

Nov. 30, 1954

E. N. JACOBI
ELECTRIC SWITCH

2,695,932

Filed July 13, 1951

3 Sheets-Sheet 1

Fig. 1.

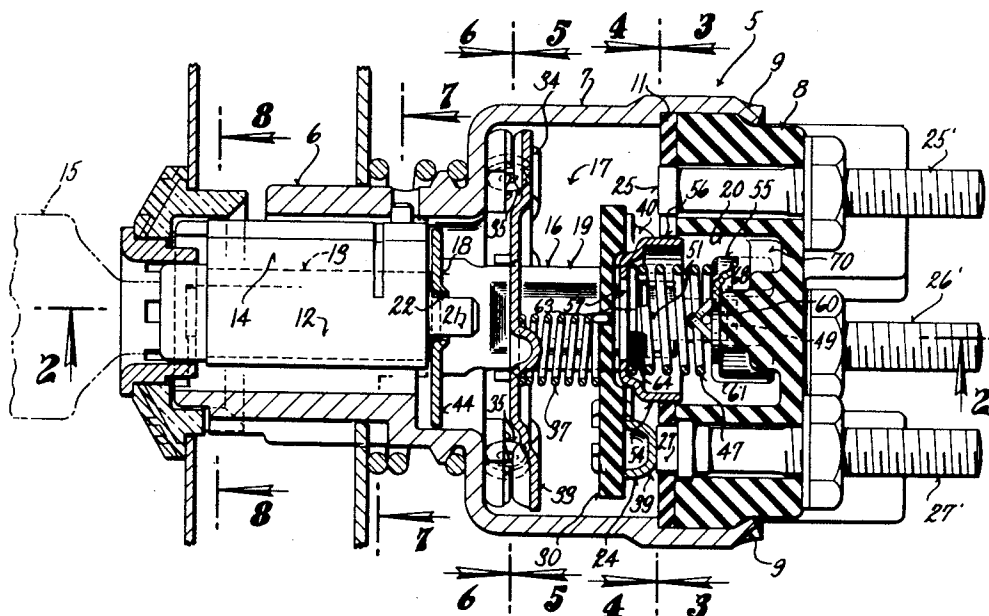
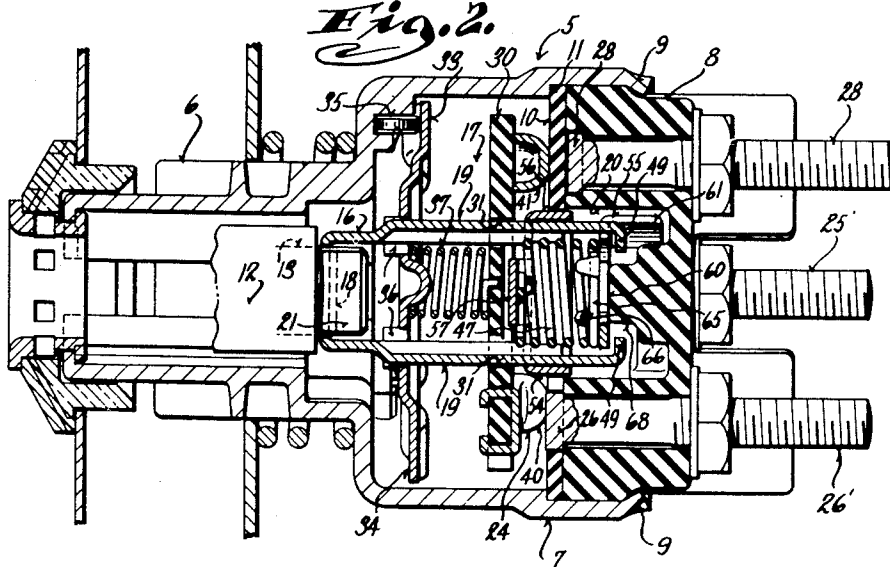


Fig. 2.



