Sept. 9, 1941. L. F. BLUME 2,255,501

ELECTRIC SWITCH

Original Filed June 30, 1937

Fig. 1.

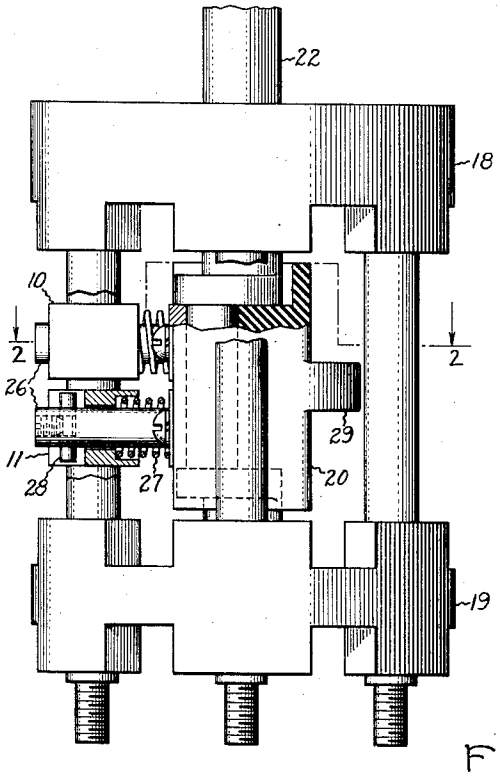


Fig. 3.

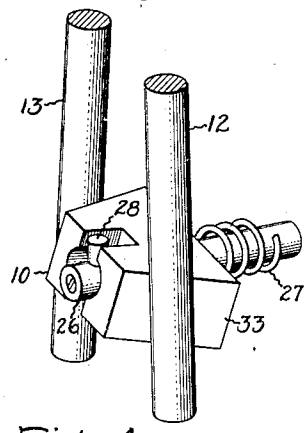


Fig. 4.

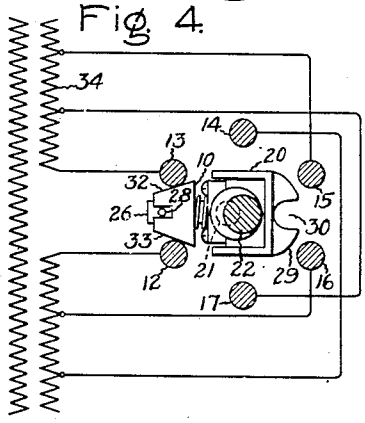


Fig. 5.

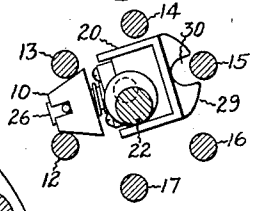


Fig. 6.

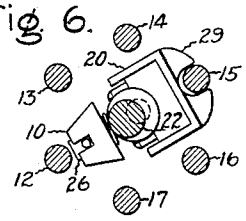


Fig. 2.

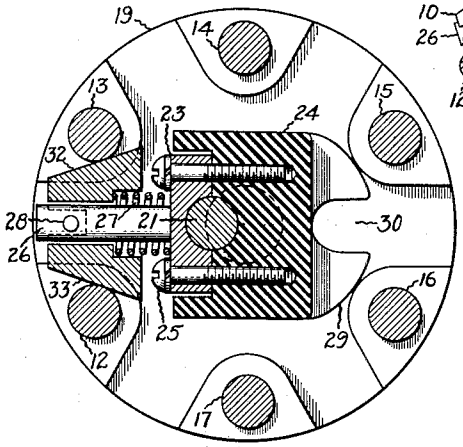


Fig. 7.

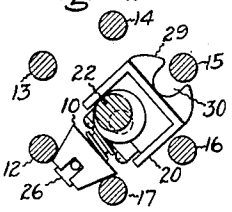
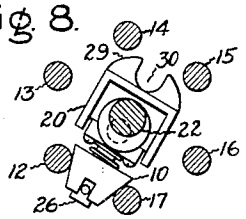


Fig. 8.



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UNITED STATES PATENT OFFICE

2,255,501

ELECTRIC SWITCH

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Continuation of application Serial No. 151,197, June 30, 1937. This application December 12, 1939, Serial No. 308,786

5 Claims. (Cl. 200—6)

This application is a continuation of my copending application Serial No. 151,197, filed June 30, 1937.

