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CONTROL DEVICE

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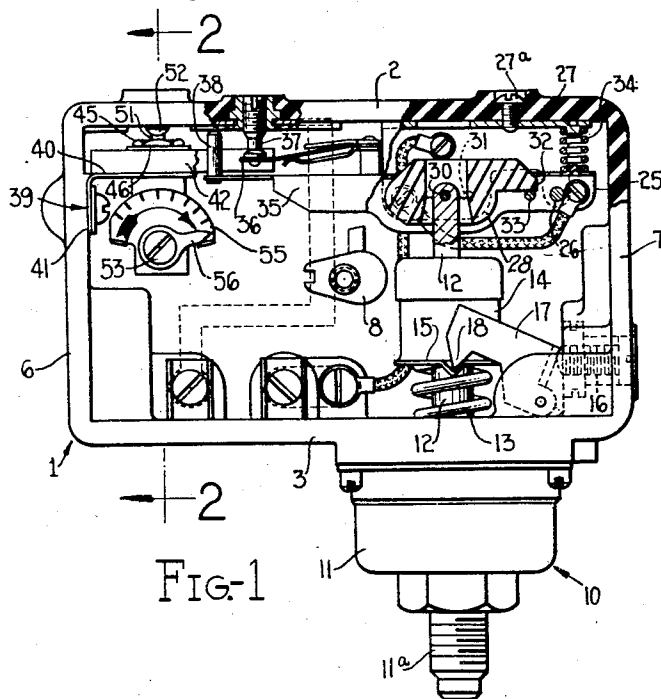
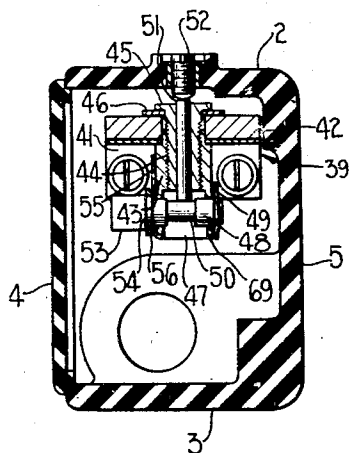


FIG-2

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CONTROL DEVICE

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15 Claims. (Cl. 200—83)

Our invention relates generally to the method of and means for controlling an electric circuit, and more particularly to the switch for controlling an electric circuit.

One of the objects of our invention is to provide a switch mechanism employing an armature and magnet for determining the differential of operation of the switch and to provide new and improved adjustment means for adjusting the differential of operation of the switch.

Another object of our invention is to provide a switch having adjusting means for changing the differential of operation of the switch and for indicating the differential setting of the switch.

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

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

Figure 1 is a side view of a control device embodying our invention, the cover of the device being removed to show the arrangement of the parts, certain of which are shown in elevation and other of which are broken away and shown partly in section, and

Fig. 2 is a view shown in vertical cross-section taken along the line 2—2 of Fig. 1.

Referring to the drawing, the control device shown for the purpose of illustrating our invention includes a supporting member, preferably a casing 1 that is rectangular in shape having a top wall 2, bottom wall 3, side walls, 4, 5 and end walls 6, 7. The casing 1 is preferably constructed of a good electric insulating material and the side wall 4 thereof is preferably removable as a cover. The cover 4 may be secured in place by a screw that may screw-thread into a boss 8 formed integral of side wall 5.

Carried by the casing 1 and secured to the bottom wall 3 thereof there is an actuator which, among other types of actuators, may be employed to actuate our hereinafter described switch, the actuator shown being a pressure responsive power element designated in general by the numeral 10. The power element 10 is not shown nor described in detail since such devices are well known in the art to which this invention appertains, but in general such devices comprise an expansible chamber which may include a bellows (not shown) that is usually enclosed in a cap-like casing, as at 11, the expansible chamber being communicable with a source of pressure

through a fitting 11^a. Carried by and movable with the bellows there is a thrust rod 12 that projects upward into the casing 1 through an aperture in the casing bottom wall 3. The power element 10 is operable to move the thrust rod 12 upward and surrounding the rod, within casing 1, there is a helical coil spring 13 which, in the present instance, is under compression acting to move the thrust rod 12 downward. The power element 10 and spring 13 thus oppose each other and when one overcomes the force exerted by the other, the thrust rod 12 is moved in a corresponding direction. The upper end of the coil spring 13 may abut a movably adjustable abutment member 14 which, in the present instance, is in the form of a cap that fits over an upper end portion of the spring and at its lower or open end preferably has an outturned annular flange 15. The position of the abutment member or cap 14 may be adjusted by means of an adjusting screw 16 acting through a lever 17. The lever 17 is pivotally supported within casing 1, and preferably one end thereof is bifurcated or forked for straddling the cap 14 and has downwardly directed, pointed, extended portions 18 for engaging in upwardly facing indentations or sockets in the cap flange 15. The adjustment screw 16 abuts the lever 17 adjacent the fulcrum thereof and may be screw-threaded into the casing end wall in a manner such that the screw will be accessible from externally of the casing.

