

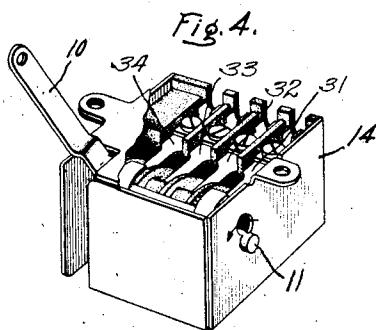
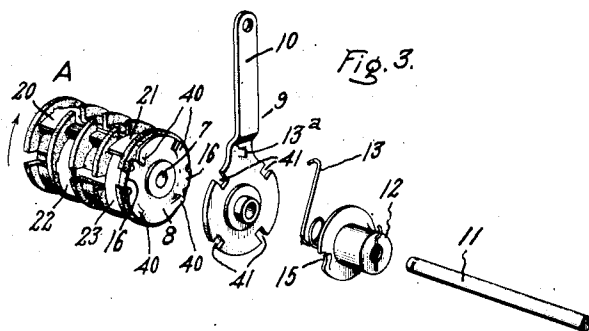
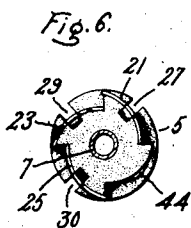
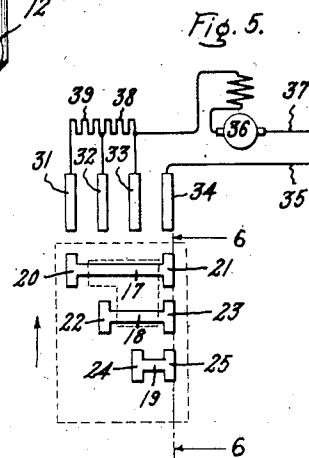
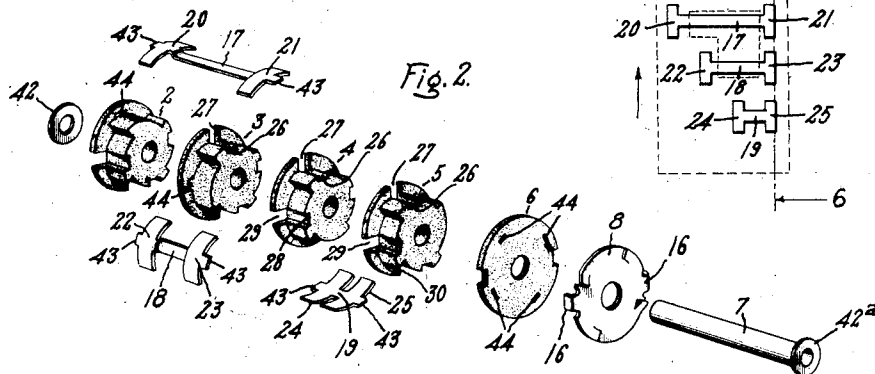
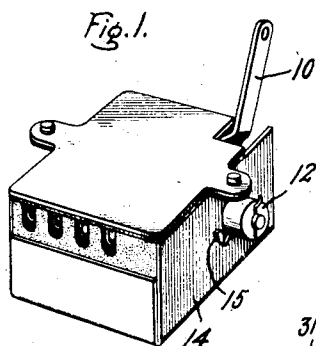
June 25, 1929.

H. F. MORSE

1,718,478

ELECTRIC SWITCH

Filed May 24, 1927



Inventor:
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UNITED STATES PATENT OFFICE.

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ELECTRIC SWITCH.

Application filed May 24, 1927. Serial No. 193,764.

My invention relates to switches for electric circuits. More particularly the invention relates to switches adapted for use in connection with electric motors and the like and in particular for use in connection with three-speed motors.