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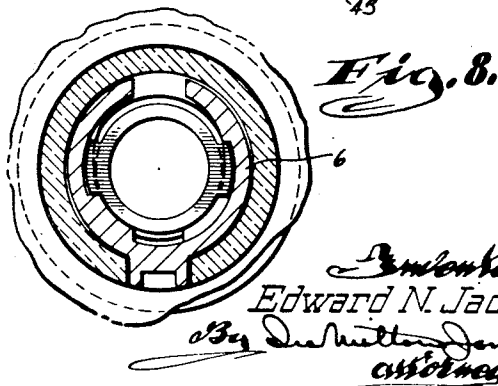
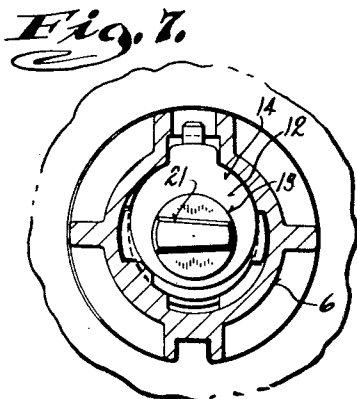
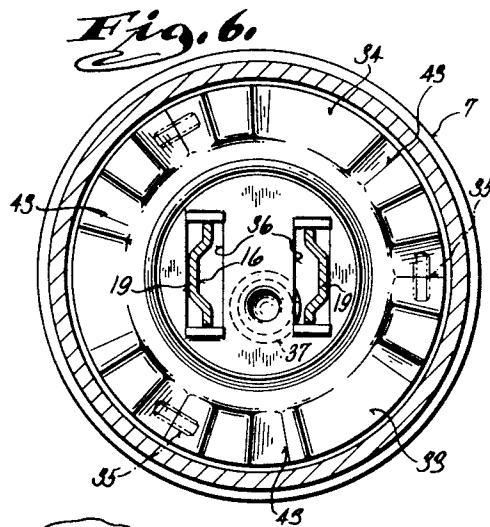
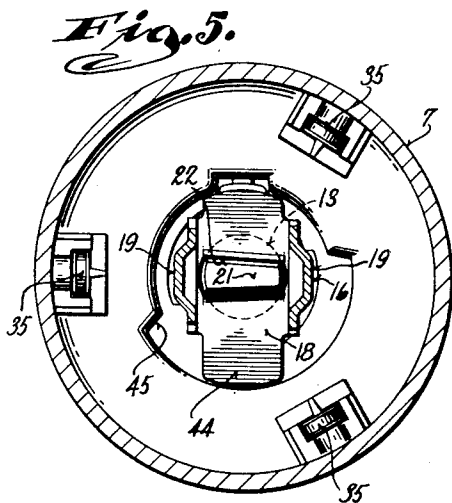
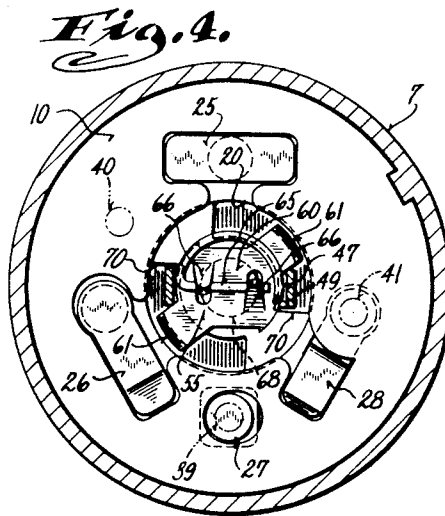
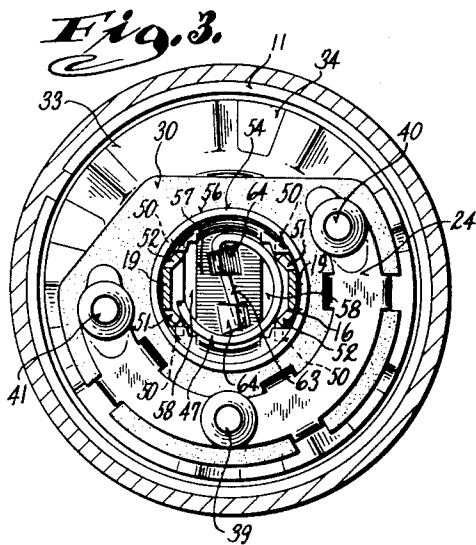
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2,695,932

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3 Sheets-Sheet 2



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ELECTRIC SWITCH

2,695,932

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3 Sheets-Sheet 3

Fig. 9.

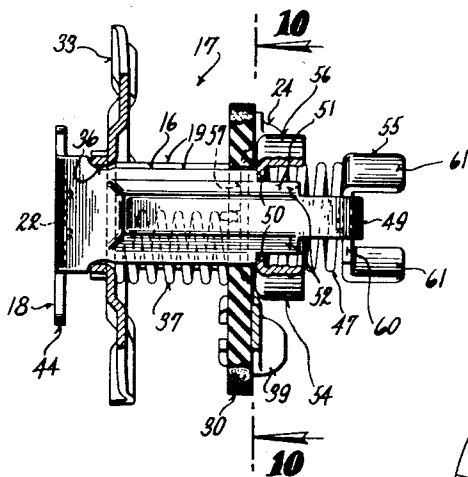


Fig. 10.

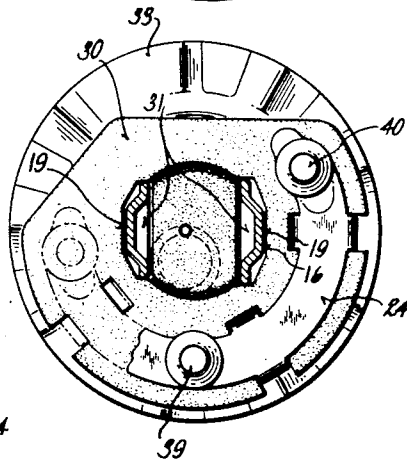
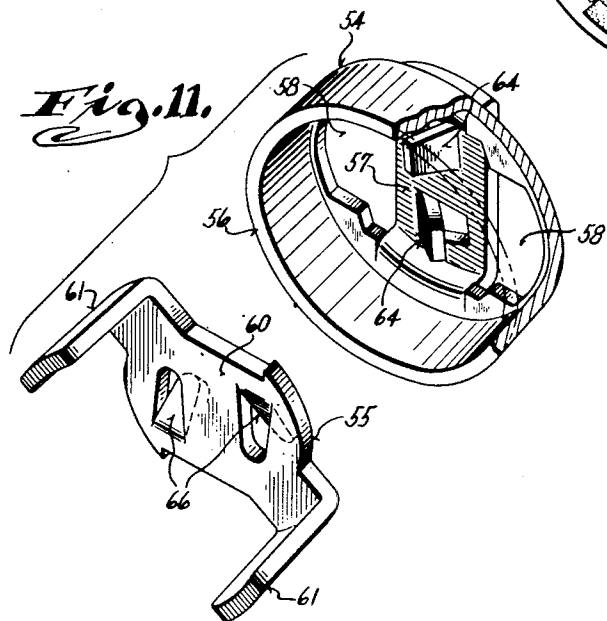


Fig. 11.



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2,695,932

ELECTRIC SWITCH

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Application July 13, 1951, Serial No. 236,550

21 Claims. (Cl. 200—11)

This invention relates to electric switches and refers more particularly to improvements in automobile ignition-starter switches of the type disclosed in my copending application Serial No. 123,709 filed October 26, 1949.

