SPEED RESPONSITIVE SWITCH

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References Cited

UNITED STATES PATENTS


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ABSTRACT

A speed responsive switch which is actuated at a first predetermined speed of rotation and deactuated at a second, but lower, pre-determined speed of rotation. A collar is urged axially by a flyweight governor and its movement is resisted by a leaf spring and the lever arm of an electrical switch which resists movement of the collar in only one direction.

6 Claims, 5 Drawing Figures
SPEED RESPONSIVE SWITCH

This invention relates to a speed responsive switch and more particularly to a speed responsive switch that is actuated at a first pre-determined speed of rotation and deactivated at a second pre-determined speed of rotation.

In numerous applications it is desirable to have an electrical switch that is responsive to the speed of rotation of some member to open or close, as the case may be. At a first pre-determined speed of rotation and to assume its original position at a second pre-determined speed of rotation. A particular application for this type of switch is in an automotive vehicle where it is desirable to actuate or deactivate certain mechanisms, such as anti-pollution devices, in response to the road speed of the vehicle.

Accordingly, it is an object of this invention to provide an improved speed responsive switch that is actuated at a first pre-determined speed of rotation and deactivated at a second pre-determined speed of rotation.

A further object of this invention is to provide a reliable, simple and inexpensive speed responsive switch that can be mounted in an automotive vehicle and actuated at a first pre-determined speed of rotation and deactivated at a second, lower, speed of rotation, with the speed of rotation being proportional to the road speed of the vehicle.

Other objects and advantages of this invention will become apparent from the following detailed description, wherein:

FIG. 1 is a cross-sectional view of the speed responsive switch of this invention;
FIG. 2 is a sectional view taken along the line 2–2 of FIG. 1 showing particularly the mounting of the electrical switch;
FIG. 3 is an end view of the flyweight governor;
FIG. 4 is an end view of the axially movable collar used in this invention; and
FIG. 5 is a side view of the axially movable collar used in this invention.

The application of the speed responsive switch of this invention as described herein is in an automotive vehicle, with the switch being arranged so as to be responsive to the road speed of the vehicle. The function of this switch is to actuate and deactivate an emissions reduction system in response to the road speed of the vehicle.

In the preferred embodiment described herein, the speed responsive switch is mounted in the wall of the case of a vehicular transmission in the place normally used to receive the speedometer cable. The switch is interposed between the gear normally used to drive the speedometer cable and the speedometer cable itself. This arrangement permits, with only minor modifications to a conventional automotive transmission, the speed responsive switch to be driven at a speed directly proportional to the road speed of the vehicle.

Referring to FIG. 1, the speed responsive switch 50 comprises a housing having a first section 12 and a second section 14 which are swaged together. A shaft 16 extends through the housing and is journaled therein in bushings 18 and 20. One end 22 of the shaft 16 is adapted to mount a spur gear 24 shown in phantom lines. The spur gear 24 is adapted to run in mesh with a worm gear 26 of a vehicular transmission which runs at a speed directly proportional to the output shaft of the transmission, and hence at a speed directly proportional to the road speed of the vehicle. The first section 14 of the housing is received in a bore 28 in the wall 30 of the transmission case. An O-ring 32 provides a seal between the wall 30 and the housing section 14. The housing is retained in place by a retainer plate 34.

The outer end 36 of the shaft 16 is sealed by an oil seal 38 and is adapted to receive in driving relationship the core of a conventional speedometer cable (not shown). The outer end 40 of the housing section 14 is threaded to receive the connector fitting of a conventional speedometer cable. The first section 12 of the housing has ports 42 which permit transmission fluid to flow to the interior of the housing. This transmission fluid serves as a lubricant for the switch.

Mounted within the housing and on the shaft 16 is a governor means which is comprised of a weigh carrier 44 pivotally supporting flyweights or governor weights 46. The weight carrier comprises an annular portion 48 which abuts against the end of the first section 12 of the housing and which is pinned to the shaft 16 by means of a roll pin 50. See particularly FIG. 3. The pinned annular portion 48 plus a lock ring 49 restrain the shaft 16 against axial movement.