It is an object of the invention to provide a switch with rows of contacts on a rotatable element and a ratchet device for advancing the element one step at a time; to provide a device of the foregoing character in which a series of brushes are used in connection with the rotatable element, one of the brushes arranged to engage all of the contacts in a row and each of the other brushes arranged to engage one contact in each row; to provide a device in which a lever is mounted to oscillate about the axis of the rotatable element; to provide ratchet means associated with said lever whereby the rotatable device may be advanced one step at a time upon each oscillation of the lever; to provide contacts for the drum in the form of links with T heads; the said heads forming the contacts of the drum, the links between the heads being embedded in recesses in the drum whereby the brushes may pass over the links without establishing contact therewith; and to provide other features in the form of improvements for increasing the efficiency and serviceability of the device above referred to.

The invention will be readily understood from the following specification and drawing, in which drawing Fig. 1 shows the switch of the invention in perspective; Fig. 2 shows the details of the rotatable device and its contacts in a so-called "exploded" form; Fig. 3 shows the drum sections assembled with their contacts in position and shows the shaft, the ratchet and the spring restoring mechanism associated with the drum; Fig. 4 shows the device of the invention in perspective and with a portion of the cap broken away showing the position of the brushes in the device; Fig. 5 shows a diagrammatic layout of the brushes, contacts and circuits leading to a motor under the control of the switch; Fig. 6 is a section through the drum corresponding to a plane through the line 6-6, Fig. 5.

Referring more in detail to the drawing, it will be seen that the drum is made up of a number of sections 2, 3, 4, 5 and 6, of insulating material. In Fig. 3 these sections or

elements are shown assembled upon a tube 7. The cylinder is provided with a head piece 8 which forms a portion of the ratchet mechanism. The other portion of the ratchet mechanism consists of the element 9 provided with the arm 10. In Fig. 3 there is shown a shaft 11 and the remaining elements in Fig. 3 are assembled upon this shaft. The elements shown in Fig. 3 are mounted on the shaft 11 in the order in which they are shown in this figure. First in order will appear the bushing 12, then the element 9, and then the cylinder A. The order of these elements in their assembled form within the device can be readily perceived from an inspection of Figs. 1 and 2. When the elements are assembled upon the shaft 11, the end of the retractile spring 13 is caught in a spur 13^a at the base of the lever 10. It will be understood that the shaft 11 and the bushing 12 are fixed with respect to the casing 14 of the device. The bushing 12, it will be seen, is provided with the prongs 15, 180° apart, which prongs engage suitable openings in the casing 14 of the device as indicated in Fig. 1. It will also be seen that the prongs 16 on the ratchet element 8 engage the corresponding recesses in the element 6 of the cylinder. The contact links 17, 18 and 19 which are mounted on the cylinder are provided each with T heads 20 and 21, 22 and 23, 24 and 25. The link 17 when in position in the cylinder lies in the recesses 26 and extends through the slots 27 in the elements 3, 4 and 5 of the cylinder. Similarly, the link 18 lies in the recess 28 of the element 4 of the cylinder and passes through the slots 29 in the elements 4 and 5. Likewise, the link joining the contact heads 24 and 25 passes through the slot 30 in the element 5 of the cylinder. The positions of the links 17 and 18 are clearly indicated in Fig. 3. When the links are in place the contacts or heads of the links rest upon the shoulders of the elements 2, 3, 4 and 5, as indicated in the figures and the contact elements 21, 23 and 25 rest upon the element 5 as indicated in Fig. 6. Referring to the diagrammatic switch in Fig. 5, the brushes 31, 32 and 33 are illustrated in alignment respectively with the contacts 20, 22, 24, while the brush 34 is illustrated in alignment with the contacts 21, 23, 25. The direction of rotation of the cylinder A is indicated by the arrow in Fig. 3. This direction of move-