In switches of this type a contactor is rotated across the face of a terminal head having stationary contacts thereon in consequence to the manual rotation of an actuator which may comprise a key controlled lock cylinder; and detent means energized by the spring which assures adequate contact pressure produces a pronounced snap action for the switch comparable to that of conventional quick break snap switches. Also the actuator provided by the rotatable key controlled lock cylinder is spaced axially from the terminal head, with the contactor interposed therebetween, and a driver is employed to couple the actuator to the contactor for the transmission of rotation from the actuator to the contactor.

As in said copending application, the switch of this invention in addition to controlling the ignition and starter circuits of an automobile, also controls its accessory circuits so as to afford assurance that all the accessories (such as the radio and heater) are automatically switched off in consequence to turning off the ignition to prevent their operation without a proper key. In this case also the lock cylinder preferably has an intermediate key removing "off" position in which none of the switch circuits is operable; a first switch on position defined by the detent means in which the ignition and accessory circuits are closed, established by rotation of the lock cylinder in one direction from the off position; and a second switch on position reached by further rotation of the actuator in the same direction and at which both the ignition and starter circuits are closed but the accessory circuits are open.

After the engine starts the contactor of the switch (and the actuator as well) is automatically returned to its first switch on or "running" position in which the ignition and accessory circuits are closed. This is accomplished by means of a torsion spring loaded by rotation of the actuator to carry the switch contactor from its first to its second switch on position, an which spring effects retrograde rotation of the switch contactor to the "running" position when the actuator is released following starting of the engine.

In general it is an object of this invention to provide an improved contactor assembly for a switch of the character described which features simplicity of construction and ease of assembly in the switch.

More specifically it is an object of this invention to provide a switch of the character described wherein the switch contactor and the actuator are coupled for rotation with one another by a driver which is both torsionally biased against rotation to the "start" position of the switch and urged axially forwardly into anti-rattling engagement with the actuator by the same spring.

Still another feature of this invention resides in the manner in which the driver is rotatably supported jointly by the actuator and the terminal head, and guided by the latter for rotation coaxially with the actuator.

Another advantageous feature of this invention resides in the specific manner in which the torsion spring is mounted on the driver to rotate bodily therewith between the off and first switch on positions of the contactor but to be loaded torsionally by rotation of the driver to carry the contactor from the first to the second or start position of the switch without imposing tilting forces on the driver

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tending to misalign the same with respect to the actuator. This assures easy rotation of the driver which is at all times free of binding on its bearings.

Still another feature of this invention resides in the provision of a spring seat on the driver to receive the axial thrust of the torsion spring and which spring seat has a cylindrical side wall forming a journal bearing to rotatably fit a hole in the terminal head and thereby guide the rotary movement of the driver.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction 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 hereinafter disclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate 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 view of a switch constructed in accordance with this invention, showing the same in longitudinal section;

Figure 2 is a longitudinal sectional view taken through Figure 1 generally along the line 2—2;

Figure 3 is a cross sectional view taken through Figure 1 along the plane of the line 3—3;

Figure 4 is a cross sectional view taken through Figure 1 along the plane of line 4—4;

Figure 5 is a cross sectional view taken through Figure 1 along the plane of the line 5—5;

Figure 6 is a cross sectional view taken through Figure 1 along the plane of the line 6—6;

Figure 7 is a cross sectional view taken through Figure 1 along the plane of the line 7—7;

Figure 8 is a cross sectional view taken through Figure 1 along the plane of the line 8—8;

Figure 9 is a side elevational view of the contactor assembly with parts thereof broken away and shown in section;

Figure 10 is a cross sectional view taken through Figure 9 along the plane of the line 10—10; and

Figure 11 is a group perspective view of the two spring seat members between which the torsion spring is confined and to which its ends are connected.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts throughout the several views the numeral 5 generally designates the housing for the switch of this invention. The housing is preferably made as a die casting having a small diameter substantially tubular front end portion 6 and a larger hollow rear end portion 7, open at its back. The open back of the enlarged rear portion of the housing is closed by a terminal head 8 of insulating material over which the side wall of the housing is clinched as indicated at 9; with the front face 10 of the terminal head held against a rearwardly facing shoulder 11 inside the housing so that the terminal head is fixed to the housing against motion relative thereto.

A tumbler lock 12 is mounted in the tubular front end portion 6 of the housing. The lock includes the customary plug or cylinder 13 constrained to rotation in a casing 14 and freed for rotation upon insertion of a proper key 15 into the front end of the cylinder.

The cylinder 13 projects rearwardly from the lock casing 14 toward the interior of the large rear end of the housing and has a driving connection with a driver or coupling 16 forming part of a rotary contactor assembly indicated generally by the numeral 17. According to this invention the driver 16 is a substantially U-shaped metal stamping having a front end wall 18 abutting the rear of the cylinder 13 and opposite drive arms 19 joined to said front wall and projecting rearwardly therefrom into a well or recess 20 in the terminal head opening to the front face 10 thereof, coaxially of the lock cylinder.

A tongue 21 on the rear end of the lock cylinder and having slightly tapering sides engages in a similarly shaped aperture 22 in the end wall 18 of the driver to provide

a rotation transmitting connection between the cylinder and the driver by which a contactor 24 mounted on the driver is carried across the front face of the terminal head into and out of engagement with stationary contacts 25, 26, 27 and 28 thereon to control the various circuits of the automobile. These contacts, of course, are flush with the front face of the terminal head and are formed on the forward ends of terminals 25', 26', 27' and 28' projecting rearwardly from the terminal head to provide for the connection of conductors thereto.

The terminal 26' is connectible with the battery and its contact 26 is, therefore, a supply contact; the contact 25 is adapted to be connected with the ignition coil by its terminal 25'; the starter coil is adapted to be connected with the starter contact 27 by its terminal 27'; and the contact 28 is adapted to have its terminal 28' connected with the accessory circuits.

