Feb. 4, 1941. H. L. HARTZELL ET AL 2,230,536

CONTROLLING MECHANISM

Filed Feb. 3, 1938 2 Sheets-Sheet 1

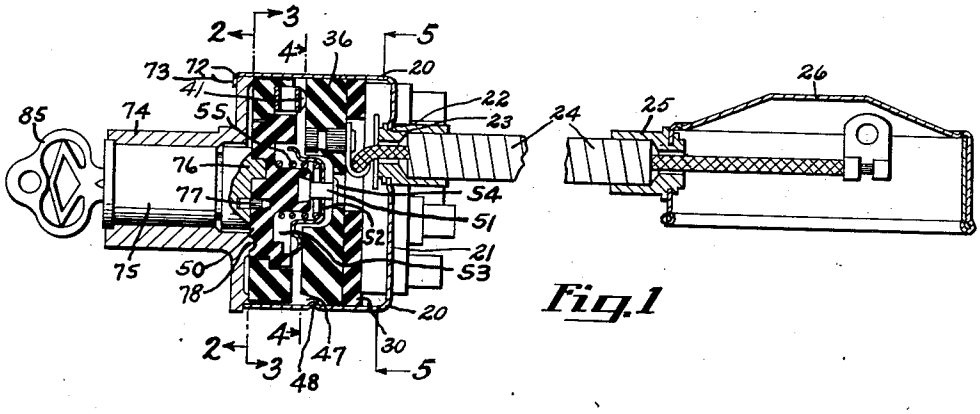
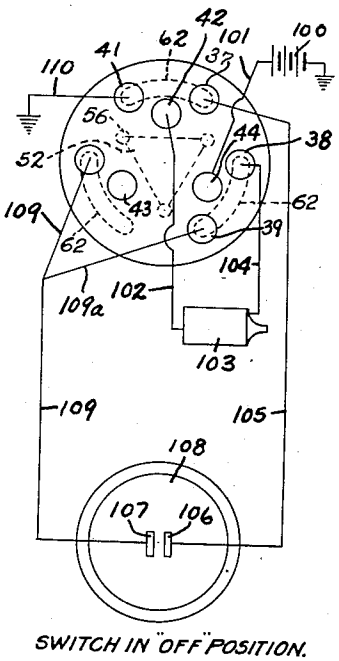
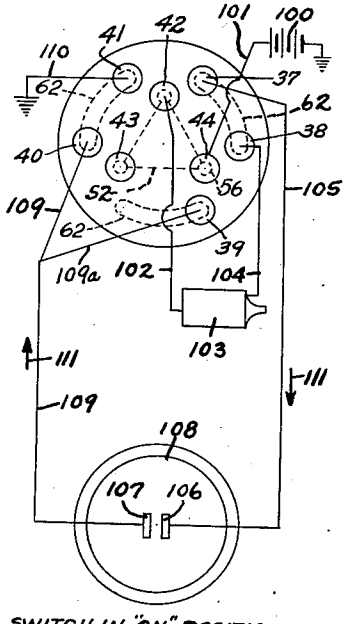


Fig. 1



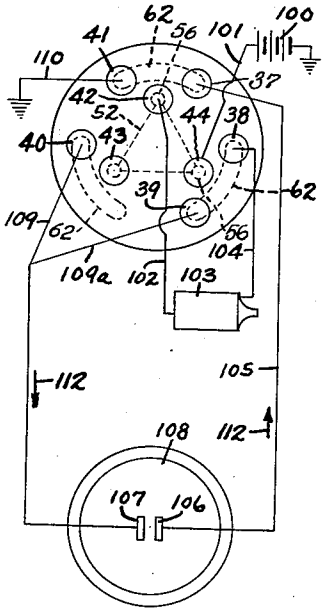
SWITCH IN "OFF" POSITION.

Fig. 8



SWITCH IN "ON" POSITION WITH CURRENT PASSING THRU DIST. POINTS IN THIS DIRECTION.

Fig. 9



SWITCH IN "ON" POSITION WITH CIRCUIT THRU DIST. POINTS REVERSED.