ment is also indicated in Fig. 5 by an arrow. It will be seen that the brush 34 is connected with the conductor 35 which leads to a suitable source of potential, while the motor 36 is connected with the conductor 37, which also leads to the same source of potential, while the brush 33 is connected with the other side of the motor direct. On the other hand, the brush 32 is connected with the same side of the motor through a resistance element 38, while the brush 31 is connected with the same side of the motor through the resistance elements 39 and 38 in series. It will be seen, therefore, that when the link 19 is under the brushes 33 and 34 the speed of the motor will be maximum, while when the link 18 is under the brushes the circuit will extend through the brushes 34 and 32 and the speed of the motor will be an intermediate speed. Finally, when the link 17 is under the brushes the circuit of the motor is closed through the brushes 31 and 34 with the result that the motor operates at minimum speed. In Fig. 5 I have indicated a dotted section over the link 17 in alignment with the terminal 22. Similarly, I have indicated a dotted section over the link 18 in alignment with the contact 19. This dotted section is intended to indicate that the brushes do not make contact with the link portions 17, 18 and 19 of the cylinder, but only with the terminal portions 20, 22, 24, and 21, 23 and 25.

It will be seen, therefore, that with a device such as described by operating the lever 10 about the shaft 11 the ratchet device comprising the elements 8 and 9 is brought into operation. Normally the teeth 40 on the element 8 engage with the slots 41 on the element 9 and each time that the lever 10 is pressed forward in the direction indicated by the arrow in Fig. 3 the cylinder A is advanced one step and the tension is increased in the spring 13. Upon the lever 10 being released it is restored to its normal position by said spring. If it is assumed that before the lever 10 is pressed forward the brushes 31 and 34 are in engagement with the contacts of the link 17, then when the cylinder is rotated the circuit is broken through the resistance element 39 and a new circuit established through the brushes 32 and 34 by way of the link 18. Upon again operating the lever 10 the cylinder is advanced another step, thereby breaking the circuit through the link 18 and establishing a circuit through the link 19. Upon the next operation of the lever the circuit through the motor 36 is broken. Upon operating the lever 10 once more connection is again closed through the motor 36 by way of the link 17. This cycle of operation may be repeated any number of times.

It will be seen that the links 17, 18 and 19 are provided with projections 43. It will

also be seen that the elements 2, 3, 4, 5 and 6 are provided with recesses 44 which receive the projections 43 for anchoring the links and contacts in position. In order to hold all of the elements of the cylinder together, the washer 42 is slid over the end of the tube, after which the end is peened to form a head or rivet similar to the head 42^a. The elements of the cylinder therefore are held securely in position on the cylinder between the heads 42 and 42^a.

It will be seen, therefore, that applicant has devised an improved electric circuit switch having a cylinder A of insulating material mounted to rotate about its longitudinal axis, which extends through the center of the shaft 11. The cylinder A is formed by assembling the various sections 2, 3, 4, 5, each of which is provided with a set of detents, some of which are transversely cut by slots, such as the slots 27, 29 and 30. It will be seen that the slots in certain sections of the cylinder constitute depressions between detents on enclosing segments of the cylinder, for example, the slot 26 constitutes a depression extending to the right of segment 2 of the cylinder Fig. 2. The detents in each segment are, of course, located in alignment in transverse order of the cylinder. Likewise, the depressions in each segment of the cylinder are located in alignment in transverse order of the cylinder. The commutator segments are connected by link sections such as the link sections 17, 18 and 19. Furthermore, the segments 20 and 21 are disposed transverse the longitudinal axis of the U formation of the metal element. The U formation of the metal elements is distinctly shown in Fig. 2. In the assembled device as shown in Fig. 4 the brushes 31, 32, 33, 34, are shown mounted transverse the cylinder and rest in free engagement with the cylinder so that the cylinder may be readily rotated under the brushes in the direction of the arrow. With the arrangement described, for example, the brushes 31 and 34, when the cylinder reaches a given position, snap simultaneously from detents on the cylinder into engagement with the commutator segments 20 and 21, that is, the brush 31 will snap from the toe of one of the teeth of the segment 2 on to the heel of the next tooth and on top of the segment 20, while the brush 34 will snap from the toe of the detent in section 5 of the cylinder on to the heel of the next succeeding tooth and into engagement with the segment 21. Therefore, as the cylinder rotates the brushes will snap from the toe of one set of detents to the heel of the next set of detents thereby breaking contact simultaneously with one of the segment elements and making contact simultaneously with another segment element. It will be seen that the commutator segments

