

May 16, 1939.

R. POPP

2,158,678

SWITCH

Filed Jan. 21, 1937

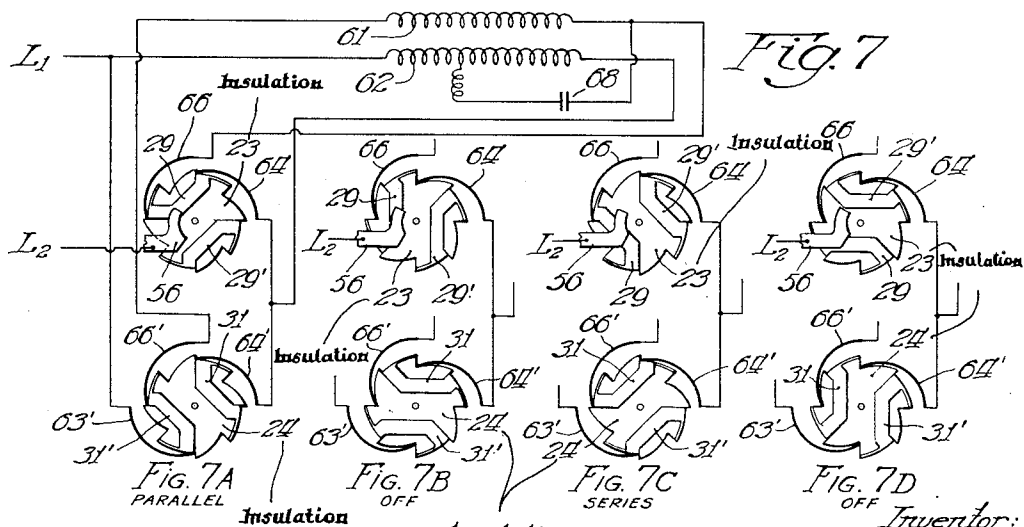
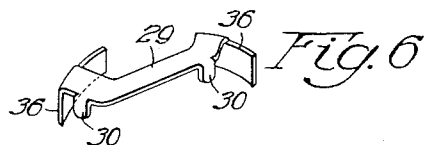
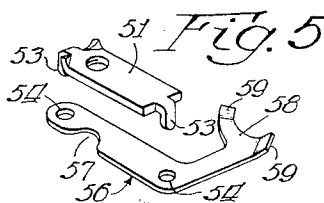
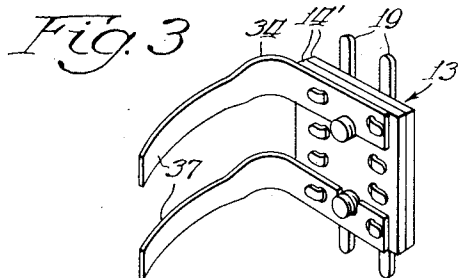
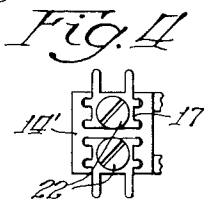
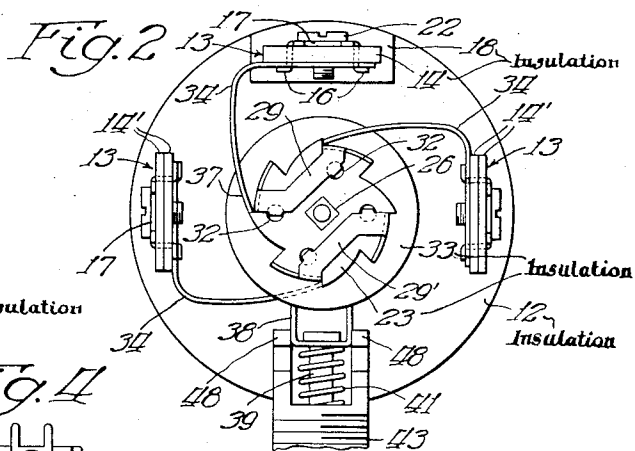
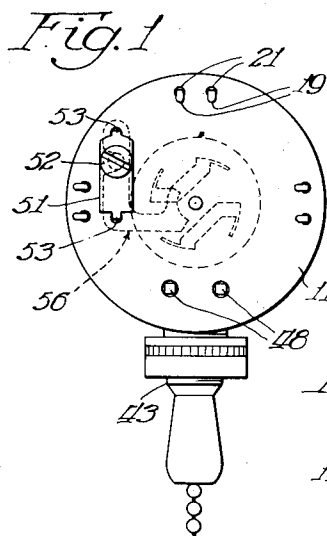


