

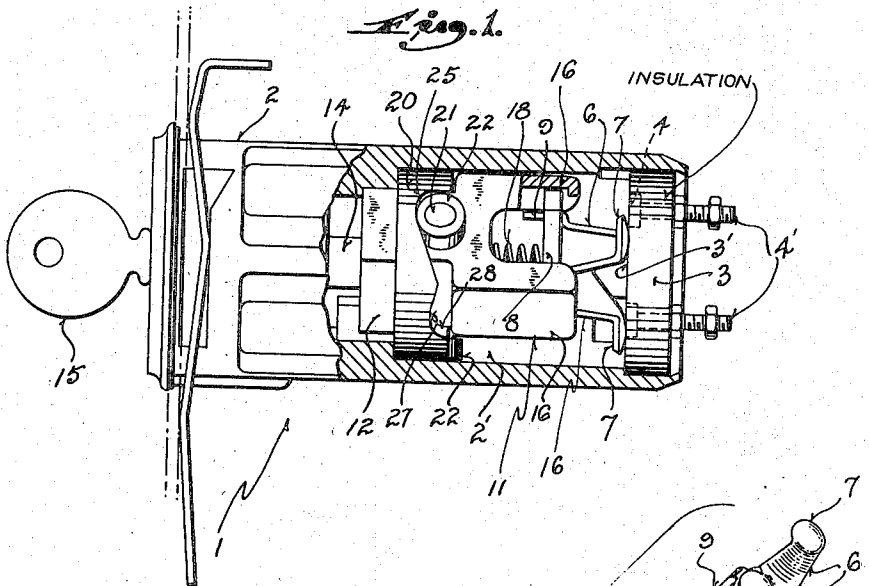
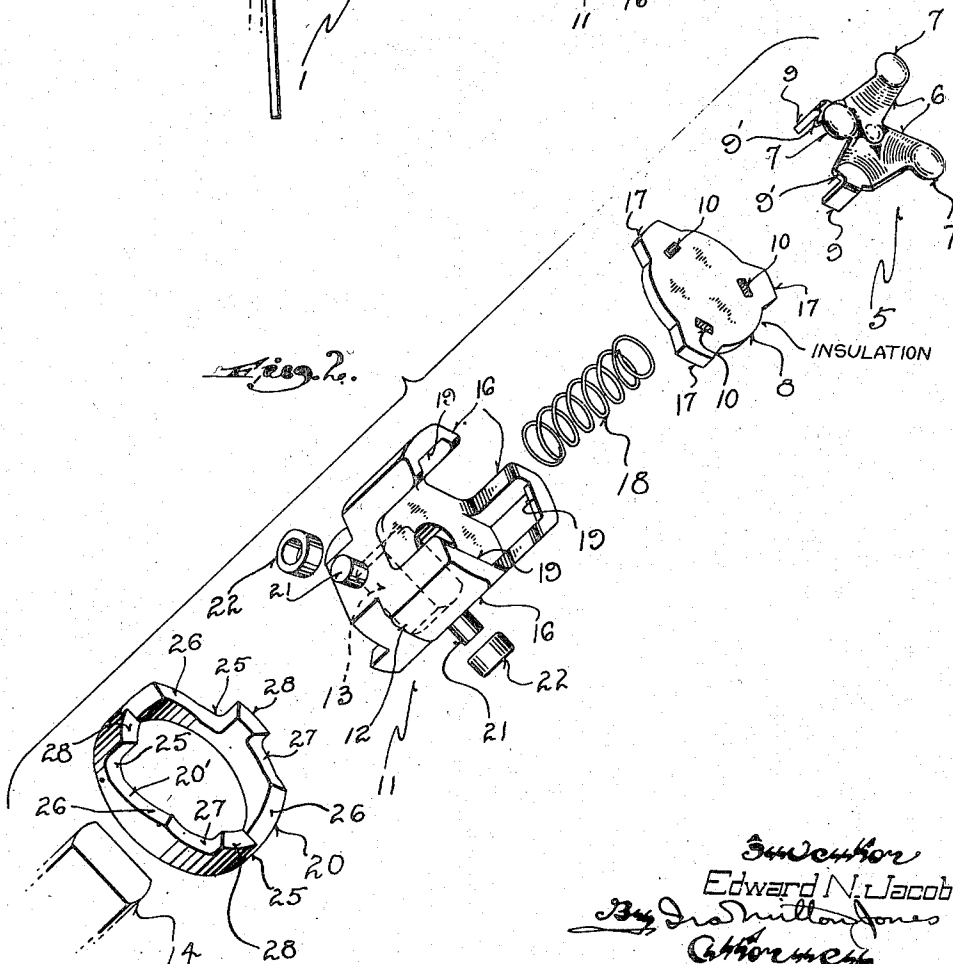
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SWITCH