Fig. 10

INVENTORS
Herman L. Hartzell.
Leslie O. Parker.

By Spencer, Hardman & Fehr
their ATTORNEYS

Feb. 4, 1941. H. L. HARTZELL ET AL 2,230,536

CONTROLLING MECHANISM

Filed Feb. 3, 1938 2 Sheets-Sheet 2

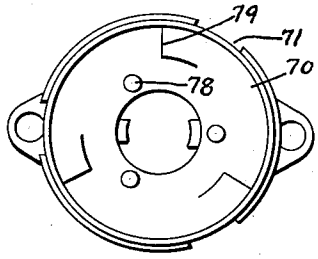


Fig. 2

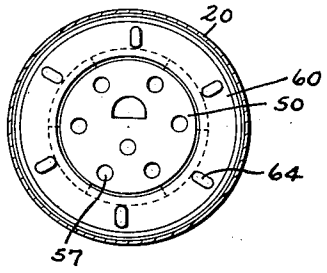


Fig. 3

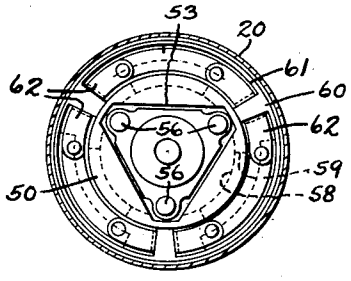


Fig. 4

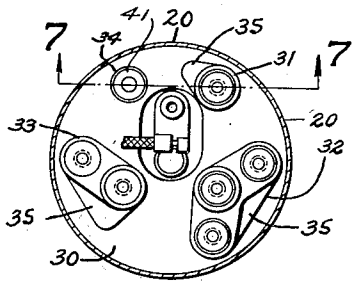


Fig. 5

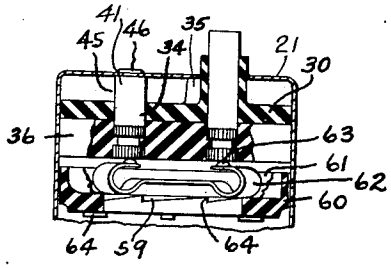


Fig. 7

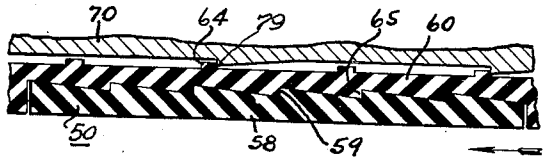


Fig. 6

INVENTORS
Herman L. Hartzell.
Leslie O. Parker.

By Spencer, Hardman & Fehr
their ATTORNEYS

Patented Feb. 4, 1941 2,230,536

UNITED STATES PATENT OFFICE

2,230,536

CONTROLLING MECHANISM

Herman L. Hartzell and Leslie O. Parker, Anderson, Ind., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application February 3, 1938, Serial No. 188,440

11 Claims. (Cl. 200—14)

This invention relates to controlling mechanisms for electric circuits, a mechanism being more particularly adapted for use in the ignition circuit for motor vehicles employing internal combustion engines.

An object of the present invention is to provide a switch for controlling an electrical circuit, such as an ignition circuit of an internal combustion engine and so constructed that the direction of flow of current will be changed through the circuit breaker mechanism of an ignition timer each time the switch mechanism is actuated from an "off" position to an "on" position.

Another object of the invention is to provide a polarity reversing switch which is compact in construction, and to provide for operating such a switch by successive manual movements.

Another object of the invention is to provide an inexpensive housing having essential locking features for holding the switch elements in either of alternate positions of adjustment.

Another object of the invention is to supply an improved contact carrier having means for receiving a contact bridging member and preventing accidental removal of the contact bridging member.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a sectional view of the switch mechanism embodying the present invention.

Fig. 2 is a bottom plan of a cover of the switch and looking in the direction of line 2—2 of Fig. 1.

Figs. 3, 4 and 5 are sectional views taken on the lines 3—3, 4—4, and 5—5 respectively of Fig. 1.

