Dec. 2, 1958 L. E. THATCHER 2,863,017

SPEED RESPONSIVE ELECTRIC SWITCH

Filed July 24, 1956

FIG. 1.

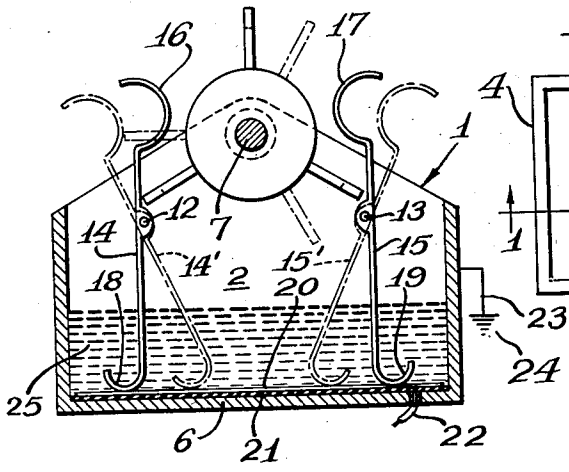



FIG. 2.

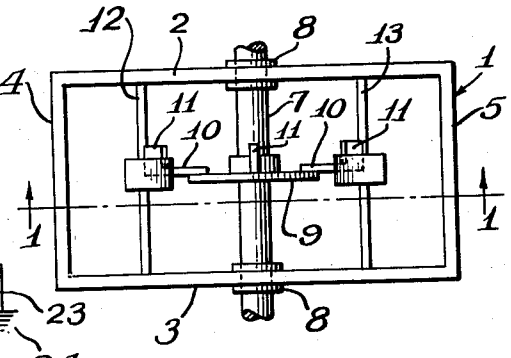



FIG. 4.

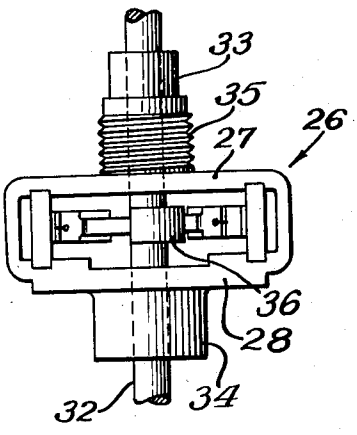
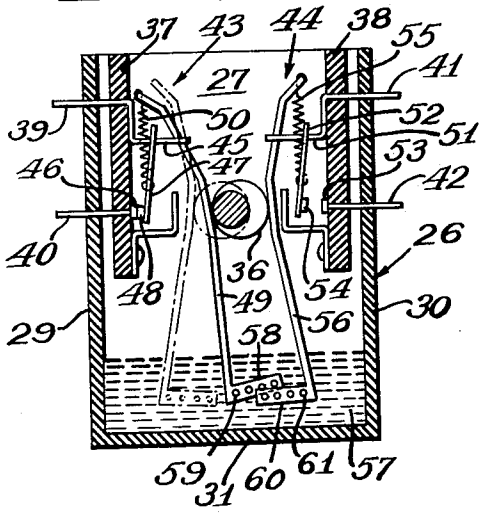



FIG. 3.




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# SPEED RESPONSIVE ELECTRIC SWITCH

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8 Claims. (Cl. 200—80)

This invention relates to improvements in a rotary control switch, that is, a switch whose actuation is responsive to the rate of rotation of a rotating body, and refers particularly to a switch of the character described which is simple and rugged in construction and is extremely reliable in operation.

In the control of many operations it is desirable to exercise said control in response to the rate of rotation of a rotating body. For instance, in anti-creep devices for automobiles having automatic transmissions and hydraulic torque converters, it is desirable to bring the anti-creep device into operation at extremely low speeds of travel of the automobile to prevent unintended creeping of the automobile.

The device comprising the present invention is ideally adapted for the aforesaid purpose since it may be employed to energize or deenergize an electric circuit at extremely low rates of rotation of a rotating body which may be rotated at a rotary speed proportional to the translatory speed of the automobile. Of course, there are other uses to which the present invention may be put and, hence, it is not intended that the invention be limited to any specific use.

The objects and advantages of the present invention will be apparent from the accompanying drawing and following detailed description.

In the drawing, Fig. 1 is a sectional elevational view of a device embodying the concepts of the present invention, as taken on line 1—1 of Fig. 2.

Fig. 2 is a top plan view of the device illustrated in Fig. 1.

Fig. 3 is a sectional view of a modification of the invention.