Within the casing 1 and overlying the thrust rod 12 is a lever member 25 extending longitudinally of the casing 1 and pivotally supported on a fulcrum member 26 intermediate the thrust rod 12 and casing end wall 7. The fulcrum member 26 is rigidly carried by a supporting member 27 secured to the casing top wall 2 as by a screw 27^a. The thrust rod 12 is connected to a second lever 28, by means of a pin 30, which pivots about a pair of trunnions or pins 31. The lever 28 has an extended portion 32 which is operable to engage a pin 33 secured to the lever 25 and forms the means whereby lever 25 is actuated by the power element 10 in a counterclockwise direction. A spring 34 interposed under compression between the casing top wall 2 and one end portion of the lever 25 intermediate the fulcrum member 26 and casing end wall 7 and spring 34 is operable to move the lever 25 in a clockwise direction.

The outer end portion 35 of the lever 25 extends toward the casing end wall 6 and carries a contact member 36 cooperable with a fixed contact member 37 secured to the casing top wall 2 to open and close an electrical circuit therethrough as the

lever 25 rotates about its fulcrum member 20. A stop member or pin 38 is secured to the end portion 35 and acts to limit movement of the lever 25 in a clockwise direction by engagement with the casing top wall 2.

Disposed within the casing 1 and preferably secured to the casing end wall 6 there is a supporting member 39 that is preferably a resilient, or flexible, plate or hinge member, preferably formed of spring metal having a horizontally disposed portion 40 that is under tension acting to spring or move upward toward the top casing wall 2. The horizontally disposed portion 40 preferably extends from the casing end wall 6 toward and terminates adjacent the free or other end portion 35 of lever 25, the horizontal portion 40 and lever proper being preferably in substantially the same horizontal plane. The supporting member or spring plate 39 may have a downturned flange portion 41 that may be provided with apertures for receiving screws, or other suitable means, for securing the supporting member 39 to the casing end wall 6. Carried by and supported on the upper surface of the spring supporting member 39 there is a magnet 42, preferably of the so-called U-shaped, permanent type. The magnet 42 extends horizontally or substantially parallel with and adjacent the underside of the casing top wall 2, and is arranged such that its opposite end portions or poles overlie the free or other end portion 35 of lever 25, which lever end portion serves as an armature for attraction by the magnet. The magnet 42 is also preferably arranged so that its poles straddle the stop member 38 and the cooperative contact members 36 and 37.

The magnet 42 determines the differential of operation of the switch. Carried by the supporting member 39 there is a manual adjustment means for flexing the supporting member to move the magnet poles closer to or farther away from the lever 25. By changing the distance between the magnet poles and the lever 25 it will be understood that the effective holding force of the magnet 42 will be changed with accompanying change in the differential of operation of the switch. The supporting member 39 is provided with an aperture therethrough that is disposed between the parallel portions of the U-shaped magnet 42 and receives an upper end portion of a tubular, open ended fitting 43 that has an external, upwardly facing, annular shoulder that seats against or abuts the underside of the supporting member 39. The fitting 43 is preferably formed out of square stock and is internally threaded longitudinally thereof to receive a tubular screw 44 that threads into the fitting from the top thereof, the screw 44 preferably having a head 45 beneath which there is preferably a washer 46 that rests on the upper surface of the parallel magnet portions. By screw-threading the screw 44 tightly into the fitting 43 the fitting 43, magnet 42 and supporting member 39 may be rigidly secured together.

A lower end portion of the fitting 43 is preferably of enlarged diameter, as at 47, and extending through this portion of the fitting, transverse to the longitudinal axis thereof, there is a manually rotatable adjustment member 48 in the form of a pin or shaft. The shaft 48 extends through and is journaled in aligned apertures in opposite walls of the fitting 43 and extends substantially perpendicular to the casing cover 4. The end of shaft 48 that is disposed toward the casing side wall 5 has an annular slot or recess externally of the fitting 43, and in this recess there is prefer-