Fig. 6 is a development of a sectional view of the ratchet mechanism of the switch, the elements being projected upon a single plane to illustrate the relation of the cooperating parts.

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 5.

Figs. 8, 9 and 10 are wiring diagrams showing the "off" position and two "on" positions of the switch.

With particular reference to the drawings, a switch case member and wire armor sub-assembly comprise a cup-shaped casing 20 having a bottom wall 21 provided with a plurality of openings. A portion of the wall 21 is slightly depressed, as at 22 to form a flat portion which is provided with a circular opening within which a reduced portion of a bushing 23 is received. The reduced portion is upset over the inner surface of the wall 21 as clearly shown in Fig. 1 to secure rigidly the latter and the bushing to each other. A length of flexible cable armor of hard steel is secured to the bushing 23 and to a bushing 25 which is attached to a cup-shaped cover 26 for a terminal housing which is provided at one end of a housing of an ignition coil, shown diagrammatically in Figs. 8, 9 and 10.

Disposed within the casing 20 is an insulating spacer 30 having a plurality of apertured bosses or projections 31, 32 and 33 on one side thereof and an opening 34. The bosses are irregular in contours and are reduced to form shoulders 35, see Fig. 5, adapted to be engaged by the inner surface of the bottom wall 21 of the casing 20. The reduced sections of the bosses pass through corresponding openings in the bottom wall 21 of casing 20 and prevent the spacer from turning relative to the casing.

A sub-assembly of conductor and stationary contact support comprises a non-conducting block 36 of molded insulating material in which are embedded plurality of stationary terminals 37, 38, 39, 40, 41, 42, 43 and 44. These terminals are so arranged that they form two circular rows, the terminals 37, 38, 39, 40 and 41 form an outer row of terminals while terminals 42, 43 and 44 form an inner row of terminals. All of the terminals are of such size and length that they pass through and beyond their respective apertured boss of the spacer 30 with the exception of terminal 41. Terminal 41 in this instance is shorter in length than the other terminals but is long enough to extend thru the aperture 34 provided in the spacer plate 30 and an aperture in the bottom wall 21 of the casing 21. As shown in Fig. 7, the end of the terminal 41 is provided with a reduced portion which extends through the aperture in the bottom wall 21 of the casing and spun over as at 46 to provide for a ground connection.

The other ends of all terminals are flush with the plane surface of the non-conducting block or terminal support 36. The support 36 is provided with a plurality of notches 47 on its periphery one of which is shown in Fig. 1. After the spacer 30 and the terminal block 36 have been assembled in the casing 20 the material of the case is deformed to form lugs or detents 48. These lugs extend into the notches 47 and rest on the bottoms of the notches in order to hold the

spacer and block firmly in the bottom of the casing 21 and prevent the block 36 and spacer 30 from moving axially within the case.

A driving movable contact and contact carrier sub-assembly comprising a nonconducting driving disc 50 carrying on one side thereof and at its center a metallic insert 51 upon which a contact plate 52 is slidably mounted and is retained by the riveted-over head 54 on the insert. The contact plate is received by a recess 53 of such shape as to permit axial movement of the contact plate 52 but to prevent rotary movement of the plate 52 relative to the driving disc 50. A spring 55 located between the disc 50 and the plate 52 urges the plate towards the contact support 36. The plate is provided with three contact surfaces or bosses 56 adapted to engage the stationary contacts 42, 43, and 44 which form the inner row of terminal contacts. The other side of the disc 50 has six spaced recesses 57 to be described. One of the recesses 57 is shown in Fig. 1. The disc 50 is also provided with a peripheral flange 58. One side of the flange is formed to provide a succession of ratchet teeth 59 shown by dotted lines in Fig. 4.