The contactor 24 is a metal stamping clinched to a carrier disc 30 of insulating material. Opposite elongated holes 31 in the carrier disc receive the drive arms 19 of the driver to slidably spline the carrier disc thereto so that the disc rotates with the driver but is capable of lengthwise or axial sliding motion along its arms. Also slidably splined to the drive arms 19 is a detent plate 33, located forwardly of the carrier disc 30, and having an undulating rim portion 34 providing detent depressions engageable by detent rollers 35 journaled in the switch housing 7 to define the various positions of the switch.

The general arrangement of the rollers as well as the configuration of the rim of the detent plate is substantially the same as in my aforesaid copending application Serial No. 123,709, and reference may be had thereto for a more complete description of these parts. It is sufficient to note that the detent plate 33 has diametrically opposite holes 36 therein to receive the drive arms 19 and provide a sliding splined connection between the detent plate and the driver; and that a compression spring 37 engaged between the detent plate and the contactor disc yieldingly urges the same apart to press the undulating rim portion of the detent plate firmly against the detent rollers 35 and to press the contactor on the disc 30 against the front face 10 of the terminal head to thereby provide the necessary contact pressure for the switch.

The positions of the cooperating contacts on the contactor and the terminal head bear a predetermined relationship to the positions of the detent depressions in the undulating rim of the detent plate, so that the proper circuits will be either closed or opened in the various positions of the switch. For instance, in the off position of the switch shown in the drawings, the live battery contact 26 on the terminal head is not engaged by any of the contact portions of the contactor 24 so that even though the movable contact 39 on the contactor is engaged with the stationary starter contact 27, none of the circuits of the automobile controlled by the switch is operative. In this off position, another of the movable contacts 40 lies between the stationary contacts 25 and 26, and the remaining movable contact 41 lies between the stationary contacts 25 and 28. This condition is illustrated best in Figures 3 and 4 where, in Figure 4, the position of the movable contacts of the contactor 24 are shown in construction lines.

Rotation of the actuator provided by the lock cylinder, clockwise with reference to Figure 4, to a first switch on position defined by the engagement of the detent rollers 35 in depressions 43 in the rim of the detent plate brings the three movable contacts into engagement with the stationary contacts 25, 26, and 28 on the terminal head to render the ignition and accessory circuits of the automobile operative. Further clockwise rotation of the actuator to a second switch on position defined by the engagement of a radial extension 44 on the end wall 18 of the driver with a cooperating shoulder 45 on the switch housing brings the three movable contacts into engagement with the stationary contacts 25, 26 and 27 on the terminal head, disrupting the accessory circuit and closing the ignition circuit as well as the circuit for the starter coil.

Rotation of the actuator to carry the contactor from the first switch on position to the second switch on or start position thereof is yieldingly resisted by a torsion spring 47 which thus also serves to return the contactor to its first switch on position when the actuator is released following starting of the engine. The manner in which the torsion spring is connected with the driver and is loaded by rotation of the driver beyond the

first switch on position of the contactor is one of the main features of this invention since it results in an extremely simple and efficient rotary contactor assembly which can be rotated freely, without danger of binding.

According to this invention the drive arms 19 of the driver have their rear extremities projecting into the well 20 in the terminal head, as mentioned hereinbefore. At the rear extremities, however, the drive arms have hooks 49 bent radially inwardly toward one another to provide abutments facing forwardly of the driver toward a second set of abutments 50 on the driver facing rearwardly and formed at the junctions of the driver arms with reduced end portions 51 of the arms rearwardly of the shoulders 50. The torsion spring 47 is received between the reduced rear end portions 51 of the drive arms, and in the present case is a helically wound compression spring having a length such as to be accommodated axially between the abutments 49 and 50 on the driver. In addition the reduced rear end portions 51 of the driver arms have their side edges bent slightly inwardly as at 52, shown best in Figure 3, to hold the combination torsion-compression spring 47 coaxially with the driver.

The spring 47 is confined between front and rear spring seat members 54 and 55, respectively. The front spring seat member 54 is substantially cup-shaped in that it has a cylindrical side wall 56 and a bottom wall 57 which in the present case is provided with diametrically opposite holes 58 to receive the reduced rear end portions 51 of the drive arms and by which it is slidably splined to the driver to rotate therewith. The expansive force of the spring 47 yieldingly urges the front spring seat member forwardly to engage its bottom wall 57 with the rearwardly facing shoulders 50 on the drive arms.

The rear spring seat member 55 is a substantially U-shaped stamping having its bight 60 interposed between the rear end of the spring 47 and the hooks 49 on the rear extremities of the drive arms, against which hooks the rear spring seat member is pressed by the spring 47. The bight 60 of the rear spring seat member however projects radially from between the arms and has its legs 61 extending rearwardly therefrom and positioned diametrically opposite one another as seen best in Figures 4 and 9.

The opposite ends of the torsion-compression spring 47 are drivingly connected with the two spring seat members. For this purpose each end of the spring is bent inwardly to lie diametrically across the adjacent end convolution of the spring. The bent front end 63 of the spring flatwise overlies the bottom wall 57 of the front cup-shaped spring seat member and is hooked under opposite tabs 64 struck rearwardly therefrom to provide a rotation transmitting connection in the counterclockwise direction, as viewed in Figure 3, between the driver and the front end of the torsion spring.

The rear end 65 of the torsion spring flatwise overlies the rear side of the bight 60 of the rear spring seat member and is likewise hooked under opposite tabs 66 struck therefrom to provide a rotation transmitting connection between the rear end of the torsion spring and the rear spring seat member by which the torsion spring is loaded whenever the driver is rotated in the clockwise direction, as viewed in Figure 4, and the rear spring seat member is held against rotation.

From this it will be seen that the torsion spring 47 can be mounted on the rear of the driver 16 in a preloaded condition in which the spring holds the rear spring seat member 55 rotated clockwise, as viewed in Figure 4, to a position at which the end portions of the bight engage diametrically opposite side edges of the drive arms adjacent to their hook 49.