Fig. 7A
PARALLEL

Fig. 7B
OFF

Fig. 7C
SERIES

Fig. 7D
OFF

Insulation

Inventor:
Rudolph Popp
By: *Laerman L. Mueller* Atty.

UNITED STATES PATENT OFFICE

2,158,678

SWITCH

Rudolf Popp, Valparaiso, Ind., assignor to
McGill Manufacturing Company, Valparaiso,
Ind., a corporation of Indiana

Application January 21, 1937, Serial No. 121,624

4 Claims. (Cl. 200—64)

My invention relates in general to electric switches, and more in particular to a pull chain type of multi-circuit switch. This application is a continuation in part of applicant's copending application Serial No. 51,466, filed November 25, 1935, and may also be considered as a continuation in part of another of applicant's copending applications, Serial No. 716,541, filed March 20, 1934, now Patent No. 2,068,701, patented January 26, 1937.

Although many uses will be found for various switches made in accordance with the present invention, the illustrated embodiment is especially designed for controlling a two-speed series-parallel condenser type motor. Because of the condenser, which must be connected directly to one line, it is not practical to have the coils connected together at one end, and special problems are presented in opening all of the circuits to turn off the motor, as well as keeping the proper condenser connections with the motor running.

The problem is solved in the present instance by utilizing the type of switch illustrated in application Serial No. 51,466 above mentioned, together with an extra contact embodying some of the principles of the above mentioned Patent No. 2,068,701. Substantially this same embodiment of the present invention has been successfully employed as a reversing switch for a motor wherein one line is connected to the extra contact, and the other line is connected through the main coil of the motor to the switch.

A feature of this extra contact is that its connections to the bridging contacts on the switch rotor are relatively independent of the positioning of the rotor. In other words, it is not simply another single contact operating on the ordinary contact portions of the bridging contacts and connected and disconnected in the sequence determined thereby, but may be connected at all times. The problem of providing such an extra contact is aggravated in the multi-circuit switch of the aforementioned application, Serial No. 51,466, because of the large number of contacts already positioned around the rotors therein. For this reason, among others, it is impractical to use a double peripheral contact as in Patent No. 2,068,701. The problem is advantageously solved by the present invention, however, by providing an extra contact adapted to engage the bridging contacts on the radial face of the rotor rather than on its periphery, and so shaping this contact and the bridging contacts that they will remain in engagement through the desired sequence of positions.

From the foregoing it is apparent that one object of the invention is to provide a satisfactory pull chain type of switch adapted for control of a series-parallel condenser type motor, or other series-parallel apparatus, especially if the elements connected in series and parallel alternately are also cross connected in some manner, or can not have a permanent common lead to the switch.

A further object of the invention is to provide such a switch which is capable of being made almost entirely of standard parts from allied types of switches, so that it is not necessary that the manufacturing volume be large in order to prevent excessive cost.

Another object of the invention is to provide a switch embodying a radial face contact which is so constructed as to provide adequate contact pressure without enlarging the space required by the switch.

Further objects and advantages of the invention will be apparent from the following description and from the drawing in which:

Fig. 1 is a plan view of the embodiment of the switch chosen for illustration, in the actual commercial size.

Fig. 2 is an enlarged view similar to Fig. 1, but with the top frame plate removed.