Fig. 4 is a detailed top plan view of the operative portion of the device shown in Fig. 3.

Referring in detail to the drawing, 1 indicates a housing having end walls 2 and 3, side walls 4 and 5 and a bottom 6. The housing 1 may be constructed of any suitable material but is preferably constructed of metal. A shaft 7 is journaled in spaced bearings 8 which are carried in the end walls 2 and 3. The shaft 7 may be connected by a suitable coupling (not shown) to any rotating device, the rate of rotation of which is to actuate a control circuit. For instance, if the device is employed in a conventional anti-creep system the shaft 7 may conveniently be coupled to the speedometer cable of the automobile, and hence the shaft will rotate in proportion to the translatory speed of the vehicle.

A disc 9 is mounted on shaft 7 intermediate the end walls 2 and 3. The disc 9 carries circumferentially spaced arms 10 which, in the form of the invention shown, are spaced 120° apart. At the end of each arm 10 a contact member 11 is carried, the purpose of which will be hereinafter more fully described.

A shaft 12 is carried at its opposite ends in the end walls 2 and 3 and a similar shaft 13 is also mounted on said end walls. The shaft 12 is spaced laterally from shaft 7 on one side thereof and the shaft 13 is spaced



laterally from the shaft 7 on the opposite side of said shaft. An arm 14 is swingably carried upon shaft 12 and a similar arm 15 is swingably carried upon the shaft 13. Arm 14 at its upper end is formed arcuately as indicated at 16 in Fig. 1, said arcuate portion presenting its convex face toward shaft 7. The arm 15 is similarly formed arcuate at its upper end as shown best at 17 in Fig. 1, the convex face of the arcuate portion facing the shaft 7. The lower end of arm 14 terminates in an arcuate bent portion 18 and in similar fashion the lower end of arm 15 is bent arcuately as indicated at 19 in Fig. 1.

A metallic plate 20 is positioned upon the upper face of the bottom 6 and an electrical insulating sheet 21 is interposed between the plate 20 and said bottom, whereby the plate 20 is electrically insulated from the housing per se. The plate 20 is connected by means of conductor 22 to an electrical control circuit (not shown), the opposite side of the circuit being grounded. The housing 1 is connected by means of conductor 23 to ground 24 whereby all portions of the housing, including the arms 14 and 15, are grounded. Normally, the arms 14 and 15 are in stable position and are biased by gravity to extend vertically downwardly from the respective shafts 12 and 13 and the hook-like members 18 and 19 make electrical contact with the plate 20. Accordingly, it its normal position, the mechanism functions to complete an electrical circuit of which the conductors 22 and 23 comprise a part.

The contact elements 11 carried at the ends of arms 10, when shaft 7 is rotated, move in a circular path and the arcuate upper portions 16 and 17 of arms 14 and 15, respectively, are positioned in said path. Accordingly, when the shaft 7 rotates the contact members 11 make camming contact with the arcuate portions 16 and 17 and function to rock the arms 14 and 15 about shafts 12 and 13, respectively. The rocking of arm 14 takes place in a counterclockwise direction, as viewed in Fig. 1, and the rocking of arm 15 takes place in a clockwise direction as viewed in said figure. Hence, the arms 14 and 15, during rotation of the shaft 7, are rocked to the dotted line positions shown respectively at 14′ and 15′ in Fig. 1.

A quantity of liquid 25 is carried in the housing 1 and the end portions of the arms 14 and 15 dip into said liquid. The liquid 25 is preferably oil such as a silicone oil and the viscosity of said liquid may vary depending upon the control operation desired. It can readily be seen that when the arms 14 and 15 are rocked by the rotation of shaft 7, the lower portions of said arms move through the body of liquid 25 and such movement is accordingly damped. When shaft 7 is rotated at a relatively low speed one of the arms 14 or 15 will always be in contact with the plate 20 and hence the external circuit will be closed. However, at a predetermined speed of rotation of the shaft 7, due to the damping effect of the liquid 25, both of said arms will be out of contact with the plate 20. That is, there will be a lag in the return of a predetermined arm to its normal position after it has been displaced by contact with the contact elements 11. As the speed of rotation increases this lag will be such that both arms will be out of electrical contact with the plate 20. It can readily be seen that the critical speed at which both arms are caused to break contact with the plate 20 will be dependent upon the viscosity of the liquid 25 and also upon the weight and area of the arms 14 and 15, particularly that area thereof which is in contact with the liquid 25. Hence, by appropriately selecting the liquid 25 with regard to its viscosity, the critical speed at which the switch thus formed is opened may be desirably controlled. Of course, the control circuit to which the conductors 23 and 22 comprise a part may be controlled

either by the opening or the closing of the electrical circuit. In other words, the circuit may be inoperative when the arms 14 and 15 or either one of them is in contact with the plate 20 and the circuit may become actuated when that speed of shaft 7 is reached at which both arms break contact with the plate 20.