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SWITCH

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This invention relates to electric switches and refers more particularly to lock switches of the type having a contactor rotatable across the face of a terminal head toward and from engagement with stationary contacts on the terminal head to place the switch in "on" and "off" positions.

It is customary to provide a certain amount of contact pressure between the circuit making contacts of any electric switch so that the resistance across the contacts will be kept to a minimum. Such contact pressure is particularly desirable in lock switches designed for automotive use since without it the vibration normally attendant upon operation of the vehicle tends to cause intermittent separation of the contacts with resultant high resistance, poor connections, and arcing across the contacts. It is also particularly desirable that switches of the rotary contactor type have a strongly marked detent action comparable to that of conventional quick break snap switches, the advantages of which are well known. A quick break snap action is a feature of special importance in an automotive ignition lock switch inasmuch as it assures positive switch action, and especially since the driver of a motor car seldom gives much attention to the act of turning the ignition switch "on" and "off."

It is, therefore, an object of this invention to provide a rotary contactor type electric switch of the character described with a strongly marked detent action by which snap action of the switch is produced.

Another object of this invention resides in the provision of novel means in a rotary electric switch of the character described for effecting acceleration of contact separation so that turning "off" of the switch causes a quick breaking of the contacts with a snap action.

Still another object of this invention resides in providing a rotary switch of the character described with simple detent mechanism requiring a definite effort on the part of an operator actuating the switch to move the same between its "on" and "off" positions and which operates to accelerate contactor motion between the "on" and "off" position of the switch so as to produce a highly desirable snap action of the switch.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claim.

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The accompanying drawing illustrates one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a side elevation of an ignition lock switch of the type used in automobiles and the like with portions of the switch case broken away and shown in section to illustrate the application of this invention thereto; and

Figure 2 is an exploded perspective view showing the component parts of the switch mechanism.

Referring now particularly to the accompanying drawing in which like numerals indicate like parts, the numeral 1 designates generally a lock switch of the type designed for mounting on the instrument panel of an automobile for the control of the ignition circuit of the automobile.

The switch here shown comprises a casing 2 bored to rotatably receive an actuator, not shown, in the front portion of the case adjacent to the panel upon which the switch is mounted. In a lock switch of the type here shown the rotatable pin or plate tumbler cylinder constitutes the actuator for the switch.

The case 2 is provided with a counterbore 2' at its rear portion to receive the switch mechanism. The switch mechanism includes a terminal plate 3 preferably formed from non-conductive material and disposed crosswise of the counterbore to close the rear of the casing.

The terminal plate is secured to the casing in a position closing the mouth of the counterbore by means of the more or less conventional practice of spinning the rear of the case over the back face of the terminal plate.

A plurality of stationary contacts 4 are carried by the terminal plate and are exposed at the inner face thereof to be substantially flush therewith. Terminals 4' electrically connected with the stationary contacts 4 project rearwardly through the insulating terminal plate and extend from the rear thereof as shown to provide for the attachment of electrical conductors thereto.