Fig. 3 is a perspective detail view showing a double contact post construction used in the structure of Figs. 1 and 2.

Fig. 4 is a fragmentary face view of the post construction shown in Fig. 3.

Fig. 5 is a detailed exploded perspective view of the extra contact shown in dotted lines in Fig. 1 and its terminal.

Fig. 6 is a detailed perspective view of one of the bridging contacts seen in Fig. 2; and

Fig. 7 is a diagrammatic illustration showing the four positions of the switch and showing the complete connections to the line and series-parallel motor for the first position of the switch. For convenience, the various parts of this figure have been numbered 7A, 7B, 7C and 7D; 7A showing the parallel circuit position, 7B the succeeding "off" position; 7C the series circuit position, and 7D the subsequent "off" position.

Although this invention may take several forms, only one has been chosen for illustration. This switch is designed to be mounted, if desired, in the ordinary cup-shaped housing, and is supported as a unitary structure by upper frame plate 11 and lower frame plate 12 which carry therebetween the circuit breaking mechanism. The frame plates are spaced from one another and supported in parallel relationship by a plurality of posts

13, one or more of which may comprise a one-piece insulating member 14 seen at the top of Fig. 2, having apertures therein for receiving prongs 16 on terminal members 17 mounted one above the other on the post and insulatingly separated from one another by an apertured insulating plate 18. The terminal members 17 also include upwardly and downwardly extending prongs 19 which fit into corresponding apertures 21 in the top and bottom frame plates. These prongs may be upset or bent over after the switch mechanism is completely assembled between the plates to retain the same in fixed spaced relationship. Terminal screws 22 screw into each of the terminal members in the usual manner.

A modification of the post structure is illustrated in Fig. 3, wherein the insulating spacer 14 is replaced by a pair of metal plates 14', to which two separate terminal members 17 are secured just as other similar members are secured to the spacer post 14. This embodiment is employed where it is desired to have the same lead in electric connection with a contact arm for each of the two contact discs, as is described below. The advantages of the particular construction illustrated in Fig. 3 are also explained hereinafter.

Rotating between the frame plates is switching mechanism which includes a pair of contact discs 23 and 24 (24 being shown only in the diagrammatic Fig. 7), keyed to a stem or spindle 26 journaled in the upper and lower frame plates 11 and 12. The stem will also include suitable ratchet means whereby it may be rotated by a U-shaped pawl member 38 in a manner fully described in my copending application Serial No. 51,466 above mentioned. The contact discs 23 and 24 are provided in insulating material and have a plurality of teeth on the outer edge thereof. Although contact discs with eight teeth are illustrated, other numbers of teeth are contemplated for varied circuit conditions.

Bridging contact members 29 and 31 are carried on the discs 23 and 24 respectively, the numbers 29' and 31' sometimes being used to distinguish one contact member from the other on the same disc. These contact members may be all identical in the illustrated form of switch, and include contact portions fitting onto the peripheral face of the teeth in the usual manner, these contact portions being seen best in Fig. 6. Fig. 6 also shows anchoring lugs 30 which are desirably formed on the bridge members 29 and 31, and fit into apertures 32 in the discs 23 and 24 to secure the bridging members 29 in place thereon. The ratchet portion of the rotor may be positioned between the discs 23 and 24 and may be separated therefrom by insulating plates 33. The contact discs rotating with the stem 26 turn within a plurality of contact arms 34 (Fig. 2), each rigidly secured to one of the posts 13, making contact with a terminal member 17 thereon. The contact portions 37 of these arms bear against the peripheral contact portions 36 of the bridging contact members 29 etc.

The switching mechanism is actuated by a universal lever and operating mechanism, including the substantially U-shaped pawl 38 supported on a reciprocating pin 39 and bearing against the inside of the pawl 38 as shown in Fig. 2. This structure is similar to that shown in my Patent No. 1,974,054, and includes the coil spring 41 and a mounting stem 43 which also serves as a spacer post for the frame plates 11 and 12 having lug portions 42 corresponding to the lug portions 19

of the terminal members 17. The general features heretofore described need not be described in further detail, therefore, since they are very thoroughly disclosed in applicant's copending application Serial No. 51,466, except for the improvements discussed below.