Referring particularly to Figs. 3 and 4, a modification of the invention is shown wherein 26 indicates a housing having opposite side walls 27 and 28, opposite end walls 29 and 30 and a bottom 31. A shaft 32 extends transversely through the housing 26 and is journaled in bearings 33 and 34 carried by the side walls 27 and 28, respectively. The exterior portion of the bearing 33 may carry threads 35 whereby it, if the device is employed with a speedometer cable, may be coupled to the sheath (not shown) of said cable.

Intermediate the side walls 27 and 28, a cam 36 may be mounted upon shaft 32. A switch plate 37, constructed of an insulating material may be mounted upon end wall 29 and a similar switch plate 38 may be mounted upon end wall 26. Terminals 39 and 40 may extend from switch plate 37 through wall 29 and in similar fashion terminals 41 and 42 may extend through wall 30. The walls of the housing 26, in this form of the invention are preferably constructed of insulating material, but if constructed of metal, at least one terminal from each switch plate must be insulated from the walls.

The switch plate 37 carries a conventional snap switch 43 and the switch plate 38 carries a similar snap switch 44. The snap switch 43 comprises a metallic fulcrum 45 which may comprise a continuation of terminal 39. Adjacent the inner face of switch plate 37, terminal 40 may carry a switch point 46. A switch arm 47 is pivotally mounted upon fulcrum 45 and carries at its end in juxtaposed position with respect to switch point 46, a companion switch point 48. A cam follower arm 49 is journaled adjacent its upper end upon fulcrum 45 and a coil spring 50 connects the upper end of arm 49 to an intermediate portion of switch arm 47. Thus, an intermediate portion of follower arm resiliently bears upon cam 36. The switch 43 thus formed is a toggle snap switch with an "over-center" spring 50.

The switch 44 is similar to switch 43 and comprises fulcrum 51, pivoted switch arm 52, contact points 53 and 54, spring 55 and cam follower arm 56 which latter resiliently bears, intermediate its length, upon cam 36.

The housing 26 carries a body of liquid 57, preferably an insulating oil of the silicone type, having a properly selected viscosity. The lower end portion of arm 49 dips into the oil body 57 and carries an offset lug 58 provided with a desired number of apertures 59 and in similar fashion, the lower end of follower arm dips into the liquid, has an offset lug 60 which is provided with a desired number of apertures 61.

The movement of arms 49 and 56 is damped by oil 57 and, hence, the degree of damping may be controlled by the selection of an oil of a desired viscosity. In addition, as each aperture 59 and 61 provides a shear surface, the effective damping may be increased or decreased by increasing or decreasing the number of apertures 59 and 61.

In the form of the invention illustrated in Figs. 3 and 4, a normally closed electrical system is shown when the switches 43 and 44 are connected in parallel, that is, when shaft 32 is stationary or rotates at a relatively low speed one or both switches 43 and 44 will be closed, thereby closing a circuit (not shown) in which they may be connected. It will be seen, by reference to Fig. 3, that arm 49, impelled by spring 50 follows cam 36 and permits switch points 46 and 48 to remain closed. However, arm 56 is displaced by cam 36 and, hence, switch points 53 and 54 break contact. When the shaft 32 is stationary or rotating at a relatively low speed, this relationship will obtain with either switch 43 or switch 44 closed. However, when a critical speed of shaft 32 is reached,



the arms 49 and 56 will lag and will not be able to follow cam 36 and, hence, both switches will remain open.

Of course, switches 43 and 44, which are normally closed switches, could be replaced by normally open snap switches in which case, the operation would be reversed, that is, the switches would be open when the shaft 32 is stationary or rotating at relatively low speed, but would close when the critical speed for the device is reached and would remain closed so long as said critical speed were exceeded.

In both forms of the invention the respective switches were considered as being connected in parallel. Of course, in either case the respective switches may be connected independently. This and other uses of the present invention are contemplated herein and, hence, it is not intended that the invention be limited except as necessitated by the appended claims.

