

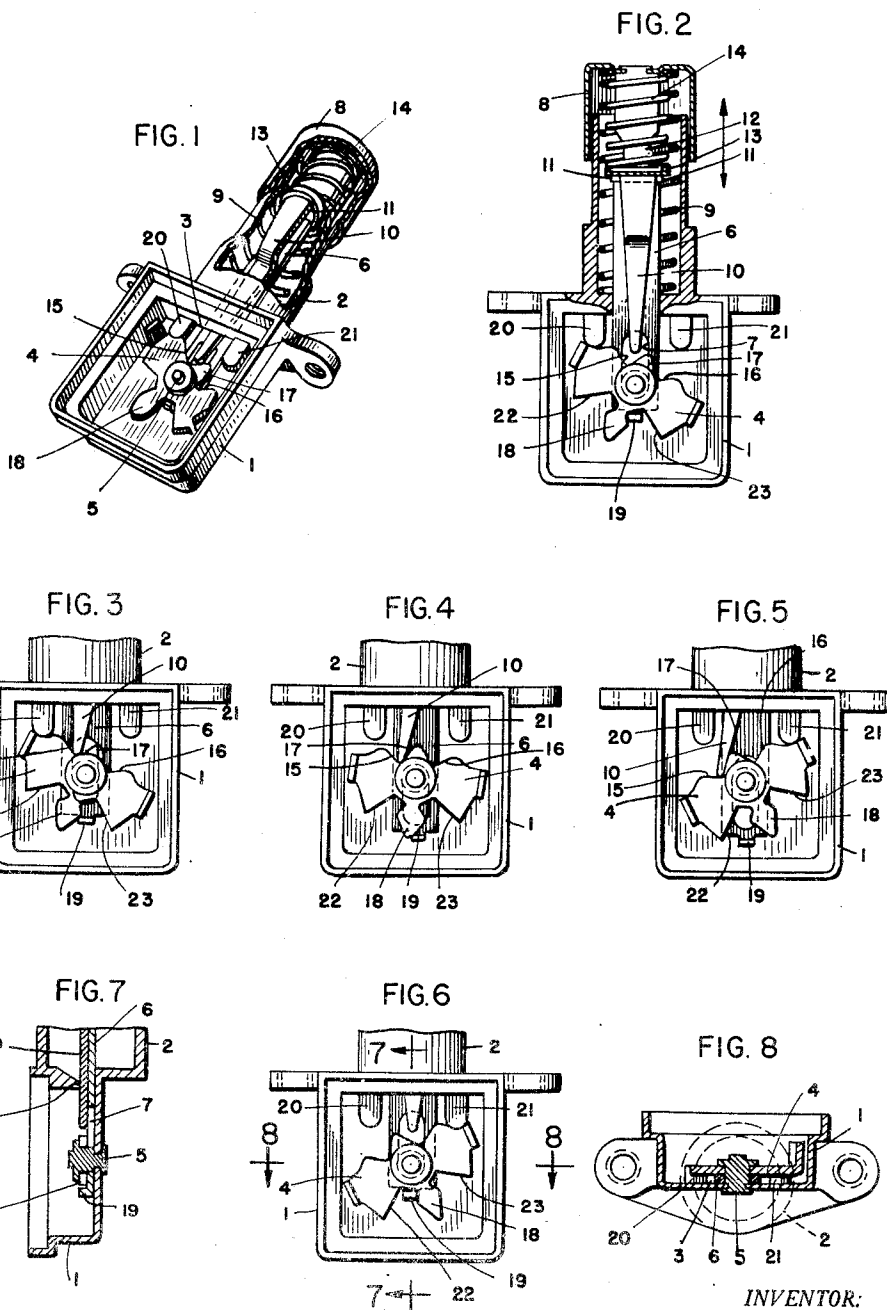
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FOOT DIMMER SWITCH OPERATING MECHANISM

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FOOT DIMMER SWITCH OPERATING MECHANISM

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This invention relates to snap-acting switch mechanisms and particularly to a plunger actuated rotary-switch operating means such as may be employed to operate a dimmer switch used in the head-light circuit of a motor vehicle.

The main objects of this invention are to provide an improved snap-acting switch operating mechanism; to provide an improved plunger-actuated snap-acting rotary switch operating means; to provide an improved operating rotor for snap-acting rotary switches; and to provide an improved arrangement and construction for controlling the operation of a snap-acting rotor in such devices which will result in a greatly increased useful life for the operating parts.