The rotatable contactor 5 of the switch is in the form of a spider in that it has a plurality of circumferentially spaced legs 6 each terminating in a foot 7 constituting the movable contacts per se and adapted for engagement with the stationary contacts 4 on the inner face of the terminal plate.

The contactor has its feet 7 normally engaged with the inner face of the terminal plate and is adapted to be rotated thereacross to establish or

break the circuit or circuits controlled by the switch.

The contactor 5 is operatively connected with an insulating disc 8 through which rotation is imparted to the contactor. The connection between the contactor and insulating disc comprises three circumferentially spaced legs 9 on the contact spider remote from the contacts 7 thereof which extend longitudinally forwardly to slidably engage in mating apertures 10 in the insulating disc.

As will be readily seen, rotation of the insulating disc imparts rotation to the contact spider through the legs 9 thereof engaging in the apertures 10 in the disc while the insulating disc 8 is free to slide along the legs 9 axially of the counterbore 2' a limited distance toward and from the contact spider. The legs 9 are offset with respect to the body of the spider from which they are struck so as to provide shoulders 9' engageable with the rear face of the insulating disc to limit motion of the disc rearwardly in the counterbore toward the contactor and terminal plate.

The insulating disc 8 is in turn carried by a driver or coupling element designated generally by the numeral 11. The driver is freely rotatably mounted in the counterbore 2' between the contact spider and the actuator for the switch and has a substantially cylindrical body portion 12 of a size to guide the driver for rotation and axial sliding motion in the counterbore 2' on the axis thereof.

A suitable axial non-circular hole 13 in the forward end of the body portion 12 is provided to receive a driving lug 14 on the inner extremity of the actuator or lock cylinder so that the driver or coupling element 11 is constrained to rotate with the lock cylinder when the latter is turned by means of a proper key 15 while being free to slide axially relative to the actuator and contactor.

The driving connection between the coupling element and the contactor is provided by a plurality of circumferentially spaced legs 16, in the present case three, extending rearwardly from the body portion 12 of the driver 11. The legs 16 are spaced radially from the axis of the driver and have a channel shaped cross section, with the flanges on the channel facing inwardly to receive lugs 17 on the insulating disc 8 therebetween and thus constrain the insulating disc and the contactor to rotation with the driver while permitting free sliding of the driver in the case.

A compression spring 18 confined in the axial well formed between the legs 16 of the driver 11 reacts against the body portion 12 of the driver and the insulating disc 8 and consequently the contactor 5 to yieldingly urge the disc and contactor rearwardly toward the terminal plate and to urge the driver forwardly toward the front of the casing.

Inwardly turned flanges 19 at the rear extremities of the driver legs 16 prevent the insulator 8 from becoming detached from the driver legs by the spring prior to assembly of the switch mechanism in the casing and require the disc to be tilted for assembly in the driver well.

The spring 18, as stated, yieldingly urges the driver forwardly toward the bottom of the counterbore 2' and such motion of the driver is limited by an annular cam 20 pressed into the bottom of the counterbore so as to be fixed with respect to the case. The cam may be formed integrally with the case if desired, but is prefer-

ably made as a separate unit and inserted into the case during final assembly of the switch mechanism. The cam 20 has its cam surface 20' facing rearwardly toward the back of the case.

Three circumferentially spaced trunnions 21 project from the sides of the forward end of the driver on radial axes and rotatably mount collar-like cam rollers 22 the peripheries of which are maintained in engagement with the cam surface 20' by the compression spring 18 so that the cam determines the axial position of the driver in the switch case. It will also be noted that the thrust of the spring 18 is borne by the cam track and consequently the casing, and that the shoulders 9' on the legs 9 of the contactor hold the insulating disc 8 spaced inwardly of the flanges 19 on the driving legs 16 so that the full force of the spring is utilized to press the contactor against the inner face of the terminal plate.