in each U shaped element are disposed transverse the longitudinal axis of the U formation. It will be seen that the cylinder consists of as many segments as there are brushes and that each segment is formed of a drum element with detents arranged in consecutive order around the drum and that the drum is provided with a head flange, which head flange is transversely slotted in order to provide depressions in the cylinder for receiving the link portions of the metal elements, the ends of which form the commutator segments. It will be understood that the cylinder can only be rotated in one direction indicated by the arrow Fig. 4 inasmuch as the detents in combination with the brushes operate to prevent the cylinder from rotating in a direction counter to that indicated by the arrow in Figs. 3 and 4. In the construction shown it will be seen that the teeth are all in phase. This is indicated, for example, in Fig. 2, that is, the teeth are in alignment in a direction transverse the flanges of the drum sections which form the body element or cylinder. This arrangement enables the brushes to all snap simultaneously from the toes of one set of teeth to the heels of another set of teeth. However, the slots or depressions for receiving the link sections of the metal elements are not in phase.

While I have disclosed my invention in connection with specific apparatus and circuits, I do not wish to be so limited inasmuch as in view of the disclosure variations may obviously be produced without departing from the spirit of the invention or the scope of the claims contained herein.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An electric switch having a body element of insulating material mounted to rotate about its longitudinal axis, a series of detents formed lengthwise said body element, a metal element having a pair of terminals and a metal link connecting the latter, one such metal element being mounted on each of said detents with the link thereof extending lengthwise the detent, a plurality of brushes, one individual to one terminal on each detent and one common to one terminal on each detent, the terminals common to the common brush being located in alignment with each other and with their brush along a plane transverse the said body element and each individual brush being mounted in alignment with its contact along a similar plane, one of said planes being interposed between two others, said brushes being so mounted with respect to their contacts and with respect to the detents that one end of each brush snaps from detent to detent as the said body rotates, the said interposed plane extending transverse one of

said links on one of said detents, a depression in the latter detent between the terminals thereon, the link joining said terminals being located in said depression whereby when the switch rotates, the brush along the interposed plane will not make contact with the link in said depression.

2. An electric switch having a body element of insulating material mounted to rotate about its longitudinal axis, a series of detents formed lengthwise said body element, a metal element having a pair of terminals and a metal link connecting the latter, one such metal element being mounted on each of said detents with the link thereof extending lengthwise the detent, a plurality of brushes, one individual to one terminal on each detent and one common to one terminal on each detent, the terminals common to the common brush being located in alignment with each other and with their brush along a plane transverse the said body element and each individual brush being mounted in alignment with its contact along a similar plane, one of said planes being interposed between two others, said brushes being so mounted with respect to their contacts and with respect to the detents that one end of each brush snaps from detent to detent as the said body rotates, the said interposed plane extending transverse one of said links on one of said detents, a depression in the latter detent between the terminals thereon, the link joining said terminals being located in said depression whereby when the switch rotates, the brush along the interposed plane will not make contact with the link in said depression, said contacts and brushes being so related that when the said body element is rotated contact is made and broken simultaneously between a pair of said brushes and one of said metal elements.