The weight carrier 44 has two pairs of opposed upstanding arms 52 and 54 which support by means of pins 56 the governor weights 46. Each of the governor weights 46 has a depending or upstanding, as the case may be, bell crank lever 58 which in a static position is normal to the axis of the shaft. Inward movement of the governor weights is restricted by the bell crank levers 58 abutting the annular portion 48. Outward movement of the governor weights is restricted by the upstanding arms 52 and 54.

An annular collar 60, preferably formed of a low friction material such as a filled nylon, is slidably mounted on the shaft 16 in contact with the bell crank levers 58. The collar 60 which is free to slide axially on the shaft is restrained against rotational movement by a rib 62 which depends from the housing section 14 and which freely fits into a notch or groove 64 formed in the collar 60. An upstanding leaf spring 66 is mounted in an annular groove 68 formed in the collar 60. See FIGS. 4 and 5.

As may be seen in FIG. 1, the upstanding leaf spring 66 has its outer or free end positioned against a set screw 70 which is threadably mounted in a wall in the second section 14 of the housing. Adjustment of this screw will vary the initial force applied by the leaf spring 66.

A conventional electrical switch 72 of the snap-action Micro-Switch type secured in a bracket 74 is located in the lower portion of the second section 14 of the housing. The bracket 74 has upstanding ears 76 which are riveted or pinned at 78 to the second section 14 of the housing. See FIG. 2. The bracket 74 is further comprised of a transverse portion 80 which is integral with the ears 76 and a depending portion 82 which is integral with the transverse portion 80. The depending portion 82 has extending therefrom a side arm 84 to which the switch 72 is secured by rivets 86. A tab portion 88 extends laterally from the side arm portion 84 and rests atop an adjusting set screw 90 which is threadably mounted in the wall of the first section 14 of
the housing. The bracket 74 is preferably formed of sheet metal and because of the above described construction is resilient, with the transverse portion 80 and the depending portion 82 free to bend. Adjustment of the set screw 90 will therefore move the bracket and hence the switch 72 radially relative to the shaft 16.

The electrical switch 72 is operated by a depressible button contact 92 which when depressed opens or closes the switch, as the case may be. A lever arm 94 overlies the contact 92 and is pivotally mounted at one end 96. The opposite end 98 of the lever arm 94 is bent to conform to a cam surface 100 formed on the collar 60. This cam surface 100 is particularly shown in FIGS. 4 and 5. In the preferred embodiment, the angle of the cam surface 100 is 45°. The angle of the end 98 of the lever arm is slightly less or 35° (measured normal to its length) to assure that it rides freely on the cam surface. Varying the angle of the cam surface will vary the resistance imposed by the lever arm, and hence will vary the difference between the first and second pre-determined speeds.

The switch 72 is connected to a pair of leads 102, 104 which exit through the side wall of the first section 14 through a rubber grommet or plug 106. One of these leads may be grounded to the housing. In operation, the speed responsive switch 10 functions in the following manner. On rotation of the spur gear 24, the shaft 16 rotates causing the governor weights 46 to move outwardly under the influence of centrifugal force. Outward movement of the governor weights 46 causes the bell crank levers 58 to bear against the axially slideable collar 60 in a first direction. Axial movement of the collar 60 is concurrently resisted by the leaf spring 66 bearing against the adjusting screw 70 and by the end 98 of the lever arm bearing against the cam surface 100 of the collar. As the speed of rotation increases to a first pre-determined speed the centrifugal force imposed on the collar 60 is sufficient to overcome the resistance of the leaf spring 66 and lever arm 94, whereas a sufficient axial movement of the collar 60 causes the lever arm to pivot out of engagement with the cam surface to ride on the outer diameter of the collar 60. This pivoting of the lever arm depresses the contact 92 causing the switch to open or close, as the case may be. This condition exists so long as the speed or rotation remains above a second pre-determined speed which is lower than the first pre-determined speed. Further, axial movement of the collar, once the lever arm is in an overriding position, is prevented by the governor weights abutting against a portion of the weight carrier.