A specific embodiment of this invention is shown in the accompanying drawings in which:

Figure 1 is a perspective view of a switch operating mechanism embodying the invention, the view being partly broken away to illustrate the arrangement of the actuating means.

Fig. 2 is a plan view of the same partly in section, the view showing the plunger and the rotary element in neutral position.

Fig. 3 is a fragmentary plan view of the same showing the rotary element and actuating parts in the first position of operation.

Fig. 4 is a similar view showing the rotor in almost mid position and just prior to its release for snap action.

Fig. 5 is a similar view showing the parts immediately after the rotor has been snapped to its changed position.

Fig. 6 is a similar view showing the operating elements in neutral position when actuation of the mechanism has been completed.

Fig. 7 is a sectional view of the device as taken on line 7-7 of Fig. 6, illustrating the manner in which the rotor is mounted and the relationship of the trip lever or operating finger with the rotor, and

Fig. 8 is a sectional view of the same as taken on line 8-8 of Fig. 6.

In the form shown in the drawings, the improved switch operating mechanism comprises a hollow box-like body 1 having a hollow neck or extension 2 projecting from one side, the neck or extension being open at its outer end and having communication with the box-like body 1 at its inner end through a slot-like opening 3 in the body side wall. A rotor or carrier plate 4 is pivotally mounted within the body 1 on a fixed stud 5, which in turn is mounted on the bottom wall of the body 1 substantially at its center, and a flat reciprocable plunger bar 6, which extends

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through the neck 2 into the housing 1 by way of the slot 3, is disposed below the rotor 4 between the rotor and the bottom wall of the housing. The plunger bar 6 extends beyond the pivot post or stud 5 and a longitudinal slot 7, through which the body of the pivot stud 5 extends, is formed adjacent the inner end of the plunger bar.

The plunger bar 6 extends through the neck 2, and beyond the outer end of the same, where it is attached to a cup-like cap member 8 adapted to fit slidably over the end of the neck 2; and a coiled compression spring 9 is mounted within the neck 2, to bear between the end of the plunger cap 8 and the wall of the housing 1, so as to normally urge the plunger bar 6 in an outward direction, the outward movement of the plunger bar 6 being limited by engagement of the far or inner end of the slot 7 with the pivot stud 5.

As shown in Figs. 1 and 2, the plunger bar 6 carries a trip lever or operating finger 10, which lies longitudinally parallel with the plunger bar and extends into the housing 1 through the slot 3 and this trip finger is disposed on the upper side of the plunger bar 6 so as to lie in substantially the same plane as the rotor 4. The trip lever 10 is mounted on the plunger bar 6 by means of a pair of laterally spaced end fingers 11, which are turned at right angles to the trip lever and which straddle a reduced portion 12 of the plunger bar adjacent the outer end thereof, the reduced portion 12 being of sufficient length to allow a limited longitudinal movement of the trip lever relative to the plunger bar.

As shown a cup washer 13 is disposed at the outer end of the trip lever 10, so as to bear against the end fingers 11, to receive one end of a second compression spring 14, nested within the first compression spring 9, which bears between the cup washer 13 and the end of the plunger cap 8. This spring 14 normally urges the trip lever forwardly toward the rotor 4 and longitudinally of the plunger bar. The fingers 11 at the outer end of the trip lever are sufficiently spaced laterally to loosely straddle the reduced portion 12 of the plunger bar and thus the trip lever 10 is swingable, to a limited extent, in either direction laterally of the plunger bar centerline. The inner spring 14 normally holds the trip lever in the central position with respect to the plunger bar, and yields slightly on one side or the other when force is applied to the free end of the trip lever to cause it to swing laterally.

As shown in the drawings, the rotor or carrier 4 comprises a flat metal body having a central hub portion and a pair of diametrically op-

posite wing portions projecting laterally from the hub. This body is provided with a pair of angularly spaced V-shaped seats 15 and 16, in its margin nearest the inner end of the trip lever 10, which seats are formed by notches made in the rotor margin at locations equally spaced on either side of a line intersecting the rotor axis at right angles to the wing portions. The adjacent margins or edges of the seats 15 and 16 intersect or converge inwardly to form a triangular projection or tooth 17, which separates and defines the seats and also serves as a center guide to lead the free end of the trip lever into one or the other of the seats as the lever is moved toward the rotor. Also, the rotor 4 is provided with an integral rhombus-shaped cam 18 on its opposite margin, which cam is located diametrically opposite the tooth or projection 17 and engages an upstanding tongue or stop lug 19 formed on the inner end of the plunger bar 6. This stop lug locks the carrier or rotor against turning, by engagement at the base of the cam 18, until the plunger bar 6 is moved inwardly a sufficient distance to disengage the stop lug from the cam.