ably clamped and secured a friction washer 49 that engages the outer wall surface of the fitting to prevent the shaft 48 from being too easily rotated. Within the enlarged bore portion 47 of the fitting 43 the shaft 48 is formed having a cam or eccentric portion 50, and seating on the eccentric portion 50 is one end of a pin or thrust member 51 that is slidably received in the bore of tubular screw 44. The upper end of the thrust pin 51 projects above the screw head 45 and abuts end to end with a screw 52 that is adjustably screw-threaded into a metallic, open ended, tubular insert member that is secured in and to the casing top wall 2. The screw 52 may be provided with a slot in its upper end for receiving a screw driver or other tool for adjusting the position of the screw. By means of the screw 52 the resilient supporting member 39 and all the parts carried thereby may be moved upward or downward to the positions desired. The end of the shaft 48 that is disposed toward the casing cover 4 is provided with an enlarged portion or head 53 that provides an external, annular shoulder 54 facing toward and spaced from the outer wall surface of the fitting 43. A dial plate 55 is provided and preferably has an aperture to receive the shaft 48 and positions between the outer wall surface of the fitting 43 and the head or enlarged portion 53 of shaft 48. A pointer member 56 is provided and preferably has an aperture to receive the shaft 48 and is disposed between the enlarged portion 53 of the shaft and the face of the dial plate 55, the pointer 56 being secured to the shaft for rotary movement therewith. On the face of the dial plate 55 there may be provided suitable indicia for cooperation with the pointer 56 to aid in determining the desired position of the magnet poles relative to the armature portion of lever 25. It will be seen that the dial 55 and pointer 56 cooperate to indicate the differential of operation of the switch, and that the dial and pointer are readily observed upon removal of the cover 4.

The operation of the herein described device is as follows: When the spring 13 overcomes the power element 10, the spring will move the thrust rod 12 downwardly, pivoting lever 28 in a counterclockwise direction, as seen in Fig. 1. Counterclockwise movement of lever 28 will permit the spring 34 to pivot lever 25 in a clockwise direction about its fulcrum member 26, moving the lever 25 toward the poles of magnet 42 and the contact member 36 toward its cooperative contact member 37. After the lever 25 has been moved a predetermined distance toward the poles of magnet 42, the attractive force of the magnet will become effective and pivot the lever with a quick action, moving contact member 36 into engagement with its cooperative contact member 37. Initial engagement of contact member 36 with contact member 37 is made before the stop member 38, carried by lever 25, engages the casing top wall 2.

When the force exerted by the power element 10 builds up and becomes equal to the force exerted by the spring 13 and the holding force of magnet 42, the power element will move the thrust rod 12 upwardly, which will pivot lever 28 in a clockwise direction, as seen in Fig. 1, and will pivot lever 25 in a counterclockwise direction. Counterclockwise movement of lever 25 will move the contact member 36 out of engagement with contact member 37, thus opening the circuit. Movement of the lever 25 by the power element 10 is quick or with a snap action, and therefore the contact members 36, 37 are quickly

parted to reduce sparking of the contacts on parting of the same.

From the foregoing description, it will be seen that we have provided a new and improved switch and a control device having a new and improved adjustment means for adjusting the position of a magnet relative to its armature. In addition, we have provided a switch which is efficient and reliable in operation.

This application is a division of our copending application, Ser. No. 116,750, filed Dec. 19, 1936, for Switches now Patent No. 2,199,357, dated April 30, 1940.

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

1. In a device of the character described, a casing, means carried by said casing and having a passageway therethrough, a cam means carried by said means, and means extending through said passageway and abutting said casing and said cam means and operable to move said carried means relative to said casing.

2. In a device of the character described, a casing, a first means carried by said casing, a second means carried by said casing and having a passageway therethrough, a cam means carried by said second-named means, and means extending through said passageway connecting said first-named means and said cam means and operable to move said second-named means relative to said casing.

3. In a device of the character described, a casing, supporting means carried by said casing, adjustable means carried by said supporting means, clamping means extending through and holding said adjustable means and said supporting means in cooperative relation, said clamping means having an aperture therethrough, rod means within said aperture, and cam means carried by said clamping means and cooperable with said rod means to adjust said adjustable means.

4. In a control device, an adjustable member having a hollow portion, a shaft journaled in said member and extending into said portion, said shaft having an eccentric portion within said hollow portion, resilient means holding said shaft in position, said member having a bore transverse to and opening into said hollow portion in line with said eccentric portion, a thrust member reciprocal in said bore and seating against said eccentric portion, and an abutment means cooperable with said thrust member such that upon rotation of said shaft said adjustable member will be moved relative to said abutment means.

5. A switch comprising a contact member, a lever member having an armature portion, a blade carried by said lever member, a contact member carried by said blade and cooperable with said first-named contact member to control an electric circuit, said second-named contact member engaging said first-named contact member by movement of said lever member in one direction, said lever member having continued movement in said one direction to a predetermined position after engagement of said contact members to flex said blade and move said second-named contact member along the contact surface of said first-named contact member, stop means for limiting movement of said lever member in said one direction after engagement of said contact members, a movably adjustable magnet arranged to attract said lever armature portion and hold said lever member in said predetermined position, means urging said magnet in

one direction, and cam means for moving said magnet in a second direction and against the force of said urging means thereby to move said magnet relative to said lever armature portion.