3. An electric switch having a body element of insulating material mounted to rotate about its longitudinal axis, a series of detents formed lengthwise said body element, a metal element having a pair of terminals and a metal link connecting the latter, one such metal element being mounted on each of said detents with the link thereof extending lengthwise the detent, a plurality of brushes, one individual to one terminal on each detent and one common to one terminal on each detent, the terminals common to the common brush being located in alignment with each other and with their brush along a plane transverse the said body element and each individual brush being mounted in alignment with its contact along a similar plane, one of said planes being interposed between two others, said brushes being so mounted with respect to their contacts and with respect to the detents that one end of each brush snaps from detent to detent as

the said body rotates, the said interposed plane extending transverse one of said links on one of said detents, a depression in the latter detent between the terminals thereon, the link joining said terminals being located in said depression whereby when the switch rotates, the brush along the interposed plane will not make contact with the link in said depression, said body element being formed of a series of sections, each section bounded by two parallel planes transverse the axis of the body element, and means for securing said sections together along the axis of the said body element.

4. An electric switch having a body element of insulating material mounted to rotate about its longitudinal axis, a series of detents formed lengthwise said body element, a metal element having a pair of terminals and a metal link connecting the latter, one such metal element being mounted on each of said detents with the link thereof extending lengthwise the detent, a plurality of brushes, one individual to one terminal on each detent and one common to one terminal on each detent, the terminals common to the common brush being located in alignment with each other and with their brush along a plane transverse the said body element and each individual brush being mounted in alignment with its contact along a similar plane, one of said planes being interposed between two others, said brushes being so mounted with respect to their contacts and with respect to the detents that one end of each brush snaps from detent to detent as the said body rotates, the said interposed plane extending transverse one of said links on one of said detents, a depression in the latter detent between the terminals thereon, the link joining said terminals being located in said depression whereby when the switch rotates, the brush along the interposed plane will not make contact with the link in said depression, said body element being formed of a series of sections, each section bounded by two parallel planes transverse the axis of the body element, and means for securing said sections together along the axis of the said body element, one brush being provided for each section, each section having a flange head extending beyond the detents, one of the heads being located along one of said planes transverse said depression, said head being provided with a slot in alignment with said depression to permit said link corresponding to said depression being imbedded therein.

5. An electric switch having a body element of insulating material mounted to rotate about its longitudinal axis, a series of detents formed lengthwise said body ele-

ment, a metal element having a pair of terminals and a metal link connecting the latter, one such metal element being mounted on each of said detents with the link thereof extending lengthwise the detent, a plurality of brushes, one individual to one terminal on each detent and one common to one terminal on each detent, the terminals common to the common brush being located in alignment with each other and with their brush along a plane transverse the said body element and each individual brush being mounted in alignment with its contact along a similar plane, said planes being displaced with respect to each other, the planes through the individual brushes being all located to one side of the plane through the common brush, said brushes being mounted in operative relation with respect to their corresponding contacts whereby the contacts are engaged by their corresponding brushes as the body element is rotated, certain of said links extending transverse certain of said planes, the links thus crossed by such planes being deflected out of the path of the brushes corresponding to such plane.

6. An electric switch having a body element of insulating material mounted to rotate about its longitudinal axis, a series of detents formed lengthwise said body element, a metal element having a pair of terminals and a metal link connecting the latter, one such metal element being mounted on each of said detents with the link thereof extending lengthwise the detent, a plurality of brushes, one individual to one terminal on each detent and one common to one terminal on each detent, the terminals common to the common brush being located in alignment with each other and with their brush along a plane transverse the said body element and each individual brush being mounted in alignment with its contact along a similar plane, said planes being displaced with respect to each other, the planes through the individual brushes being all located to one side of the plane through the common brush, said brushes being mounted in operative relation with respect to their corresponding contacts whereby the contacts are engaged by their corresponding brushes as the body element is rotated, certain of said links extending transverse certain of said planes, the links thus intercepted by said planes being imbedded in depressions in said body element whereby the brushes corresponding to the intercepting planes are prevented from making contact with such links.

In witness whereof, I have hereunto set my hand this twentieth day of May, 1927.

HAROLD F. MORSE.