A driven movable contact and contact carrier sub-assembly comprises a non-conducting ring 60 provided on one side thereof with a plurality of circumferentially spaced recesses 61 for the reception of yieldable contacts 62. Referring to Fig. 7 the contacts 62 are preferably formed from arcuate ffat stock with the ends thereof bent toward each other to form yieldable U-shaped formations. These ends are provided with contact engaging surfaces 63 and are spaced so that they will bridge a pair of adjacent terminals of the outer row which include the terminals 37 to 41 inclusive. One side of the ring member 60 is provided with a series of equally spaced lugs or teeth 64 to be described. The ring member 60 is provided with an inwardly extending flange having a series of ratchet teeth 65 forming one way ratchet engagement with the similarly fashioned teeth 59 of the driving disc 50.

The driving movable contact and contact carrier sub-assembly and the driven movable contact and contact carrier sub-assembly are mounted in the casing 20 so that the contact surfaces 56 of plate 52 and the contact surfaces 63 of the contact members 62 will bear against the plane surface of support 36. These sub-assemblies are held within the casing by a switch casing closure and lock sub-assembly which comprises a switch casing member or plate 70 having notches 71 see Fig. 2, adapted to receive tangs 72 provided by the case 20, said tangs 72 being bent over as shown at 73 in Fig. 1 in order to retain the plate upon the casing 20.

By reason of this construction it is possible to secure satisfactory contact pressure between the movable contact 52 and the inner row of stationary contacts by the spring 55. Satisfactory contact pressure is had between the yieldable contact members 62 and the outer row of stationary contacts 37, 38, 39, 40 and 41.

The plate 70 is permanently attached to the lock-barrel 74 within which a key operating cylinder 75 is located. The cylinder 75 carries a lug 76 adapted to be received in a recess provided in a driving disc 50. A pin 77 embedded in the disc 50 extends into a recess provided in the cylinder 75. Thus a driving connection is provided between the cylinder 75 and the block 50.

In the illustrated form of the invention the underside of the plate 70 has three equally spaced bosses 78 cooperating with the six spaced recesses 57 in the disc 50 to hold yieldingly the driving disc in the "off" or "on" position of the switch. It will be noted, see Fig. 3 that the recesses 57 are not equally spaced on the driving disc 50 as it is preferably to provide for an over travel in the "off" position of the switch in order to insure proper engagement between the ratchet teeth on the disc 50 and the ring 60 when the disc 50 is actuated to move the ring 60. The plate 70 is also provided with three pawls 79 which are integral with plate 70 and which extend away from the plane of the plate. These pawls 79 cooperate with the teeth 64 to prevent the ring 60 from moving in a counterclockwise direction as viewed in Fig. 4.

The switch structure shown in Figs. 1 to 7 inclusive is particularly useful in an ignition circuit of an internal combustion engine, and so constructed that the direction of flow of current will be changed by the successive operation of the switch so as to prevent excessive pitting of the contact points at which the circuit may be broken temporarily, as at the make and break of the ignition coil, will be neutralized by having the current to flow in one direction and then having the current to flow in another direction upon successive operations of the switch.

Referring to Figs. 8, 9 and 10, the switch is shown, in which its parts are shown diagrammatically, for controlling the ignition circuit of an internal combustion engine. In these figures 100 represents a battery or other source of electrical energy from which current will flow in one direction from one of its terminals to a lead 101 which is electrically connected in this instance to the stationary contact 44 of the inner row of contacts carried by the support 36. Fig. 8 shows the normal or "off" position of the ignition circuit with the contact surfaces 56 out of engagement with the terminals 42, 43, 44. When it is desired to actuate the switch to close the ignition circuit the operator will actuate the key 85 in a clockwise direction to rotate both the disc 50 and the ring 60, the disc 50 driving the ring 60 through the ratchet provisions provided by the disc and ring. This movement causes the movable contact member 52 through the surface 56 to bridge the terminals 42, 43, and 44 to complete a circuit from the battery 100. The circuit completed will be from the battery 100, lead 101, terminal 44, contact 52, terminal 42, lead 102, coil 103, lead 104, terminal 38, contact member 62, terminal 37, lead 105, contacts 106 and 107, of a circuit breaker 108, lead 109, terminal 40, a second contact 62, terminal 41 to ground thru lead 110.