In Fig. 3 it will be observed that the post 13 comprises two plates 14'. Of course a single plate could be used in place of these two plates, but the two plates are preferred so that thinner stock may be used, the thinner stock being more easily punched, and in fact may be punched out with the same punch press used for the posts 14 of insulating material of greater thickness. For the sake of interchangeability of posts, it is desired that the two plates 14' together be of substantially the same thickness as the post 14 of insulating material at the top of Fig. 2. This permits utilization of the same terminal members 17 with the metal posts as with the insulating posts, and permits standardization of parts, for as noted above, the plates 14' are identical in punching with the insulating plate 14.

In addition to the terminals already described, an extra terminal member 51 is provided, having a screw 52 screwed therein for securing a wire thereto. The terminal member 51 is provided with lugs 53 seen best in Fig. 5, which pass through apertures 54 in an extra contact member 56 on the under side of the upper frame plate 11. In other words, the terminal member 51 is positioned on the upper side of the upper frame plate 11 and has lugs passing through said frame plate and through the contact member 56 to secure both the terminal member and the contact member in place, and to make the electrical connection between the two. The contact member may be recessed as at 57 to permit passage of the screw 52 therethrough. It will be understood that the lugs 53 will be bent over after the parts are in place.

The contact end 58 of the extra contact member 56 is positioned between the top frame plate 11 and the bridging members 29 so as to bear against said bridging members or against the disc 23 by which they are carried. The contact end 58 of the contact member 56 is specially shaped, being provided with two upwardly inclined wing portions 59. These wing portions serve a double purpose. One purpose is to serve as a bevel to insure that the contact portion 58 will ride up over the bridge member 29, thus making it unnecessary for the bridge members to be countersunk into the disc 23. The other purpose of the inclined wings 59 is to press the contact portion 58 against the bridge contact member 29 with sufficient firmness to insure proper electrical connection, it being understood that the wings themselves will bear against the top plate 11 and that the contact end 58 will flex as the bridging contact members 29 pass thereover.

The shape of the contact portion 58 may be such as to provide contact with a bridging member 29 in any desired position and may vary for different switch uses. With the switch used as illustrated in Fig. 7, it is desired that this contact portion be shaped approximately as shown so as to engage the bridging contact 29 in at least the first to third positions. As a matter of fact, the shape shown would provide engagement in the fourth position also.

The operation of the switch is clearly seen from Fig. 7. The position of the contact discs in the diagrammatic illustration of Fig. 7 corresponds with Figs. 1 and 2. At Fig. 7A the first

position of the switch is shown with the motor coils 61 and 62 connected in parallel therethrough to the lines L₁ and L₂ to provide high speed operation of the motor. It will be observed that spring contact arm 63' (on the lower disc) is connected to the line L₁, which is also connected to one end of coil 62. The other end of coil 62 is connected through a metallic post 14' to spring contact arms 64 (on the upper disc) and 64' (on the lower disc). Fixed spring contact 66 on the upper disc is connected to one end of coil 61, the other end of which is connected to spring contact 66' operating on the lower disc. These contacts 66 and 66' are in engagement with the upper and lower terminals 17 respectively on the insulating post 14. One branch of the parallel circuit may therefore be traced from line L₁, through coil 62 to contact 64, through bridging contact 29 to extra contact 56 connected to line L₂. The other branch of the parallel circuit may be traced from line L₁ through contact 63', through bridging contact 31' to spring contact 66', and from this contact through the coil 61 to spring contact 64, bridging contact 29 and extra contact 56, which is connected to line L₂.