When the speed of rotation is decreased to a second pre-determined speed, lower than the first speed, the governor weights move inwardly thereby reducing the force imposed by bell crank levers on the collar. The collar is urged to its original position by the leaf spring 66 acting alone, because the lever arm 94 being in an override position on the outside diameter of the collar imposes no substantial aid or resistance to axial movement of the collar. This second pre-determined speed is a function of the leaf spring 66 operating alone against the force imposed by the flyweight governor. When the collar has been urged to its starting position by the leaf spring 66, the end 98 of the lever arm re-engages with the cam surface 100 thereby allowing the switch 72 to assume its former state which may be open or closed, as the case may be.

In adjusting the speed responsive switch 10, the adjusting screw 90 is first adjusted to place the lever arm 94 in a desired degree of contact with the collar 60. The adjusting screw 70 is then adjusted to impose the desired load on the leaf spring 66 in combination with the load imposed by the lever arm 94 acting against the cam surface 100 determines the first or higher pre-determined speed. The second or lower pre-determined speed is a function of the load imposed by the leaf spring 66 acting against the collar 60.

Having described our invention, we claim:

1. A speed responsive switch comprising, a housing, a shaft journaled for relative rotation within said housing, a collar slidably mounted on said shaft, governor means for applying force to move said collar axially in a first direction, said force being substantially proportional to the speed of rotation of said shaft, a leaf spring secured to said collar and extending into contact with an axially adjustable member secured to said housing for resiliently resisting axial movement of said collar in said first direction, an electrical switch, and lever means responsive to axial movement of said collar in said first direction for actuating said electrical switch, said lever means adapted to provide resistance to axial movement of said collar in said first direction and substantially no resistance to axial movement of said collar in the opposite direction.

2. The speed responsive switch of claim 1, wherein said governor means comprises a flyweight governor having a lever arm bearing against said collar.

3. The speed responsive switch of claim 1, wherein said lever means comprises a lever arm pivotally secured to said electrical switch and having a free end adapted to yieldingly engage said collar.

4. A speed responsive switch comprising, a housing, a shaft journaled for rotation within said housing, a collar slidably mounted on said shaft, restraining means for preventing rotation of said collar, a weight carrier fixed to said shaft, an opposed pair of governor weights pivotally mounted on said weight carrier and adapted to swing radially outwardly on rotation of said shaft, said governor weights having bell crank levers adapted to engage said collar, a leaf spring secured to said collar and having a free end bearing against an adjustable screw that is threadably secured in said housing for resiliently urging said collar into engagement with said bell crank levers, an electrical switch having an axially extending and pivotally mounted lever arm, said electrical switch being actuated by pivotal movement of said lever arm, bracket means for mounting said electrical switch within said housing, a portion of said lever arm being adapted to engage said collar whereby axial movement of said collar will cause said lever arm to pivot thereby actuating said electrical switch and overriding said collar.

5. The speed responsive switch of claim 4, plus means for varying the location of said bracket means relative to said collar, to thereby vary the position of said electrical switch and lever arm relative to said collar.

6. A speed responsive switch comprising, a housing, a shaft journaled for relative rotation within said housing, a collar slidably mounted on said shaft, governor means for applying force to move said collar axially in a first direction, said force being substantially proportional to the speed of rotation of said shaft, a spring
secured to said collar and extending into contact with an axially adjustable member secured to said housing for resiliently resisting axial movement of said collar in said first direction, an electrical switch, and lever means responsive to axial movement of said collar in said first direction for actuating said electrical switch, said lever means adapted to provide resistance to axial movement of said collar in said first direction and substantially no resistance to axial movement of said collar in the opposite direction.