I claim as my invention:

1. An electric switch which is operable in response to rotary speed of a rotating body which comprises, a housing, a body of insulating liquid carried in said housing, a pair of cooperating electric switch actuating arms pivotally mounted in said housing and normally biased to a stable position in said housing, a rotatable body journaled in said housing between said arms, means carried by said body for alternately rocking said arms as the body rotates to displace said arms from their stable position to actuate the respective switches, corresponding end portions of said arms dipping in said liquid whereby the displaced arms are delayed by the friction of the liquid in the housing in returning to their respective stable positions.

2. An electric switch which is operable in response to the rotary speed of a rotating body which comprises, a housing, a body of insulating liquid carried in said housing, a pair of cooperating electric switches carried in said housing, a switch actuating arm for each switch pivotally mounted in said housing and normally biased to a stable position holding said switches in corresponding off and on positions, a rotatable body journaled in said housing between said arms, means carried by said body for alternately rocking said arms in spaced time relationship with respect to each other as the body rotates alternately to displace said arms from their stable position to actuate the respective switches, corresponding end portions of said arms dipping in said liquid whereby the displaced arms are delayed by the friction of the liquid in the housing in returning to their respective stable positions.

3. An electric switch which is operable in response to the rotary speed of a rotating body which comprises, a housing, a body of insulating liquid carried in said housing, a pair of cooperating electric switch actuating arms pivotally mounted in said housing and normally biased to a stable closed position in said housing, a rotatable body journaled in said housing between said arms, means carried by said body for alternately rocking said arms as the body rotates alternately to displace said arms from their stable position alternately to open the respective switches, corresponding end portions of said arms dipping in said liquid whereby the displaced arms are delayed by the friction of the liquid in the housing in returning to their respective stable closed positions.

4. An electric switch which is operable in response to the rotary speed of a rotating body which comprises, a housing, a body of insulating liquid carried in said housing, a pair of cooperating electric switches each having an actuating arm pivotally mounted in said housing and normally biased to a stable closed position in said housing, means for connecting said switches in parallel in an external electric circuit, a rotatable body journaled in said housing between said arms, means carried by said body for rocking said arms in spaced time relationship with respect to each other as the body rotates to displace said arms from their stable position alternately to open the respective switches, corresponding end portions of

said arms dipping in said liquid whereby the displaced arms are delayed by the friction of the liquid in the housing in returning to their respective stable closed positions when the body rotates above a predetermined speed.

5. An electric switch which is operable in response to the rotary speed of a rotating body which comprises, a housing, a body of insulating liquid carried in said housing, a pair of cooperating electric switch arms pivotally mounted in said housing and normally biased to a stable closed circuit position in said housing, a rotatable body journaled in said housing between said arms, means carried by said body for periodically alternately rocking said arms in spaced time relationship with respect to each other as the body rotates alternately to displace said arms from their stable position to open the respective switches, corresponding end portions of said arms dipping in said liquid whereby the displaced arms are delayed by the friction of the liquid in the housing in returning to their respective stable closed positions.

6. An electric switch which is operable in response to the rotary speed of a rotating body which comprises, a housing, a body of insulating liquid carried in said housing, a pair of cooperating electric switch arms pivotally mounted in said housing and normally biased to a stable closed circuit position in said housing, a rotatable body journaled in said housing between said arms, angularly spaced spokes carried by said body for periodically alternately rocking said arms in spaced time relationship with respect to each other as the body rotates to alternately displace said arms from their stable position to open the respective switches, corresponding end portions of said arms dipping in said liquid whereby the displaced



arms are delayed by the friction of the liquid in the housing in returning to their respective stable closed positions.

7. A device as contemplated in claim 6 wherein said switch arms comprise metallic members pivoted intermediate their respective lengths to the housing, the upper portions of each of said switch arms being curved convexly facing said body whereby said spokes contact said convex arm portions to rock said arms.

8. An electric switch which is operable in response to the rotary speed of a rotating body which comprises, a housing having opposite sides, a body of insulating liquid carried in said housing, an electric snap switch carried on each of one pair of opposite side of said housing, a rotating body journaled in the other opposite sides of said housing, an actuating arm carried by each snap switch, a cam carried by said rotatable body between said snap switches, resilient means carried by each snap switch urging a respective arm into contact with said cam whereby rotation of said body alternately displaces said arms to actuate said snap switches, an end portion of each actuating arm dipping in said liquid whereby return of said arms under the influence of said resilient means to contact with said cam is delayed by the frictional resistance of said liquid upon the displaced arms.

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