Prior to assembly of the switch mechanism in the switch case, the spring 18 is first placed in the well formed between the legs 16 of the driver 11. The insulator 8 is then set in place over the spring by tilting the insulator and advancing two of its driving lugs 17 down the grooves of two of the driver legs 16, against the pressure of the spring 18 until the remaining lug may clear the flange 19 on the third leg 16 whereupon the disc is again tilted to bring its remaining lug 17 under its retaining flange 19.

The flanges 19 then prevent the insulator 8 from being expelled from the legs 16 by the spring 18 and hold the disc connected with the driver for assembly in the case as a unit.

If the cam track 20 has been made separately, it is next pressed into the bottom of the counterbore 2' in the switch case from the rear. The cam rollers 22 are slipped onto the trunnions 21 on the driver 11 and the driver, together with the spring 18 and the insulator 8, assembled as aforesaid, is inserted into the counterbore 2', with the cam rollers 22 engaging the cam track 20, and the lug 14 received in the hole 13 in the driver body portion 12.

The legs of the contact spider 5 are then slipped into the slots 10 in the insulator 8, and the terminal plate 3 secured in place closing the rear of the case. This may be conveniently accomplished by spinning the rear rim of the case over the rear edge of the contact plate, although any other suitable means may be employed to hold the terminal plate in place.

When the switch is in the "off" position the rollers on the driver are seated in depressions 25 in the cam surface 20' as indicated in Figure 1 and the contact feet 7 of the spider bear comparatively lightly against the inner face 3' of the terminal plate 3, but are not in contact with any of the stationary contacts 4. This condition is brought about by the action of the spring 18 as hereinbefore pointed out.

As the actuator or switch key is turned toward the switch "on" position, the cam followers 22 on the driver are caused to ride up one side of "humps" 26 on the cam track, there being one hump for each of the rollers. These humps cam the driver rearwardly toward the terminal plate and cause the spring 18 to be compressed between the driver and the insulator disc 8 thereby increasing the pressure of the contact spider feet 7 against the face 3' of the contact plate.

Just before the contact feet 7 are brought into complete engagement with the stationary contacts 4, the cam rollers 22 move over the peaks

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of the humps and are caused to snap into depressions 27 at the opposite sides of the humps with but little relief of contact pressure.

Engagement of the cam followers in the depressions 27 defines the switch "on" position wherein the contact feet 7 of the contractor 5 are completely engaged with the stationary contacts 4. Continued rotation of the contractor at this time is prevented by engagement of the cam followers with abutments 28 on the cam surfaces alongside the depressions 27.

Since the cam track 20 is considerably higher at the detent forming depressions 27 than at the "off" positions 25 of the track, the driver 11 maintains the spring compressed between it and the disc 8 to hold the contactor firmly pressed against the stationary contacts.

When the switch is turned toward "off" position, a definite effort is required to rotate the key 15 or other actuator and overcome the force which the spring 18 exerts to hold the cam rollers 22 in the detent forming depressions 27 of the cam track and to move the rollers over the peaks of the humps 26. Immediately after the rollers pass the peaks of the humps and before the contacts are completely disengaged, the spring 18 rapidly drives the rollers down the inclined sides of the humps and into seating engagement in the depressions 25 to produce an extremely rapid "break" minimizing arcing of the contacts by the speed of their separation.

From the foregoing description taken in connection with the accompanying drawing, it will be readily apparent that this invention provides a mechanism for a lock switch or other type of rotary switch which produces a snap action of the switch to insure rapid breaking of the circuit or circuits controlled by the switch.