In Fig. 7B the next position of the switch is shown, in which it is seen that, although line L₂ is connected through extra contact 56 to bridging contact 29, all branches of the circuit are interrupted at this point because the bridging contact 29 is not engaged by any other stationary contact, the spring contact 66 riding on an idle tooth of the disc 23. It follows that this not only interrupts the circuits directly through the coils 61 and 62 but also interrupts the circuit through the condenser 68.

In Fig. 7C the third position of the switch is shown, this position being that in which the coils 61 and 62 are connected in series for slow speed operation of the motor. In this position the circuit may be traced from line L₁ through the coil 62 to contact 64' (the twin contact 64 engaging the dead bridging contact 29', which engages no other contact). From contact 64' the circuit is continued through bridging contact 31 to spring contact 66' and from it through coil 61 to spring contact 66 which in this position engages bridging contact 29 which in turn engages the extra contact 56 connected to line L₂.

In the fourth position of the switch shown in Fig. 7D all branches of the circuit are again broken by the bridging contact 29 for, although this contact is still engaged by contact 56, it engages no other contact.

Since the switch is symmetrical the succeeding four positions are identical with the four just described except that the bridging contact 29' will take the place of the bridging contact 29 and the bridging contact 31' will take the place of the bridging contact 31. These other positions therefore need not be described.

From the foregoing it is seen that a switch is provided which, though using parts standard in similar switches of other uses, such for instance as a reversing switch for a motor as mentioned above, is capable of connecting a series-parallel condenser type motor for series and parallel connections with intervening "off" positions, the condenser being connected directly to one line in each "on" position, although being disconnected in both "off" positions. Furthermore, it will be observed that contact portion 56 is so shaped as to insure proper contact pressure with

the bridging contact members 29, although taking up a minimum of space.

I claim:

1. In an electric switch having an insulating frame, the combination with a rotary switching unit mounted in said frame comprising a plurality of coaxial switching rotors electrically independent of one another, of a terminal and brush unit supported on said frame and substantially as long as the axial length of said rotary switching unit, said terminal and brush unit comprising a plurality of substantially identical metal plates in face to face engagement for fastening together to provide ruggedness and satisfactory electrical conductivity over the length of said terminal and brush unit, a plurality of stationary electrical brushes mounted on one side of said plurality of metal plates corresponding in number to the number of rotors in the rotary switching unit with said metal plates being electrically common to all of said rotors through said brushes but being out of direct engagement therewith, and means for both mounting said brushes on said metal plates and rigidly securing said metal plates together in face to face relationship.

2. An electric switch comprising a pair of insulating frame plates, a rotor carried therebetween having a peripheral portion and a face portion substantially at right angles thereto, contact means on said rotor including a peripheral contact portion and a face contact portion, a stationary peripheral brush carried by said frame, and a stationary face brush carried by one of said frame plates intermediate said frame plate and the face contact portion of said rotor, said face brush including a spring contact arm for engagement with said face contact portion and having a wing portion extending angularly away from said face contact portion toward the frame plate with the tip of the wing engaging said frame plate to provide spring pressure in the face brush to press the same firmly against said face contact portion.

3. In a switch as defined in claim 2, said face brush being supported on the inside surface of said frame plate and means for supporting said face brush on said inside surface, said means comprising a terminal block on the outside surface of said frame plate having a pair of integral lugs extending through apertures in said frame plate and corresponding apertures in said face brush, with said lugs being upset against said face brush to secure it against the inside surface of the frame plate.

4. An electric switch including in combination an insulating frame plate, a switching rotor supported at said frame plate with its axis at right angles thereto having a peripheral contact portion and a face contact portion substantially at right angles thereto, a terminal member mounted on said frame plate and a stationary face brush electrically connected to said terminal for engaging the face contact portion on said rotor comprising an engaging portion positioned intermediate the frame plate and the face contact portion of said rotor having a resilient offset portion in engagement on one side with the frame plate and resiliently pressing at the other side against said rotor at the face contact portion to maintain an effective electrical connection between the terminal member on the frame plate and said switching rotor.

RUDOLF POPP.