteristic or condition of the atmosphere, such as temperature or barometric pressure.

Another object is to provide a device of simple construction and which will operate efficiently.

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 a preferred embodiment of our invention, in which drawing—

Figure 1 is a top plan view of the control device embodying our invention, but with the cover member and certain temperature responsive operating means removed;

Fig. 2 is a view in section on the line 2—2 of Figure 1, but showing the cover and temperature responsive operating means in position, and

Fig. 3 is a view in end elevation, but showing the cover member in section.

Referring to the drawing by characters of reference, 1 designates a base or back member which is substantially rectangular and preferably of insulating material. Adjacent one end of the base member there are laterally spaced bosses 2, 3. A plate member 4 of resilient sheet metal is secured to the top faces of and extends between the bosses 2, 3. The member 4 is rigidly secured to the bosses 2, 3 by screws 4a and is provided between the bosses 2, 3 with substantially parallel end slots 5, 6 which receive the upwardly projecting arms or poles 7 of a U-shaped permanent magnet 8. The plate member 4 has a tongue portion 9 formed between the slots 5 and 6, which extends between the arms or magnet poles 7. The plate portion 9 is secured to the magnet by a rivet, or the like, 10 so that the plate member 4 supports the magnet 8. The rivet 10 also secures one end of a supporting bar or member 11 to the magnet 8 and plate member 4. The supporting member 11 extends longitudinally of the base member in substantially parallel overlying relation thereto and is preferably provided with depending side flanges 12 which make the member 11 substantially rigid. The member 4 serves as a hinge or fulcrum for the member 11 and flexibly connects the member 11 to the base member 1. The member 11 is also secured to the plate member 4 by a screw 13 which also extends through and serves to hold a contact supporting block 14 in position between the members 4 and 11. The block 14 is preferably slotted at one end, as at 14a, to receive a contact member 15 which projects through the plate member 4 and the supporting bar 11, being adjustably screw-threaded therein. The supporting bar 11 has secured adjacent its free end a switch blade or contact carrying arm 16 which extends toward and into overlying relation to the magnet 8 and is provided with a contact member 17 cooperable with the contact member 15. The end portion 18 of the blade 16 which overlies the magnet 8 serves as an armature for cooperation with the magnet poles 7. The blade 16 is secured to the supporting member 11 by screws 19, or the like, the blade being insulated from the supporting member by a sheet of insulating material 20. The blade 16 is provided with a permanent set or is bent upwardly from the supporting member 11, as at 20a, adjacent the screws 19 so that the contact 17 is normally out of engagement with the contact member 15 by the inherent resilience of the blade. At the sides of the supporting member 11 there are longitudinally spaced supporting posts 21 rigid with and rising from the base member 1. A plate member 22 is secured to and seats upon the top ends of the posts 21 and overlies the blade 16, being substantially parallel with the base member 1. Supported by the plate member 22 and by the posts 21 there is a power means 23 responsive to temperature for operating the switch blade 16. The means 23 preferably comprises a substantially cup-shaped container or casing having a marginal flange 24 which seats upon and is secured to the plate member 22. The container is provided with a movable wall 25 preferably formed by the head or end wall of an expansible-collapsible metal bellows 26 which is secured and sealed at its other end, as at 27, to the inner periphery of an annular flange 28 carried by a ring member 28a which fits within and is sealed to the inside face of the container. The sealed space between the wall of the container and the bellows 26 provides an expansible-collapsible chamber 29. The chamber 29 is charged with a suitable volatile liquid which on expansion and contraction due to changes in air temperature to which the means 23 is subjected will

