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ROTARY SPEED RESPONSIVE SWITCH HAVING A ROTATABLE VANE-HELD CONTACT

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This invention relates to improvements in a rotary speed responsive switch and refers particularly to a switch which may function to control an electric circuit in response to a determined speed of a rotating body.

In copending patent application, Serial No. 308,085, filed September 5, 1952, in the name of Lewis E. Thatcher, now Patent No. 2,678,977 issued May 18, 1954, a rotary speed responsive switch is shown and described comprising a container for carrying a body of electrically non-conducting liquid. At the bottom of the container below said liquid a metal plate is positioned which may be connected to one side of an electric circuit. A vane is hingedly positioned in the container with its lower edge in contact with the plate when the vane is stationary, and means is contemplated for rotating the vane whereby its lower edge drags upon the plate until the vane reaches a predetermined rotary speed, at which time the frictional resistance of the liquid causes the vane to cant upon its hinge whereby the vane breaks contact with the plate. Means is also provided for connecting the vane to the ground whereby the electric circuit is broken when the vane breaks contact with the plate.

The present invention is directed to a switch which employs substantially the same principle as that of the device described in the aforesaid patent application. However, as a feature of the present invention, a rotary member may be carried in the lower edge of the vane whereby said vane makes rolling contact with the plate at the bottom of the container. Thus the frictional resistance of the vane upon the plate is reduced while the vane rotates but before the circuit is broken. The rotary member may comprise a roll, a ball or a wheel or the like having projections on its curved surface. When the latter expedient is used excellent electrical contact is made with the plate and yet the advantage of rolling contact is secured.

Other 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 longitudinal sectional view of a switch embodying the concepts of the present invention.

Fig. 2 is a transverse sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a perspective view of one form of the vane.

Fig. 4 is a longitudinal sectional view, corresponding to Fig. 1, but employing a modified form of vane.

Fig. 5 is a perspective view of the vane employed in Fig. 4.

Fig. 6 is a perspective view of a third form of vane.

Although the present invention may be employed in substantially any environment and conjunction with any type of rotating body to control a desired electrical circuit, for purposes of illustration, the device will be described in conjunction with its use on an automotive vehicle wherein the rotating body comprises the usual speedometer cable.

Referring to the drawing and in particular to Figs. 1, 2 and 3, 1 indicates generally the speed-responsive switch embodying the concepts of the present invention. The device 1 comprises a cup-shaped body 2 having a top closure 3. The cup-shaped body 2 has a bottom 4 and cylindrical side wall 5. Within the body 1, a central cylindrical boss 6 is positioned whereby an annular space 7 is provided in the body.

The body also carries a downwardly extending cylindrical sleeve 8 which is provided with an opening 9 for the reception of an end of a speedometer sheath 10 within which a speedometer cable 11 is carried. The cable 11 extends upwardly through the boss 6 and also through a sleeve 12 comprising a portion of closure 3. The sleeve 12 is provided with an opening 13 adapted for the engagement of a spaced end 14 of the speedometer cable sheath.

Within the boss 6, a frictional gripping member 15 engages the speedometer cable 11, said member being embraced by a sleeve 16 which is rotatably positioned within boss 6. A cap 17 is rigidly positioned upon the sleeve 16 and member 15 and is journalled within the closure 3 for rotation with the speedometer cable.

A shaft 18 is secured to cap 17 and extends radially outwardly from said cup into the upper portion of the annular space 7. A vane 19, which comprises a relatively flat plate carries a sleeve 20 at its upper end, said sleeve being formed bylooping the upper portion of the plate upon itself. A notch 21 is provided in the lower edge of the plate, being defined at opposite ends by downwardly extending legs 22. The legs 22 carry sleeves 23 at their lower ends whereby bearings are provided for the reception of opposite end portions of a shaft 24. Shaft 24 carries a roller 25 which is positioned in the notch 21, said roller having its axis disposed substantially parallel to the axis of sleeve 20.

The vane 19 is adapted to be supported by shaft 18, said shaft extending through the sleeve. A lug 26 is carried at the end of shaft 18 whereby unintended axial movement of the sleeve upon the shaft is prevented.

Sleeve 20 has an internal diameter greater than the diameter of shaft 18 whereby a degree of radial movement of the sleeve upon the shaft is permitted.

An electrically conductive plate 27 is positioned upon the bottom of the container 2 within the zone 7 and, under normal conditions, that is, when the vane 19 is stationary, the roller 24 will rest upon said plate. An electrical conductor 28 connects plate 27 to an electrical circuit (not shown) and vane 19 may be grounded through shaft 18, cap 17, cable 11 and sheath 14, as shown at 29 in Fig. 1.

In the operation of the device, a body of non-conducting liquid 30 is positioned in the zone 7 above plate 27. When the speedometer cable 11 rotates, cap 17 will be rotated and, hence, vane 19 will rotate in zone 23. The rotation of the vane 19 will be opposed by the liquid 30 and, hence, the force of opposition will tend to cant vane 19 about shaft 18. When the force offered by the liquid 30 reaches a predetermined maximum, the vane 19 will be so canted that roller 25 will break contact with plate 27. Hence, the electrical circuit including conductor 28 and ground 29 will be broken.

As a feature of the present invention, while speedometer cable 11 rotates and before the force of resistance offered by the liquid is reached which will cant the vane away from the plate 27, the roller 25 will make rolling contact with the plate 27. The frictional resistance of the roller upon the plate is substantially negligible and, hence, very little wear of the moving parts occurs.