It will be noted that in this instance the current flow is in the direction indicated by the arrows 111 shown in Fig. 9. The current will flow in this particular direction so long as the switch is maintained in this position.

When the operator desires to open the ignition circuit shown in Fig. 9 the key 85 is actuated in a counter-clockwise direction but moving only the disc 50 in the same direction. The ring 60 is held stationary by reason of the pawls 79 engaging the projections 64 to prevent same from moving in the reverse direction. On a succeeding operation of the key 85 to complete the ignition circuit both the driving disc 50 and the contact ring 60 will be rotated in a

clockwise direction substantially 60 degrees. When this happens a new series of outer row of stationary contacts will be bridged to reverse the flow of current from the terminal **38** to the timer contacts **106** and **107**. In this instance the current flow from the battery will be in the direction as indicated by the arrows **112** shown in Fig. 10. The circuit completed is as follows: from battery **100**, lead **101**, terminal **44**, contact **52**, terminal **42**, lead **102**, coil **103**, lead **104**, terminal **38**, contact **62**, terminal **39**, lead **109***a*, contacts **107**, **106**, lead **105**, terminal **37**, a second contact **62**, terminal **41**, to ground through lead **110**. As soon as the operator desires to open the circuit completed in Fig. 10 the key **85** is moved in a counterclockwise direction. When the operator actuates the key again the circuit completed will be that shown in Fig. 9.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A switch comprising in combination; a tubular housing; a non-conducting terminal block supported within the housing and carrying a plurality of terminals arranged in inner and outer circular rows; a non-conducting ring member adapted for rotation within the housing and carrying spaced yieldable contacts adapted to bridge pairs of outer terminals and having ratchet provisions; a driving member supported within the ring member and having ratchet provisions co-operating with the ratchet provisions of the ring to impart step-by-step movement in one direction only to the ring member; a yieldable contact carried by the drive member for engagement with the inner row of terminals; manual operating means for rotating the driving member in one direction to rotate the ring in the same direction; and means for preventing a reverse movement of the ring member when the manual means is actuated to move the drive member in the reverse direction.

2. A switch comprising in combination; a tubular housing; a non-conducting terminal block supported within the housing and carrying a plurality of terminals arranged in inner and outer circular rows; a non-conducting ring member adapted for rotation within the housing and carrying spaced yieldable contacts adapted to bridge pairs of outer terminals and having ratchet provisions; an oscillatable driving member proided with ratchet provision cooperating with the ratchet provisions of the ring to rotate the ring member in one direction only; a yieldable contact carried by the oscillatable member for engagement with the inner row of terminals; manual operating means for rotating the driving member in one direction to turn the ring member; and ratchet means provided by the housing and the ring member to prevent a reverse movement of the ring member upon reverse movement of the driving member by the manual operating means.

3. An electric switch comprising in combination; a tubular housing; a non-conducting terminal block supported in a non-rotatable relation within the housing, said block carrying a plurality of terminals extending through the block and outside the housing, said terminals being arranged in concentric rows; a non-conducting ring member adapted for rotation within the housing having ratchet provisions; spaced yieldable contact members carried by the ring member adapted to bridge pairs of terminals of the outer row of terminals; a movable member having ratchet provisions cooperating with the ratchet provisions of the ring member; a yieldable contact member carried by the movable member for engagement with the inner row of terminals; means for actuating the movable member for imparting to said ring member a step-by-step rotary motion in one direction only through the ratchet provisions; and means for preventing a movement of the ring member in the reverse direction upon reverse movement of the movable member.

4. An electric switch comprising in combination; a tubular housing; a non-conducting terminal block supported in a non-rotatable relation with respect to the housing, said block carrying a plurality of terminals arranged in concentric rows; a non-conducting ring carrying spaced contacts for engagements with the outer row of terminals; a non-conducting disc carrying a yieldable contact for engagement with the inner row of terminals; ratchet provisions between the disc and ring; means for actuating the disc to impart movement to the ring in one direction only through the ratchet provisions therebetween and ratchet provisions between the housing and the ring to prevent reverse movements of the ring.