Thus when the plunger bar 6 is pushed inwardly, by means of pressure exerted on the cap 8 against the action of the spring 9, the inner end of the trip lever 10, under pressure from the spring 14, is brought into engagement with the tooth 17 on the rotor 4 and its free end is swung laterally, by the adjacent one of the inwardly diverging walls of the tooth, and seated in the nearest one of the seats 15 and 16, the rotor 4 always being turned to one side or the other when the plunger is in its released or neutral position as shown in Figs. 2 and 6. This engagement of the trip lever in one or the other of the rotor seats will exert a turning or torque force on the rotor because of the fact that the seats are located laterally with respect to the axis of the rotor and the longitudinal centerline of the plunger bar 6. Turning of the rotor, however, is restrained by engagement of the stop lug 19, on the inner end of the plunger bar, with the rhombic or diamond-shaped cam 18 and the trip lever must, therefore, yield rearwardly along the plunger bar, against the action of the spring 14, until the stop lug 19 is carried beyond the end of the cam 18 by inward movement of the plunger bar. At the instant that the cam is released from the stop lug the trip lever 10, under the stored up tension of its spring 14, will immediately move forwardly along the plunger bar and cause the rotor to swing or turn suddenly, with a snap action, in the direction opposite the side engaged by the trip lever.

The mechanism thus far described, for imparting the snap-action turning movement to the rotor, has been used for many years in the operating mechanism for automotive foot dimmer switches. However, in this prior mechanism, the cam, by which the turning of the rotor was restrained, was of the beaver-tail type having a broad outer end surface and outwardly diverging sides, and the stop lug of the plunger bar operated in narrow angularly displaced radial slots formed in the rotor body, which slots defined the cam shape. In that arrangement the rotor body adjacent these slots extended beyond the end of the cam so that, as the rotor was snapped from one side to the other under the action of the spring pressed trip lever, the turning of the rotor was stopped, when it had reached the desired position, by engagement of the outwardly projecting rotor body portions, at

the sides of the cam, with the stop lug on the end of the plunger bar.

This resulted in the full load of the turning force or torque, applies to the rotor by the trip lever, being received by the restraining lug, and, since the lug is merely an upturned projection on the end of the plunger bar, its structure would crystallize in a relatively short time under the repeated shock of operation and the lug would break off rendering the mechanism useless. Another difficulty experienced with the former beaver-tail cam arrangement was that often the stop lug would become engaged on the broad end surface of the cam and cause the carrier to become hung in a dead center or partially turned position so that its action was not always positive. This resulted in an incomplete switch operation which in an emergency was very dangerous as, instead of dimmed head-lights, there would be no light at all.

It is, therefore, the purpose of the present invention to cure these difficulties by improving the form of the cam portion of the rotor and the arrangement of the limit stop means so that the stop or lock lug on the end of the plunger bar is wholly relieved of any shock load in the operation of the mechanism; and so that operation of the mechanism is certain at all times.

This is accomplished by providing the cam, as heretofore described, with a substantially diamond or rhombic shape and by providing sufficient open space in the rotor body on either side of the cam so that the cam body can never engage the stop lug; and by providing independent, fixed stop means in the housing body for limiting the turning movement of the rotor.

Thus, as shown in the drawings, the rhombic-shaped cam 18 engages the stop lug 19 with a sliding motion only, the lug 19 serving the sole purpose of restraining rotation of the rotor against the action of the trip lever 10 until the plunger bar 6 has moved inwardly a sufficient distance to move the lug 19 beyond the tip of the cam 18 at which point the rotor 4 is released to complete its turning motion with a snap action. In the form shown, the stop means for limiting the turning movement of the rotor 4 comprises a pair of pillars or impact columns 20 and 21 formed integrally with the body of the housing 1 and located at the end thereof through which the trip lever extends. These stop elements 20 and 21 project inwardly into the path of the rotor wings, so as to engage the respective wings edgewise when the rotor has turned to its maximum desired extent.