move the end wall 25 relative to the plate member 22. The chamber 29 may be charged by means of the usual filling tube 29a which is then sealed by solder or other suitable means. The end wall 25 is provided with a plunger or operating member 30 of insulating material which extends downward through a guide aperture 31 in the plate member 22. The free end of the plunger has an axial extension or thrust rod 32 of reduced diameter providing on the plunger a downward facing shoulder 33 engageable with the blade 16. The rod 32 extends through aligned apertures in the blade 16, the insulating plate 20, and the supporting member 11. The aperture through the supporting member 11 is surrounded by a flange 34 which serves to center or position one end of a coil spring 35 which abuts the underside of the member 11 and seats at its other end in a recess 35a formed in the top or front face of the base member 1. The spring 35 is held under compression between the base member 1 and the supporting member 11 and normally tends to urge the supporting member and the blade 16 toward the temperature responsive means 23. The extent of movement of the supporting member 11 by the spring 35 is determined by an adjustment screw 36 extending through the bar 11 and insulating member 20 and adjustably threaded in a slotted insulating block 37 secured to the underside of the supporting member 11 by the screws 19. The adjustment screw 36 preferably abuts the underface of the plate member 22 between the posts 21. Movement of the plunger 30 by expansion of chamber 29 is opposed by a coil spring 38 held under compression and which seats at one end on the plate member 22 around the aperture 31 and at its other end engages the movable end wall 25. The thrust rod 32 projects through the member 11 and seats in a recess formed in the end face of a plunger or operating member 39 which is positioned within the coil spring 35 and which extends through a guide aperture 40 in the base member 1. Secured to the rear face of the base member 1 opposite the power means 23, there is a second power means having a cup-shaped container or casing 41 having a movable wall 42 preferably formed by the head or end wall of an expansible-contractible metal bellows 43 which is secured and sealed at its other end, as at 43a, to the inner periphery of a flange 44 carried by a ring member 44a which fits within and is secured and sealed to the side wall of the container 41. The plunger 39 extends into the bellows 43 and seats upon the end wall 42 for movement thereby. The container 41 and bellows 43 provide therebetween and within the container 41 a sealed expansible-collapsible chamber 45. The chamber 45 is in communication with a bulb element 46 by means of a tube 47 secured by a fitting 48 to the container 41. The chamber 45 and bulb 46 are charged with a suitable expansible-contractible fluid, which may be either a liquid or a gas, which will be responsive to variations in a characteristic of the atmosphere.

The operation of our control device is as follows: The device is connected in a circuit to be controlled with one lead wire secured to the blade 16 at one of the screws 19 such that current will be transmitted through the blade 16 to the contact member 17. The other lead wire of the circuit is connected to the plate member 4 by one of the screws 4a with current flowing to the contact member 15 through the plate member 4 and supporting member 11. The screw 36 is adjusted to determine the temperature at which it is desired to make circuit at the contact members 15 and 17. As the temperature surrounding the means 23 increases, the volatile liquid in the chamber 29 will expand, collapsing the bellows 26 against the opposing force of the spring 38. Expansion of the chamber 29 will move the plunger 30 toward the blade 16 and the shoulder 33 into engagement therewith to flex the blade against its inherent resilience, moving the armature 18 toward the magnet poles 7. As the armature 18 is moved into the magnetic field, the field strength acting on the armature will increase and prior to the engagement of the contacts 17, 15 the magnet poles 7 will overcome the resilient force of the blade 16 to make contact between the members 15 and 17 with a quick and substantially snap action. The expansive force of chamber 29 acting on the plunger 30 to move the blade 16 to make contact is regulated by the opposing force exerted by the plunger 39. The force exerted by the plunger 39 is controlled by the fluid in the chamber 45. The chamber 45 may be charged with a gas such as nitrogen at atmospheric pressure so that the force acting on the plunger 39 will vary in accordance with changes in atmospheric pressure. With the chamber 45 so charged, the operation of the plunger 30 by the temperature responsive means 23 will be compensated for changes in atmospheric pressure. Thus, any decrease in the atmospheric pressure acting on the wall 25 which would result in a greater pressure of the liquid in chamber 29 on the plunger 30 at a given temperature would be offset or compensated by the opposing force of the fluid in the chamber 45 acting through the plunger 39 in opposition to movement of the plunger 30 since the chamber walls 25 and 42 are of equal area.

The chamber 45 and bulb 46 may be charged with a suitable volatile liquid responsive to variation in temperature. When so charged, the blade 16 will be operated in response to a differential between the temperature surrounding the means 23 and the temperature surrounding the bulb 46. The force acting on the plunger 39 due to the volatile liquid in the chamber 45 and the bulb 46 will vary in accordance with the temperature surrounding the bulb 46. The force acting on the plunger 30 due to the volatile liquid in the chamber 29 will vary in accordance with the temperature surrounding the responsive means 23. In order for the plunger 30 to be moved by the wall 25, the spring 38 must be overcome, the force of the spring 38 determining the differential between the forces acting on the plunger 30 and on the plunger 39 which must obtain in order for the plunger 30 to move the blade 16. The temperature surrounding the means 23 which will cause operation of the blade 16 to make circuit at a given temperature of the bulb 46 must increase in order to actuate the switch blade upon an increase in the temperature surrounding the bulb 46. The temperature at which the means 23 will actuate the switch blade 16 varies in accordance with variation of the temperature surrounding the bulb 46, because the force acting on the plunger 39 responsive to the temperature of bulb 46 determines the force which must be exerted by means 23 and therefore the temperature surrounding the means 23 which will overcome the force of plunger 39 and actuate the switch blade.