What I claim as my invention is:

1. A switch of the type having a substantially tubular case, an actuator rotatable in the front portion of said case, a fixed contact plate disposed across the rear portion of said case and having a plurality of stationary contacts exposed on the front surface of the plate at the inside of the case, and a movable contactor inside the case having contact means abutting the front surface of said plate, said contactor being adapted to be rotated toward and from an operative "switch closed" position in which its contact means engages the stationary contacts on the plate, characterized by: a rotatable driver for the contactor disposed in the case between the actuator and contactor; a driving connection between the driver and the contactor by which the driver is axially slidable in the case relative to the contactor while the latter is constrained to rotate with the driver; spring means reacting between said contactor and driver tending to separate the same axially for pressing the contact means on the contactor into engagement with said contact plate; a splined driving connection between the driver and actuator; cooperating cam means on the driver and the case defining the axial position of the driver and for translating rotary motion of the driver in a direction to carry the contactor toward "switch closed" position into an axial rearward movement of the driver relative to the contactor to compress said spring means therebetween whereby said contact means is caused to engage the contact plate with an increasing pressure upon actuation of the contactor toward "switch closed" position; and means on the driver engageable with a part fixed with respect to the case with a detent action upon rota-

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tion of the driver to "switch closed" position to define the operative position of the switch.

2. A switch of the type having a bored case, an actuator rotatable in said bore and accessible at the front of the case, a contact plate extending across the rear of the case and provided with a plurality of stationary contacts on the inner surface of the plate, and a movable contactor abutting said surface of the plate and adapted to be rotated into circuit making engagement with said stationary contacts to "close" the switch, characterized by: a driver rotatable in the case and operatively connected between the actuator and contactor so that said elements rotate in unison, said connections permitting the driver to slide axially in said bore relative to the actuator and contactor; cooperating cam means on the driver and the case for translating rotary motion of the driver in a direction to effect closing of the switch into movement of the driver toward the contact plate, said cam means providing a detent defining the "closed" position of the switch; and spring means reacting between the driver and the movable contactor for urging the contactor against the contact plate with a pressure increasing with rotation of the driver toward switch closed position, said spring means also acting through the driver to yieldingly maintain said cam means engaged and to supply detent pressure upon rotation of the driver to "close" the switch.

3. A driver adapted to be received within the tubular case of a switch of the character described for transmitting rotary motion of actuating means accessible at the front of the case into rotation of a contact carrier to bring the same into and out of engagement with stationary contacts inside the case at the rear thereof, said driver comprising: a body; means on the body to guide the same for rotary and axial movement inside the tubular case; means at one end of the body substantially axially thereof providing for the establishment of a splined driving connection between the driver and actuating means; a plurality of longitudinally extending driving arms spaced radially from the axis of rotation of said body portion and extending from the opposite end of the body, said arms being adapted to receive said rotatable contact carrier between them and provide a driving connection between the driver and carrier permitting the driver to slide axially relative to the carrier, the space between said arms forming substantially a well for receipt of a compression spring to react between the body of the driver and the carrier by which pressure of the contact carrier against the stationary contacts is secured; and rollers carried by said body portion for rotation on fixed axes normal to the axis of the driver and cooperable with cam means on the case for governing the axial position of the driver in the case.

4. A driver adapted to be received within the tubular case of a switch of the character described for transmitting rotary motion of actuating means accessible at the front of the case into rotation of a contact carrier to bring the same into and out of engagement with stationary contacts inside the case at the rear thereof, said driver comprising: a body; means on the body to guide the same for rotary and axial movement inside the tubular case; means defining an axial non-circular hole in one end of the body cooperable with a lug on the actuator to provide a splined driving connection between the actuator and driver; a plurality of contactor driver arms spaced radially from the axis of rotation of said

body portion but integral therewith and extending longitudinally from the opposite end of the body to provide for the establishment of a splined driving connection between the driver and contactor of the switch; flanges on the outer extremities of said arms for limiting the amount of relative axial motion between the driver and contactor, the space between said arms substantially forming a well to receive a spring for reaction between the driver and contactor; and cam followers projecting from the sides of the body for cooperation with cam means on the case by which the axial position of the driver in the case is determined.