5. An electric switch comprising in combination; a housing; a non-conducting terminal block supported by the housing, said block carrying a plurality of terminals, said terminals being arranged in concentric rows; a non-conducting ring member carrying spaced yieldable contacts for engagement with the outer row of terminals; a non-conducting disc carrying a yieldable contact for engagement with the inner row of terminals; ratchet means between the ring and disc; ratchet means between the ring and housing; and means for actuating the disc in one direction to impart movement to the ring in one direction only through the first mentioned ratchet means, the second mentioned ratchet means operating to prevent return movement of the ring upon actuation of the manual means to move the disc in the opposite direction.

6. A switch comprising in combination; a plurality of stationary terminals arranged in two concentric rows; a pair of bridging members adapted to engage the terminals and arranged in concentric relation with respect to the terminal rows; ratchet means associated with each bridging member; and means for actuating one of the bridging members in one direction of rotation to impart movement to the second bridging member in the same direction only through one of the ratchet means, the other ratchet means operating to prevent reverse movement of the second mentioned bridging member upon reverse movement of the actuating means to move the first mentioned bridging member in the reverse direction.

7. A switch comprising in combination; a housing; stationary terminals arranged in concentric rows supported within the housing; a pair of concentric members rotatably supported within the housing, said members having a contact adapted to bridge the stationary terminal in the respective rows of terminals; and means associated with the concentric members to cause both members to move in one direction; means associated with one of the movable members and the housing to prevent movement of said member

in the opposite direction when the other member is moved in the opposite direction; and manually operated means for moving one of said members in both directions.

8. A switch comprising in combination; a housing; a non-conducting block supported within the housing and carrying a plurality of stationary terminals arranged in concentric rows; an outer rotatable member carrying a contact adapted to bridge pairs of terminals of the outer row; an inner rotatable member carrying a contact to bridge the terminals of the inner row; a pair of ratchet elements for controlling the rotative movements of the members, said elements being arranged so that both rotatable members may move simultaneously in one direction and only one rotatable member can move in the opposite direction; and manually operated means rotatably supported by the housing for actuating one of the rotatable members in both directions of rotation.

9. An electric switch comprising in combination; a non-conducting block carrying a plurality of stationary terminals arranged in concentric rows; an outer rotatable member carrying contacts for engagements with the outer row of stationary terminals; an inner rotatable member carrying a contact for engagement with the inner row of terminals; ratchet means between the rotatable members; ratchet means between the outer rotatable member and a stationary part; and means for actuating the inner rotatable member in one direction to impart movement to the outer rotatable member in one direction only through the first mentioned ratchet means, the second mentioned ratchet means operating to prevent reverse movement of the outer rotatable member upon reverse movement of the inner rotatable member by the actuating means.

10. An electric switch comprising in combination; a plurality of stationary contact terminals arranged in a pair of concentric rows; an outer movable member rotatably supported with respect to the outer row of terminals; a contact carried by the movable member adapted to bridge pairs of terminals of the outer row; an inner movable member rotatably supported with respect to the inner row of terminals; a contact carried by the second movable member to bridge the terminals of the inner row; ratchet provisions provided by the movable members and cooperating to allow the inner member drive the outer member only in one direction; ratchet provisions provided by the outer member and a stationary part cooperating to prevent reverse movement of the outer member upon reverse movement of the inner member; and means for actuating the inner movable member in either direction of rotation.

11. An electric switch comprising in combination; a terminal block carrying a plurality of terminals arranged in concentric rows; a pair of rotatable members arranged in concentric relation with respect to the rows of terminals, with the outer member having a contact adapted to engage the outer row of terminals progressively and the inner member having a contact adapted to engage the inner row of terminals simultaneously; ratchet means between the rotatable members; means for actuating the inner rotatable member to impart step-by-step movement in one direction only to the outer rotatable member through the ratchet means; and means to prevent return movement of the outer rotatable member upon movement of the inner rotatable member in the opposite direction by the actuating means.

LESLIE O. PARKER.
HERMAN L. HARTZELL.