Irrespective of whether the chamber 45 is charged with a gas or a volatile liquid, the dif-

ferential operation of the control device, that is, the difference in the number of degrees variation between making and breaking contact between the members **15** and **17**, may be controlled by adjustment of the contact member **15**. This variation in differential results from controlling the air gap between the armature **18** and the magnet poles **7**; the closer the armature **18** to the magnet when contact is made, the greater will be the holding force of the magnet, and therefore the greater the differential. The range of the control device may be regulated by the adjustment screw **36** to vary the position of the blade **16** with respect to the shoulder **33** of plunger **30** so as to require greater or less expansion of the chamber **29** in order to move the blade **16**. The spring **35** which resiliently supports the member **11** not only cooperates with the screw **36** to regulate the position of the supporting member **11** and therefore of the blade **16** with respect to the plunger **30**, but also serves as a safety means to permit overtravel of the plunger **30**. If the plunger **30** continues to move after contact is made, the member **11** is free to move toward the base member **1** upon compression of spring **35** due to the flexible plate member **4**.

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

1. A control device comprising a base member having an aperture therethrough, automatically acting power means positioned on the opposite sides of said base member and alined with said aperture, a supporting member pivotally mounted on said base member and having an aperture therethrough alined with said first-named aperture, a resilient switch blade secured to said supporting member and having an aperture therethrough alined with said apertures, a contact member carried by said supporting member and cooperable with said blade, a thrust member extending through said apertures and operatively connecting said power means, and means on said thrust member engageable with and for actuating said blade.

2. A control device comprising a base member having an aperture therethrough, automatically acting power means positioned on the opposite sides of said base member and alined with said aperture, a supporting member pivotally mounted on said base member and having an aperture therethrough alined with said first-named aperture, a resilient switch blade secured to said supporting member and having an aperture therethrough alined with said apertures, a contact member carried by said supporting member and cooperable with said blade, a thrust member extending through said apertures and operatively connecting said power means, a helical coil spring surrounding said thrust member and interposed between said base member and said supporting member whereby to permit overtravel of said thrust member, and means on said thrust member engageable with and for actuating said blade.

3. A control device comprising a substantially flat plate member defining a base, an elongated supporting member pivotally secured at one end to said base and extending longitudinally thereof, a resilient sheet metal switch blade secured to said supporting member and extending toward said one end, a contact member carried by said supporting member and cooperable with said blade, said blade and said supporting member having alined apertures therethrough, said base having an aperture therethrough registering with said apertures, a thrust member extending through all of said apertures, said thrust member having a shoulder in overlying engageable relation to and for actuating said switch blade, and oppositely disposed casing members secured to opposite faces of said base, each casing member having a movable wall and containing an expansible fluid, said walls being alined with and engaging said thrust member for actuating said switch blade.

4. A control device comprising a base member, a pair of opposed automatically acting power means carried by said member, a thrust member positioned between and operatively connecting said means such that said thrust member is moved by the differential of the forces of said power means, a supporting member extending thransversely to said thrust member and positioned between said power means, means pivotally supporting said supporting member adjacent one of its ends, means to hold said supporting member in position relative to said base member, a movably mounted switch blade extending longitudinally of said supporting member and fixed thereto, a contact member carried by said supporting member and cooperable with said blade, and means on said thrust member engageable with and operable to actuate said blade.

5. A control device comprising a base member, a pair of opposed automatically acting power means carried by said base member, a separable thrust member positioned between and operatively connecting said power means, one part of said thrust member terminating in a reduced end portion longitudinally engaging the other part of said thrust member, a supporting member positioned between said power means and having an aperture freely receiving said reduced portion such that said thrust member is reciprocatory relative to said supporting member, and a movable switch blade fixed to said supporting member and operable by said thrust member.

6. A control device comprising a base member, a pair of opposed automatically acting power means carried by said base member, a separable thrust member positioned between and operatively connecting said power means, one part of said thrust member terminating in a reduced end portion longitudinally engaging the other part of said thrust member and defining an annular shoulder, a supporting member positioned between said power means and having an aperture freely receiving said reduced portion such that said thrust member is reciprocatory relative to said supporting member, and a movable switch blade fixed to said supporting member and positioned between said shoulder and said supporting member, said shoulder being operable to engage and actuate said blade.

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