5. A switch of the type having a bored case, a rotatable actuator in said bore and accessible at the front of the case, a terminal plate extending across said bore remote from the actuator and having a plurality of stationary contacts on its inner face, and a contactor in the bore abutting said face of the terminal plate and rotatable toward and from engagement with said stationary contacts, characterized by: a driver for the contactor rotatable in the bore; separate splined driving connections between the driver and actuator and between the driver and contactor whereby said driver and contactor are constrained to rotate with the actuator with the driver free to slide axially in its bore; spring means reacting between the driver and contactor for pressing the contactor against the terminal plate; and cooperating cam means on the driver and the case through which the case receives the thrust of said spring means and by which rotary motion imparted to the driver by the actuator in a direction to engage the contactor with said stationary contacts is translated into axial motion of the driver in a direction to compress said spring means and increase the pressure of the contactor against the terminal plate.

6. A switch of the type having a bored case, an actuator rotatable in the bore and accessible from the front of the case, a terminal plate extending across the bore and having a plurality of stationary contacts exposed on its inner face, and a contactor in the bore abutting said face of the terminal plate and rotatable toward and from engagement with said stationary contacts, characterized by: a driver for the contactor rotatable and slidable in said bore; a splined connection between the actuator and driver constraining said driver to rotate with the actuator but allowing axial sliding motion of the driver in said bore; means connecting said driver with the contactor for rotation therewith and for axial motion relative thereto; a spring exerting an axial separating force between said contactor and said driver for pressing the contactor against the terminal plate; and cooperating cam means carried by the driver and the case and maintained in operative relationship with one another by said spring for receiving the thrust of the spring and for camming the driver axially in a direction to increase pressure of the contactor against the terminal plate through said spring as the driver is rotated toward the closed position of the switch, whereby the pressure of the spring acting on said cam means through the driver at the time of driver rotation to carry the contactor out of engagement with the stationary contacts effects acceleration of such rotary movement of the driver to insure speedy separation of the contactor from the stationary contacts.

7. In a switch of the type having a bored case, a rotatable actuator in the bore at the front of

the case, a terminal plate extending across the bore near the rear of the case and having a plurality of stationary contacts exposed on its inner face, and a contactor in the bore rotatable across the inner face of the terminal plate toward and from engagement with said stationary contacts thereon, characterized by: coupling means inside the bore connecting the contactor with the actuator for rotation therewith, said coupling means being slidable axially in the bore without disruption of the rotatable driving connection which it affords between the actuator and contactor; cooperating means on the case and said coupling means for translating rotation of the coupling means to carry the contactor toward engagement with the stationary contacts into axial sliding motion of the coupling means toward the terminal plate; and a compression spring reacting between the coupling means and the contactor for yieldingly urging the same against said inner face of the terminal plate, said spring being compressed by axial sliding motion of the coupling means toward the terminal plate to increase the pressure of the contactor against said inner face of the terminal plate upon rotation of the coupling means by the actuator to carry the contactor into engagement with the stationary contacts.

8. A driver for transmitting rotary motion from a lock mechanism in a bore at the front of a lock switch case to a rotatable contactor in a counterbore at the rear of said case to carry said contactor into and out of engagement with stationary contacts on a terminal plate closing said counterbore at the rear of the case, comprising: a substantially cylindrical body portion adapted to be rotatably and axially slidably received in the counterbore of said case and having an axial non-circular hole at one end to receive a lug extending rearwardly from the lock mechanism to constrain said driver to rotate with said lock mechanism while permitting axial sliding motion of the driver relative to the lock mechanism; a plurality of circumferentially spaced arms extending longitudinally rearwardly from the periphery of said body portion and integral therewith, said arms having their inner surfaces facing the axis of rotation of the driver provided with longitudinal spline forming grooves to provide for rotation of the contactor with said driver while permitting the driver to slide axially with respect to the contactor, said arms cooperating to form a well therebetween for the receipt of a coil spring for reaction between the driver and contactor; a plurality of trunnions projecting from the sides of said driver on radial axes normal to the axis of rotation of the driver and integral therewith; and rollers loosely journaled on said trunnions and adapted to cooperate with cam means fixed with respect to said case to control the axial position of the driver in the switch case.

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