The cutaway or open portions 22 and 23 of the rotor, on either side of the cam 18, are of sufficient width so that when the rotor has reached its maximum position of turning, in either direction, no part of the rotor will be engaged with the lug 19. In this manner the shock of the snap action of the rotor 4 is absorbed entirely by the stop elements 20 and 21, and since the shock load is imparted to the stop elements in the direction of their respective axes, there is no danger of the stop elements failing because of repeated shock blows. Thus, since the rotor restraining or stop lug 19 receives no shock load whatsoever, there is no danger of its being broken and the operating life of the mechanism is increased many times over that of the previous construction. Also because the tip of the cam is substantially a point, being only slightly rounded, it is virtually impossible for the stop lug to engage the end of the cam and hold the rotor in a partially turned posi-

tion, regardless of the manner of operation of the plunger bar.

The operation of the improved mechanism is illustrated by Figs. 3 to 6 inclusive, which show the position of the parts, sequentially, through one cycle of operation. The neutral or starting position is shown in Fig. 2. In Fig. 3, the plunger bar 6 has been pressed inwardly to the point where the inner end of the trip lever 10 is swung laterally by the tooth 17 and seated in the seat or notch 15. At this point, the rotor restraining and lock lug 19 has progressed about halfway of the length of the engaged surface of the cam 18 during which time it has held the rotor 4 in its initial or starting position.

In Fig. 4, the parts are shown in the position just prior to the instant of release of the rotor, where the plunger bar 6 has moved inwardly a sufficient distance to shift the restraining or stop lug 19 to substantially the end of the cam 18. By this time the rotor has begun to turn, restrained, however, by engagement with the lug 19, and the trip lever 10 has moved backwardly along the plunger bar 6 and against the action of the spring 14 so that the maximum power has been stored up in the trip lever 19 for imparting a snap action torque to the rotor 4. Thus, as the lock lug 19 passes beyond the end of the cam 18, the rotor 4 is released and the trip lever 10, under the action of its spring 14, causes the rotor to move with a sudden snap action until it is stopped by engagement of the adjacent rotor wing with the stop element 21, as shown in Fig. 5. When this action has occurred the pressure against the plunger cap 8 is released and the plunger parts are returned by the spring 9 to their neutral position shown in Fig. 6. At this position the lock lug 19 is seated at the base of the cam 18 in the cutaway portion 22 to hold the rotor 4 firmly in the position to which it has been turned.

It will be seen, from Figs. 3, 4 and 5, that up to the instant of release from the lug 19, the rotor has turned approximately 45° or one-half of its total angular movement, and that upon release the rotor only travels about 45° further before being stopped by the respective stop element 20 or 21. Thus the extent of rotor movement under the snap-action of the spring 14 is a minimum and considerably reduces the shock impact on the rotor when it is stopped by the stop elements. This is one factor which materially reduces wear and greatly prolongs the useful life of the mechanism.

The main advantages of this invention, as before mentioned, reside in the greatly increased operational life of the operating mechanism that is afforded through relieving the stop lug of any shock load; and by the arrangement whereby all shock load is sustained by rigid stop pillars which are supported by the mechanism housing. Another particular advantage will be found in the improved rhombic shape of the rotor cam wherein its tip is substantially pointed so as to practically obviate any possibility of the rotor becoming hung up in dead center position by engagement of the stop lug on the end of the cam.

Although but one specific embodiment of this invention is herein shown and described it will be understood that details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. In a device of the class described comprising a pivotally mounted carrier and a trip lever

normally disposed radially with respect to the pivot axis of the carrier and in the plane of the carrier, said trip lever having a free end adjacent said carrier adapted to swing laterally relative to its normal radial alignment with the carrier axis, a pair of angularly spaced seats in the margin of said carrier adjacent the free end of said trip lever, means on said carrier between said seats for guiding the free end of the trip lever into one of said seats, and means for shifting said trip lever radially toward said carrier and holding the free end of the trip lever in resilient pressure engagement in one of said seats to apply a torque pressure on said carrier, a cam projecting outwardly from the margin of said carrier on the side thereof opposite seat seats, a stop lug normally engaged with one side of said cam at the base thereof, means for shifting said stop lug outwardly relative to the axis of said carrier and disengaging said stop lug from the outer end of said cam during resilient pressure engagement of said trip lever with said carrier, and fixed stop means for limiting the snap-action turning movement of said carrier under the influence of said trip lever upon release from said stop lug, said stop means comprising fixed rigid laterally spaced impact columns disposed in the plane of said carrier, one on each side of the axis thereof, and engageable endwise with a respective edge of said carrier at a point intermediate said axis and the respective lateral extremity of the carrier, said carrier having its margin cut away on each side of said cam to avoid carrier contact with said stop lug and lug shifting means when said carrier reaches the limit of its turning movement.