The various parts of the driver-contactor assembly described provide a particularly simple and compact subassembly as shown in Figure 9. In the subassembly the contact pressure spring 37 in urging the contact carrier and the detent plate apart tends to push the former rearwardly off of the driver. Such rearward displacement of the contact carrier and the contactor thereon, however, is precluded by the fact that the cup-shaped front spring seat member 54 overlies the rear face of the contact carrier disc and acts as a stop to limit rearward spring propelled motion of the contactor. It is also important to note that the rear spring seat member 55 has a substantially circular shape and that the engagement of its circular edge portions with the inner surfaces of the drive

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arms adjacent to their hooked extremities, in cooperation with the attachment of the rear end of the torsion spring thereto, guides the rear spring seat member for rotation relative to the driver coaxially thereof.

When assembled in the switch housing the unitary contactor assembly extends axially between the terminal head and the rear of the actuator provided by the lock cylinder, coaxially of the latter. A post 68 in the bottom of the well 20 in the terminal head, however, projects forwardly axially of the driver into engagement with the center portion of the bight 60 of the rear spring seat member 55 to press the same forwardly away from the hooks 49 on the driver arms and thereby compress the combination torsion and compression spring 47. The expansive force of the spring 47 is transferred through the front spring seat member and the shoulders 50 onto the driver so as to yieldingly press its front end wall 18 against the rear end of the actuator provided by the lock cylinder 12. This holds both the driver and the lock cylinder against rattling.

It will also be noted that the engagement of the contactor with the front face 10 of the terminal head holds the contactor and carrier disc spaced slightly forwardly of the front spring seat member. This, of course, compresses the spring 37 and assures adequate spring pressure against the back of the detent plate 33 to make possible the positive snap action of the switch.

Attention is directed to the fact that while the front end portion of the driver in seating upon the drive tongue 21 is rotatably journaled at its front end portion by the lock casing, the rotation of the driver is also guided by means of a bearing adjacent to the rear of the driver. This bearing comprises the cylindrical side wall or skirt 56 of the front spring member which is rotatably received in the mouth of the well 20 in the terminal head so as to assure that the rear end portion of the driver will be coaxial with the actuator provided by the lock cylinder.

During rotation of the actuator to carry the contactor from the off position of the switch to its first switch on position, the combined torsion and compression spring 47 rotates bodily with the driver. In this first switch on position, however, the diametrically opposite arms 61 of the U-shaped rear spring seat member occupy position in close proximity to diametrically opposite abutments 70 on the terminal head in the bottom of the well 20 therein. Consequently, although the driver 16 may be rotated further in the clockwise direction to carry the contactor to the start position, the abutments 70 preclude such further rotation of the rear spring seat member with the driver with the result that the spring 47 is additionally loaded torsionally by the rotation of the driver to the start position of the switch. This means, of course, that the contactor has to be held manually in the start position, against the action of the torsion spring 47, while the engine starter is cranking the engine. After the engine has started the actuator is released and the torsion spring 47 imparts retrograde rotation to the contactor assembly to return the same to its first switch on or running position. In this running position only the ignition and accessory circuits are operative.

It is important to note that with the particular manner in which the torsion spring is connected between the driver and the terminal head the forces exerted on the driver by the torsion spring during loading of the spring in consequence to rotation of the driver to the start position are balanced and have no tilting effect upon the driver. This fact coupled with the fact that the rear end portion of the driver is guided for rotation coaxially of the actuator by the engagement of the cylindrical skirt on the front spring seat member in the mouth of the well in the terminal head assures the best possible switch operation free of binding of the actuator in its bearings.

From the foregoing description taken together with the accompanying drawings it will be readily apparent to those skilled in the art that this invention provides an improved rotary contactor assembly for ignition-start switches which assures easy and positive operation of the switch unimpaired by any binding of the parts.

What I claim as my invention is:

1. In an electric switch for controlling a plurality of circuits: a terminal head having stationary contacts thereon; a rotatable contactor cooperable with said stationary contacts and rotatable in one direction from a switch off position to defined first and second switch on

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positions; a manually rotatable actuator for the contactor, said actuator being axially spaced from the terminal head and the contactor being interposed therebetween; a driver coupling the actuator to the contactor so that the contactor rotates with the actuator, said driver extending axially between the terminal head and the actuator; spring means on the driver reacting against the contactor to hold the same yieldingly engaged with the terminal head and thereby provide contact pressure for the switch; a torsion spring mounted on the driver at its portion adjacent to the terminal head; means connecting both ends of the torsion spring to the driver so as to hold the torsion spring under initial tension and whereby the torsion spring rotates bodily with the driver from the switch off to the first switch on position of the contactor; and a connection between one end of the torsion spring and the terminal head established upon rotation of the driver to said first switch on position of the contactor and operative upon further rotation of the driver to carry the contactor to its second switch on position to load the torsion spring, thereby requiring the contactor to be held manually in said second switch on position, and whereby the contactor is returned to its first switch on position by the torsion spring upon release of the actuator.

2. In an electric switch of the character described: a terminal head having stationary contacts on one face thereof; a rotatable contactor overlying said face of the terminal head and cooperable with the stationary contacts thereon; a manually rotatable actuator for imparting rotary movement to the contactor, said actuator being axially spaced forwardly of said face of the terminal head and the contactor being interposed therebetween; a driver coupling the actuator to the contactor to provide a torque transmitting connection therebetween, said driver extending axially between the terminal head and the actuator and having end to end engagement with the latter; spring means carried by the driver and reacting rearwardly against the contactor to yieldingly hold the same engaged with said face of the terminal head so as to provide contact pressure for the switch; a shoulder on the driver facing said face of the terminal head but spaced forwardly therefrom; a spring seat member on the driver engageable with said shoulder; and a combination torsion and compression spring confined between said spring seat member and the terminal head and connected between the terminal head and the driver to be torsionally loaded by rotation of the actuator in one direction to a switch on position to yieldingly resist such rotation and to effect retrograde rotation of the contactor when the actuator is released, the expansive force of said spring being translated through the spring seat member and the shoulder on the driver into an axial force on the driver to hold the same pressed against the end of the actuator and thereby prevent rattling of the actuator and the driver.