Referring particularly to Figs. 4 and 5, a modification of the switch comprising the present invention is shown generally at 31. Substantially the only difference between switches 1 and 31 resides in the vanes employed and,
hence, without further description of the parts in Fig. 4 corresponding reference numerals will be applied to identical parts.

Vane 32, employed in switch 31, comprises a plate which carries a sleeve 33 at its upper edge, said sleeve being formed as described in conjunction with sleeve 28. A notch 34 is provided at the lower edge of the plate, defined at its ends by downwardly extending legs 35, each of which is looped at its end to form spaced bearings 36. A shaft 37 is journaled in bearings 36 and a ball 38 is carried intermediate the length of the shaft between the legs 35.

The operation of the switch 31 is similar to that of switch 1, the ball 38 making contact with the plate 27 before the resistive force of the liquid cants the plate to break contact between the ball and the plate.

Referring particularly to Fig. 6 another modified form of vane, vane 39, is shown. The vane 39 is constructed generally similar to vanes 19 and 32, having an upper sleeve of 40, legs 41 and opposite sleeve bearings 42. A shaft 43 is carried in the bearings and intermediate the shaft a rotary member 44 is carried. The rotary member 44 carries teeth on its outer periphery whereby when said member rolls upon the plate 27 the teeth will tend to "bite" through any film which may form upon the surface of the plate and good electrical contact will be assured.

It will be noted that the inner diameters of the sleeves 20, 33 and 40 are materially greater than the diameter of the supporting shafts 16. Hence, the vanes can be canted when the cable 11 rotates in either direction since the radial movement of the sleeves on the shaft permits the vanes to pass vertical dead center.

It is to be understood that the present invention broadly contemplates substantially any type of rolling member carried at the lower edge of a hinged vane. In addition, any type of projections may be employed upon the surface of the rolling member. Hence, it is not intended that the present invention be limited to the specific shape or form of rolling members illustrated and described.

I claim as my invention:

1. An electric switch responsive to the rotary speed of a body which comprises, a container, an electrically conductive member carried in the container, said container being adapted to carry a non-conductive liquid above said conductive member, an electrically conductive element, said electrically conductive element comprising a relatively flat plate, a rotatable contact carried at one end of said plate, means for hingedly suspending said element at its end opposite the rotatable contact with the rotatable contact dipping in said non-conductive liquid and in gravity contact with said electrically conductive member when said element is stationary, means for rotating said element in a plane substantially parallel to said electrically conductive member to cause said element to be deflected by friction between said non-conductive liquid and said element to move said rotatable contact against the force of gravity away from said conductive member, and means for connecting said conductive member and said rotatable contact in an electrical circuit.

2. An electric switch responsive to the rotary speed of a body which comprises, a container, an electrically conductive plate carried in the container, said container being adapted to carry a non-conductive liquid above and in contact with said plate, a rotatable contact carried at one end of said plate with its axis of rotation parallel to a face of the vane, a hinge for suspending said vane at its opposite end with the rotatable contact dipping in said non-conductive liquid and in gravity urged tangential contact with said plate when said vane is stationary, said hinge being parallel to the axis of rotation of said rotatable contact, said means for rotating said vane in a plane substantially parallel to said plate to cause said vane to be deflected by friction between said non-conductive liquid and said vane against the pull of gravity to move said rotatable contact away from said plate, and means for connecting said plate and said rotatable contact in an electrical circuit.

3. An electric switch responsive to the rotary speed of a body which comprises, a container, an electrically conductive plate carried in the container, said container being adapted to carry a non-conductive liquid above and in contact with said plate, a relatively flat vane, a rotatable contact carried at one end of said vane opposite end with the rotatable contact dipping in said non-conductive liquid and in gravity urged tangential contact with said plate when said vane is stationary, said hinge being parallel to the axis of rotation of said rotatable contact, in said non-conductive liquid and with said projections in gravity contact with said plate when said vane is stationary, means for rotating said vane in a plane substantially parallel to said plate and in a circular direction transverse to the plane of said vane to cause said vane to be deflected by friction between said non-conductive liquid and said vane to move said rotatable contact against the pull of gravity away from said plate, and means for connecting said plate and said rotatable contact in an electrical circuit.

4. An electric switch responsive to the rotary speed of a body which comprises, a container, an electrically conductive member carried in the container, said container being adapted to carry a non-conductive liquid above and in contact with said conductive member, an electrically conductive element, a metallic roll rotatably carried at one end of said element, means for hingedly suspending said element at its opposite end with the roll dipping in said non-conductive liquid and in gravity contact with said electrically conductive member when said element is stationary, means for rotating said element in a plane substantially parallel to said electrically conductive member and in a circular direction transverse to the plane of said conductive element to cause said element to be deflected by friction between said non-conductive liquid and said element to move said roll against the pull of gravity away from said plate and out of contact with said conductive member, and means for connecting said conductive member and said roll in an electrical circuit.

5. An electric switch responsive to the rotary speed of a body which comprises, a container, an electrically conductive member carried in the container, said container being adapted to carry a non-conductive liquid above and in contact with said conductive member, an electrically conductive element, a metallic ball rotatably carried at one end of said element, means for hingedly suspending said element at its opposite end with the ball dipping in said non-conductive liquid and in gravity contact with said electrically conductive member when said element is stationary, means for rotating said element in a plane substantially parallel to said electrically conductive member and in a circular direction transverse to the plane of said conductive element to cause said element to be deflected by friction between said non-conductive liquid and said element to move said ball against the pull of gravity away from said plate and out of contact with said conductive member, and means for connecting said conductive member and said ball in an electrical circuit.

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