2. In a device of the class described comprising a pivotally mounted carrier having laterally extending portions on each side of the pivot axis, and a trip lever normally disposed radially with respect to the pivot axis and in the plane of the carrier, said trip lever having a free end adjacent said carrier adapted to swing laterally relative to its normal radial alignment with the carrier axis, a pair of angularly spaced seats in the margin of said carrier between said lateral portion and adjacent the free end of said trip lever, means between said seats for guiding the free end of the trip lever into one of said seats, and compression spring means for shifting said trip lever radially toward said carrier and holding the free end of the trip lever in resilient pressure engagement in one of said seats to apply a turning torque on said carrier, a cam projecting radially from the margin of said carrier opposite said seats, said cam having a substantially rhombic shape with its margins in the plane of said carrier, a shiftable stop lug normally engaged with the edge of said cam at the base thereof, the inner converging margins of said cam being substantially radial relative to the rotor axis, means for shifting said stop lug radially outward relative to the axis of said carrier and disengaging said lug from the tip of said cam during the resilient pressure engagement of said trip lever with said carrier, and fixed stop means cooperate with the lateral portions of said carrier for limiting the turning movement thereof upon release of said stop lug from said cam, said stop means comprising a pair of fixed laterally spaced impact columns disposed in the plane of said carrier, one on each side of the axis thereof, and extending into the path of the respective lateral portions of the carrier for engagement with intermediate substantially radial portions thereof, and said car-

rier having its margin cut away on each side of said cam to avoid contact of said carrier with said stop lug when said carrier reaches the end of its turning movement.

3. In a device of the class described, a carrier 5 mounted for rotation on a central axis and comprising a flat body having a pair of oppositely extending lateral wing members, a tooth projecting radially from the margin of said body midway between said wing members and having 10 inwardly diverging sides, a seat in the margin of said body at each side of said tooth and at the inner ends of the sides thereof, and a substantially rhombic-shaped cam projecting radially from the margin of said body diametrically 15 opposite said tooth, the adjacent edges of said cam and said wing members diverging outwardly and said cam terminating in a rounded tip, means adapted to engage in said seats alternately and apply a resilient turning force to said carrier 20 in respectively opposite directions, a radially shiftable stop lug disposed to normally engage said cam along the side thereof toward which the turning force on said carrier is exerted, means for shifting said stop lug outwardly beyond 25 the cam tip to release said cam, and fixed laterally spaced stop members in the plane of said carrier and independent of said stop lug and lug shifting means for engaging intermediate radial edge portions of said carrier wing members respectively to limit the turning movement of said carrier in either direction.

4. A device of the class described comprising a housing having a rotatable carrier therein 35 mounted on a pivot post secured to the wall of the housing, a plunger bar extending transversely of said pivot post and having a longitudinal slot through which said post extends whereby said plunger bar may be reciprocated radially relative to said post, said plunger bar and carrier 40 being disposed on said post one above the other, a trip lever extending lengthwise of said plunger bar in the plane of said carrier and having a free end adapted to engage the margin of said carrier to cause rotation thereof, said trip lever having 45

its outer end slidably mounted on said plunger for limited outward movement lengthwise thereof and adapted to permit lateral swinging movement of the free end of the trip lever, a pair of angularly spaced seats in the margin of said carrier adjacent the free end of said trip lever and means between said seats for guiding the free end of said trip lever into one of the seats upon movement of said plunger bar and trip lever toward said pivot post, resilient means for normally holding the trip lever on the centerline of said plunger and permitting outward movement of said trip lever along said plunger upon engagement of the trip lever with said carrier, and means normally urging said plunger radially outward relative to said pivot post, a cam member on the margin of said carrier opposite said seats, said cam member being of substantially rhombic shape and terminating in a rounded tip, a stop 5 lug on said plunger extending into the path of said cam member, said cam member being adapted to engage said stop lug and resist movement of said carrier under the influence of said trip lever until said plunger has been moved a predetermined distance radially relative to said pivot post, and a fixed stop member on said housing positioned to engage an intermediate radial edge portion of said carrier and limit its turning movement upon disengagement of the stop lug and the tip of said cam member, said carrier being relieved on each side of said cam member to avoid engagement of the carrier with said stop lug at the end of its turning movement.

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