3. The electric switch set forth in claim 2 further characterized by the provision of a splined connection between the spring seat member and the driver; and a connection between the torsion spring and said spring seat member so that the torsional force of the spring is exerted on the driver through the spring seat member.

4. The electric switch set forth in claim 3 further characterized by the provision of cooperating means on the terminal head and a portion of the driver adjacent thereto defining a journal bearing for the driver coaxial with the actuator to guide the rotary motion of the driver.

5. The electric switch set forth in claim 4 wherein said journal bearing comprises a cylindrical skirt on the spring seat member, and a bearing hole in the terminal head opening to said face thereof and in which said skirt is rotatably received to guide the rotary motion of the driver.

6. In an electric switch for controlling a plurality of circuits: a terminal head having a hole opening to its front face and having stationary contacts on said face surrounding the mouth of said hole; a rotatable contactor overlying said front face of the terminal head and cooperable with the stationary contacts thereon, said contactor being rotatable in one direction from a switch off position to defined first and second switch on positions; a manually controlled actuator constrained to rotate coaxially with the hole in the terminal head for imparting rotary movement to the contactor, said actuator being axially spaced from the front face of the terminal head and the contactor being interposed therebetween; a driver positioned between the actuator and the terminal head

and supported jointly thereby for rotation coaxially of the actuator, said driver having its rear end projecting into the hole in the terminal head; cooperating means on the front end of the driver and the actuator providing a rotation transmitting connection therebetween; a splined driving connection between the driver and the contactor, whereby the contactor rotates with the driver but is movable axially thereof; spring means on the driver reacting rearwardly against the contactor to yieldingly press the same against the front face of the terminal head and thereby provide contact pressure for the switch; a helically wound torsion spring carried by the rear end of the driver, coaxially thereof, and having its ends connected with the driver to hold the torsion spring pretensioned and whereby the spring may rotate bodily with the driver during actuator produced rotation of the contactor from the switch off to the first switch on position thereof; and means for loading the torsion spring during actuator produced rotation of the contactor from the first to the second switch on positions thereof so as to require the contactor to be manually held in said second switch on position and whereby the contactor is returned to its first switch on position upon release of the actuator, said last named means comprising an abutment on the terminal head adjacent to the bottom of the hole therein, and a part on the rear end of the torsion spring engageable with said abutment upon rotation of the contactor toward its second switch on position.

7. The electric switch set forth in claim 6 wherein said part on the end of the torsion spring comprises a substantially U-shaped spring seat member having the rear end of the torsion spring connected to its bight and having its legs projecting rearwardly toward the bottom of the hole in the terminal head for engagement with diametrically opposite abutments therein upon rotation of the driver to carry the contactor toward its second switch on position, so that such loading of the torsion spring does not impose any appreciable tilting force on the driver.

8. The electric switch set forth in claim 7 further characterized by the provision of opposite drive arms on the driver extending axially thereof and between which the bight of the U-shaped spring seat member engages to normally hold the spring pretensioned on the driver, the circumferential spacing between said arms being great enough to permit the limited degree of rotary movement of the driver relative to the U-shaped spring seat member necessary to load the spring during rotation of the driver in the direction to carry the contactor to its second switch on position.

9. A contactor assembly for an electric switch comprising: an elongated driver rotatable about its longitudinal axis; a carrier disc of insulating material splined to the rear end portion of the driver to rotate therewith but slidable lengthwise thereof; a metal contactor member secured to the rear of said carrier disc; a contact spring on the driver arranged to exert its expansive force on the front side of the carrier disc so as to yieldingly urge the same toward the rear end of the driver; means on the driver rearwardly of the carrier disc defining opposing longitudinally spaced abutments; a combination torsion and compression spring disposed between said abutments to be compressible axially therebetween; front and rear spring seat members interposed between the axial ends of the combined compression and torsion spring and said abutments on the driver; a splined connection between the front spring seat member and the driver; a rotation transmitting connection between the front spring seat member and the adjacent end of the torsion spring, said front spring seat member having portions thereof engageable by the carrier disc to block rearward motion thereof off of the driver; a connection between the driver and the rear spring seat member providing for limited rotation of the latter relative to the driver and for forward axial motion of the rear spring seat member in a direction to compress the torsion spring; and a rotation transmitting connection between the rear spring seat member and the adjacent end of the torsion spring whereby rotation of the rear spring seat member in one direction relative to the driver loads the torsion spring.

10. A contactor assembly for an electric switch, comprising: a rotatable driver having a front end wall normal to the axis of driver rotation, and having substantially diametrically opposite arms thereon extending rearwardly from said end wall lengthwise of the driver axis; a car-

rier disc of insulating material splined to said arms to rotate with the driver but slidable lengthwise thereof; a metal contactor member secured to the carrier disc at the side thereof adjacent to the rear of the driver; a contact spring on the driver reacting against the carrier disc and urging the same rearwardly; means on the arms of the driver rearwardly of the carrier disc engageable thereby to block spring propelled motion of the disc off of the rear ends of the driver arms; a torsion spring carried by the driver between the arms thereof rearwardly of the carrier disc and having its forward end drivingly connected with the driver arms; and means connecting the rear end of the torsion spring with the driver arms to hold the torsion spring under tension, said last named means being movable relative to the driver and having a portion projecting therefrom for engagement with a stationary part on a switch in which the contactor assembly is incorporated to provide means whereby the tension on the torsion spring may be increased by rotation of the contactor assembly in one direction.