6. In a switch, a movable armature, a contact member carried by said armature, a contact member cooperable with said first-named contact member to control an electric circuit, a magnet for attracting said armature and holding said first-named contact member in engagement with said second-named contact member, said magnet determining the differential of operation of the switch, a movable supporting member for said magnet and operable to resiliently urge said magnet in one direction, cam means carried by said supporting member and manually operable to move said supporting member against its resilient force to adjust the position of said magnet relative to said armature to change the differential of operation of the switch, and means carried by said supporting member and cooperable with said cam means for indicating the differential setting of the switch.

7. In a device of the character described, an armature, a hinge member, a magnet carried by said hinge member and arranged to attract and move said armature, a tubular member for attaching said magnet to said hinge member and carried by and movable with said hinge member, a thrust member positioned in said tubular member for movement relative thereto, an abutment member engaged by one end of said thrust member, and a manually operable means carried by said tubular member, said manually operable means including a cam positioned to engage the other end of said thrust member to move said hinge member and change the position of said magnet relative to said armature.

8. In a device of the character described, an armature, a hinge member, a magnet carried by said hinge member and arranged to attract and move said armature, a tubular fitting carried by and movable with said hinge member and attaching said magnet to said hinge member, a thrust member disposed in said tubular member, said tubular member being movable relative to said thrust member, an abutment member, said thrust member having one end abutting said abutment member, a manually operable adjustment member carried by said tubular member and having a cam for engaging the other end of said thrust member to move said hinge member to change the position of said magnet relative to said armature, said abutment member being movably adjustable to move said thrust member to thereby move said hinge member.

9. In a device of the character described, a supporting member, means carried by said supporting member and having an aperture, cam means carried by said means and within said aperture, and thrust means extending into said aperture and engaging said cam means for movement by said cam means.

10. In a device of the character described, an abutment member, a supporting member, means carried by said supporting member and having an aperture, cam means carried by said means within said aperture, and thrust means extending into said aperture and having one end portion engaging said cam means, said thrust means having a second portion engaging said abutment member so that movement of said cam means is operable to cause relative movement between said members.

11. In a device of the character described, an

abutment member, a supporting member, means carried by said supporting member and having an aperture, cam means carried by said means within said aperture, thrust means extending into said aperture and having one end portion engaging said cam means, said thrust means having a second portion engaging said abutment member so that movement of said cam means is operable to cause relative movement between said members, and means operable to urge said cam means in one direction to frictionally hold said cam means in one position.

12. In a device of the character described, an abutment member, a supporting member, said members being so constructed and arranged that said members are resiliently urged toward each other, means carried by said supporting member and having an aperture, cam means carried by said means within said aperture, thrust means extending into said aperture and having one end portion engaging said cam means and having a second portion engaging said abutment member, said thrust means being operable to hold said members against relative movement due to said resilient force and operable to move said cam means to cause relative movement between said members, and means operable to urge said cam means in one direction to frictionally hold said cam means in one position.

13. In a device of the character described, a supporting member having a pair of bearing surfaces, a member having a pair of bearing portions journaled in said surfaces whereby said second-named member is rotatably secured to said supporting member, said second-named member having a cam surface intermediate said bearing portions, and a thrust member carried by said supporting member and having one portion engaging said cam surface and being moved relative to said supporting member by rotation of said second-named member, said second-named member having a portion external of said supporting member and operable upon movement to cause rotation of said second-named member.

14. In a device of the character described, a supporting member having a pair of bearing surfaces, a member having a pair of bearing portions

journaled in said surfaces whereby said second-named member is rotatably secured to said supporting member, said second-named member having a cam surface intermediate said bearing portions, a thrust member carried by said supporting member and having one portion engaging said cam surface and being moved relative to said supporting member by rotation of said second-named member, said second-named member having a portion external of said supporting member and operable upon movement to cause rotation of said second-named member, an indicia plate carried by said supporting member and having an aperture therethrough through which said second-named member extends, and a pointer member carried by said second-named member adjacent to and rigid with said external portion and co-operable with said plate to indicate the setting of said cam surface.

15. In a device of the character described, a supporting member having a pair of bearing surfaces, a member having a pair of bearing portions journaled in said surfaces whereby said second-named member is rotatably secured to said supporting member, said second-named member having a cam surface intermediate said bearing portions, a thrust member carried by said supporting member and having one portion engaging said cam surface and being moved relative to said supporting member by rotation of said second-named member, said second-named member having a portion external of said supporting member and operable upon movement to cause rotation of said second-named member, an indicia plate carried by said supporting member and having an aperture therethrough through which said second-named member extends, a pointer member carried by said second-named member adjacent to and rigid with said external portion and cooperable with said plate to indicate the setting of said cam surface, and resilient means acting on said second-named member and urging said pointer into frictional engagement with said plate to frictionally hold said second-named means in a fixed position.

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