11. The contactor assembly set forth in claim 10 further characterized by the provision of a detent plate slidably splined to the driver arms, said contact spring being engaged between the detent plate and the carrier disc to urge the formed forwardly of the driver and the latter rearwardly of the driver.

12. A contactor assembly for an electric switch comprising: an elongated driver rotatable about its longitudinal axis and having a front end wall fixed with respect to the driver and a rear end wall movable relative to the driver; diametrically opposite arms on the driver fixed to the front end wall thereof and extending rearwardly lengthwise of the driver axis with their rear extremities embracing the movable rear wall of the driver; inwardly bent hooks on the rear extremities of the driver arms engageable by the movable end wall to limit axial motion thereof away from said front end wall while permitting rotation of the movable end wall relative to the driver on its axis; interengaging means on said movable end wall and the driver arms for limiting rotary movement of the movable end wall relative to the driver; means on the driver arms a distance forwardly of said movable end wall providing a spring seat on the driver rotatable therewith; a compression spring confined under torsion between said spring seat and the movable end wall and having its opposite ends fixed to the spring seat and said movable end wall, the connection between the spring and the movable end wall holding the spring torsionally preloaded and enabling further torsional loading of the spring by rotation of said movable end wall in one direction relative to the driver; lug means on said movable end wall projecting from the driver to provide for rotating the movable end wall relative to the driver in the direction to additionally torsionally load the spring; a carrier disc of insulating material slidably splined to the driver arms ahead of said spring seat member so that the latter blocks rearward motion of the carrier disc off of the driver arms; a metal contact member fixed to the carrier disc at the side thereof facing the rear end of the driver; and means carried by the driver urging the carrier disc axially in one direction along the driver arms.

13. A contactor assembly for an electric switch, comprising: an elongated driver rotatable about its longitudinal axis and having a front end wall normal to the axis of driver rotation and means thereon providing for imparting rotation to the driver; substantially diametrically opposite arms fixed to said front end wall and extending rearwardly therefrom, the rear end portions of said arms being reduced to provide rearwardly facing shoulders on the arms a distance from their rear extremities and the surfaces of said shoulders lying in a common plane normal to the driver axis; a cup-like spring seat member having apertures in its bottom wall in which the reduced outer end portions of the arms are received to enable the spring seat member to slide axially along the rear end portions of the arms toward a position defined by the engagement of the bottom wall of the cup with said shoulders on the arms; hooks on the rear extremities of the arms bent radially inwardly toward one another; a helically wound combined compression and torsion spring confined axially between said hooks and the bottom wall of the spring seat member, the opposite ends of the spring being bent to extend diametrically across the driver axis; a rear spring seat member interposed between the rear end of the torsion spring and said hooks on the driver arms so that the torsion spring is held compressed be-

tween the spring seat members, said rear spring seat member being movable axially and rotationally relative to the driver and having means thereon engageable with the side edges of the driver arms adjacent to their hooked ends to limit rotary motion relative to the driver; connections between the inwardly bent ends of the torsion spring and the spring seat members whereby the rear spring seat member is rotarily biased to one limit of rotation by the spring and the spring is held in a torsionally preloaded condition and under compression to urge the front spring seat member against the shoulders on the driver arms; diametrically opposite rearwardly extending legs on the rear spring seat member for effecting relative rotation between the driver and the rear spring seat member; and contactor means slidably splined to the driver arms and biased rearwardly toward the front spring seat member said front spring seat member being engageable by the contactor means to limit rearward motion thereof relative to the driver.

14. The contactor assembly set forth in claim 13 further characterized by the fact that the apertures in the bottom wall of the cup-like spring seat member are so located with respect to the driver arms as to hold the cylindrical wall of the cup-like member coaxial with the driver, whereby said cylindrical wall of the cup-like member provides a bearing for the rear end portion of the driver.

15. The switch of claim 19, further characterized by the fact that said torsion spring is helical and has substantially straight end portions which extend substantially diametrically across its endmost coils normal to the axis of the spring; and further characterized by pairs of abutments on the driver and on the spring seat member, the abutments of each pair facing in opposite directions and being spaced equal radial distances to opposite sides of the driver axis so as to be engageable with the straight end portions of said spring, said pair of abutments on the driver thus receiving a balanced torsional reaction from the spring which will have no tilting effect upon the driver.

16. In an electric switch of the character described: a rotatable contactor cooperable with stationary contacts; a driver for rotating the contactor; a spring seat member connected with a fixed part of the switch; a helical torsion spring axially confined between the driver and the spring seat member and having straight end portions each of which extends substantially diametrically across the adjacent endmost coil of the spring normal to the spring axis; a pair of oppositely facing abutments on the spring seat member, spaced to opposite sides of the driver axis and engageable with one of said straight end portions of the spring to resist rotation of the same in one direction; and a pair of oppositely facing abutments on the driver, spaced to opposite sides of its axis and engageable with the other end portion of the spring to enable the spring to yieldingly resist rotation of the driver in said one direction and so that the forces exerted upon the driver by the spring in consequence of torsional loading of the latter are balanced and have no tilting effect upon the driver.

17. In an electric switch of the character described: a rotatable contactor cooperable with stationary contacts; a driver for rotating the contactor; a spring seat member connected with a fixed part of the switch; a helical torsion and compression spring axially confined under compression between the driver and the spring seat member and having straight end portions each of which extends substantially diametrically across the adjacent endmost coil of the spring normal to the spring axis and flatwise engaging substantially flat portions on the driver and the spring seat to react axially between them; a pair of oppositely facing abutments on the spring seat member, radially spaced equal distances to opposite sides of the driver axis and between which one of said straight end portions of the spring is received to resist rotation of the same in one direction; and a pair of oppositely facing abutments on the driver, radially spaced equal distances to opposite sides of its axis and between which the other end portions of the spring is received to enable the spring to yieldingly resist rotation of the driver in said one direction and so that the forces exerted upon the driver by the spring in consequence of torsional loading of the latter are balanced and have no tilting effect upon the driver.

18. In a switch having a movable contactor: means

for manually imparting motion in one direction to the contactor, including a rotatable driver having a driving connection with the contactor by which the contactor is constrained to move back and forth with the driver; a helical torsion spring, coaxial with the driver, for moving the contactor in the opposite direction, the end convolutions of the torsion spring terminating in substantially straight arms extending diametrically across the ends of the spring; a pair of oppositely facing abutments on the driver engaged with the arm at one end of the spring at points on opposite sides thereof and spaced substantially equal distances to opposite sides of the driver axis, by which the spring tends to rotate with the driver; and a pair of oppositely facing spring loading abutments engaged with the arm at the other end of the spring at points on opposite sides thereof and spaced substantially equal distances to opposite sides of the driver axis for holding said other end of the spring against rotation with the driver.

19. In an electric switch for controlling a plurality of circuits: fixed housing means including a terminal head having a plurality of stationary contacts thereon; a rotatable contactor cooperable with said stationary contacts; a manually rotatable actuator for imparting rotary movement to the contactor, said actuator being axially spaced from the terminal head and the contactor being interposed therebetween; a driver coupling the actuator to the contactor to provide a torque transmitting connection therebetween, said driver extending axially between the actuator and the terminal head and having end-to-end engagement with the actuator; spring means on the driver reacting against the contactor to yieldingly engage the same with the terminal head and thereby provide contact pressure for the switch; a spring seat member mounted on the driver for limited axial motion to and from engagement with a portion of the housing means by which engagement displacement of the spring seat member off of the driver and away from the actuator is precluded; cooperating means on said spring seat member and on the housing means confining the spring seat member to rotation between defined limits with respect to the housing means; cooperating means on the spring seat member and on the driver providing a lost motion connection between the spring seat member and the driver whereby the spring seat member is free for rotation between defined limits with respect to the driver; and a combination torsion and compression spring having one of its ends seated in said spring seat member and reacting axially between it and the driver to press the driver axially against the actuator, and loaded by rotation of the actuator in one direction to a switch-on position to yieldingly resist such rotation and to effect retrograde rotation of the contactor when the actuator is released.

20. In an electric switch: a housing having an annular wall; a terminal head fixed with respect to the housing near the rear thereof, with the front face of the terminal head extending across the interior of the housing substantially normal thereto, said terminal head having a hole opening to said front face and cylindrical wall surfaces in said hole providing a bearing, the axis of which is perpendicular to said front face of the terminal head; a plurality of stationary contacts on the terminal head exposed at its front face; a rotatable contactor cooperable with said stationary contacts and overlying the front face of the terminal head; a manual actuator for imparting rotary movement to the contactor; means mounting the actuator on the housing for rotation coaxially of said bearing on the terminal head and with the actuator spaced axially forwardly of the front face of the terminal head so that the contactor is interposed between the actuator and the terminal head; a driver coupling the actuator to the contactor to provide a torque transmitting connection herebetween, said driver extending between the actuator and the terminal head in radially spaced relation to the annular wall of the housing and having its front end supported by the actuator and its rear end projecting into said hole in the terminal head; spring means on the driver reacting rearwardly against the contactor to yieldingly engage the same with the terminal head and thereby provide contact pressure for the switch; means on said rear end of the driver having a cylindrical surface providing a journal supportingly engaged by said bearing on the terminal head so that the driver is guided for rotary motion at its rear end; a torsion spring carried by the driver and having arms at its terminal ends; abutments on the driver engaged by said arms

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of the torsion spring to normally hold the same partially wound up under torsion; and means fixed on the switch for reacting against one of said arms of the torsion spring during rotation of the actuator in one direction for effecting further loading of said torsion spring whereby the torsion spring effects return rotation of the actuator when the actuator is released.

21. In an electric switch: a housing having an annular wall; a terminal head fixed with respect to the housing near the rear thereof, with the front face of the terminal head extending across the interior of the housing substantially normal thereto, said terminal head having a hole opening to said front face and cylindrical wall surfaces in said hole providing a bearing, the axis of which is perpendicular to said front face of the terminal head; a plurality of stationary contacts on the terminal head exposed at its front face; a rotatable contactor cooperable with said stationary contacts and overlying the front face of the terminal head; a manual actuator for imparting rotary movement to the contactor; means mounting the actuator on the housing for rotation coaxially of said bearing on the terminal head and with the actuator spaced axially forwardly of the front face of the terminal head so that the contactor is interposed between the actuator and the terminal head; a driver coupling the actuator to the contactor to provide a torque transmitting connection therebetween, said driver extending between the actuator and the terminal head in radially spaced relation to the annular

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wall of the housing and having its front end supported by the actuator and its rear end projecting into said hole in the terminal head; spring means on the driver reacting rearwardly against the contactor to yieldingly engage the same with the terminal head and thereby provide contact pressure for the switch; means on the rear of the driver having a splined connection with the driver and having a cylindrical surface providing a journal supportingly engaged by said bearing on the terminal head so that said means guides the rear of the driver for rotary motion, said means having a radial abutment; a torsion spring having terminal arms at its ends, one of which engages said abutment; and means fixed on the switch and engaged by the other arm of the torsion spring during rotation of the actuator in one direction for effecting loading of the torsion spring whereby the torsion spring effects return rotation of the actuator when the actuator is released.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,033,252	Parker	Mar. 10, 1936
2,059,780	Edwards et al.	Nov. 3, 1936
2,062,440	Beal	Dec. 1, 1936
2,170,154	Moore	Aug. 22, 1939
2,663,780	Hept et al.	Dec. 22, 1953