My invention relates to electric switches and more particularly to electric switch contacts of the type in which a movable contact is forced between two spaced fixed contacts to complete an electric circuit.

It is a general object of this invention to provide a new and improved electric switch of the type described which is rugged in construction, comprises relatively few moving parts, and is relatively low in manufacturing costs.

The further object of the invention is to provide an improved construction and arrangement of switch contacts wherein the contacts will adjust themselves automatically to assure a substantially uniform pressure and engagement between the contact surfaces.

It is a still further object of the invention to provide an electric switch of the type described having a new and improved contact arrangement and operating means therefor whereby the contacting surfaces are wiped free of foreign matter or slight surface protuberances to insure low contact resistance.

The invention will be better understood from the following description taken in connection with the accompanying drawing in which Fig. 1 is a view partly in section of a switch provided with fixed and movable contacts constructed in accordance with the invention; Fig. 2 is a sectional view on the line 2—2 of Fig. 1; Fig. 3 is an explanatory view of the switch contacts; Fig. 4 is a circuit diagram indicating how the switch shown in Fig. 1 may be connected for adjusting the voltage ratio of a transformer; and Figs. 5, 6, 7, and 8 are explanatory sectional views of parts of the switch in different positions of adjustment.

Like reference characters indicate similar parts in the different figures of the drawing.

The electric switch shown in the drawing includes two movable contacts 10 and 11 and six fixed contacts 12, 13, 14, 15, 16, and 17 equally spaced about a common axis. It will be apparent that any desired number of fixed contacts may be provided, depending upon the number of connections to be controlled by the switch, and any number of movable contacts may be provided, depending upon the amount of current which is to flow through the switch. The fixed contacts 12 to 17, inclusive, are in the form of substantially parallel rods having cylindrical contacting surfaces rigidly supported between insulating end supports 18 and 19. The movable contacts 10 and 11 are carried by a supporting member 20 pivoted on an offset portion 21 of an operating crank shaft 22 which is journaled in the end supports 18 and 19 for rotation about the axis common to the fixed contacts. The supporting member comprises two parts 23 and 24 suitably secured together about the offset shaft portion as by screws 25. The part 24 is of insulating material for reasons as will become apparent as the description proceeds. The part 23, which may be of a suitable metal, is provided with a projecting pin 26 for each movable contact 10 and 11, the contacts 10 and 11 being mounted on the pins 26 with a loose, sliding fit. A spring 27 forces each of the movable contacts 10 and 11 outwardly on its pin 26 and into engagement with two of the fixed contacts when the contacts are in operating position. Outward travel of the movable contacts 10 and 11 is limited by a stop 28 while the movable contacts are being transferred from one operating position to another. The support portion 24 is provided with a bifurcated projection 29 on the opposite side from the movable contacts 10 and 11 defining a notch or slot 30 which is adapted to cooperate with one of the fixed contacts to act as a guiding means for the movable contacts during a switching operation.

Each of the movable contacts 10 and 11 is in the form of a rigid conductive wedge loosely surrounding its supporting pin 26 and having opposite plane contact surfaces 32 and 33 which converge outwardly from the movable contact support 20.

It is important that good contact be secured between the contact surfaces of the movable contacts 10 and 11 and the contact surfaces of the fixed contacts so that there shall be as little resistance and consequent heating as possible while current is flowing through the switch. The fixed contacts 12 to 17, inclusive, are approximately parallel to each other but may not be quite parallel because of inaccuracy in manufacture and assembly or because of subsequent distortion of the switch. To illustrate this condition, the fixed contacts 12 and 13 are shown in Fig. 3 as being considerably out of parallel. The movable contacts 10 and 11 are mounted loosely on their supporting pins 26 so that they may automatically adjust themselves to this condition of the fixed contacts and secure perfect engagement with the fixed contacts throughout the width of the contact surfaces 32 and 33 of the movable contacts, that is, each movable contact 10 and 11 is free to tip slightly as indicated in Fig. 4 so

as to bring each of its contact surfaces into perfect engagement throughout its width with the adjacent fixed contact.

The particular switch shown in the drawing is adapted for use as a tap changer in connection with a transformer winding 34 as shown in Fig. 4 to permit adjustment of the voltage ratio of the transformer. The switch is shown in a normal contact making, or operative position, with the movable contacts 10 and 11 connecting the fixed contacts 12 and 13. The movable contacts are transferred to an adjacent operating position by rotating the operating shaft 22. If this shaft 22 is rotated in a clockwise direction, the offset portion 21 of the shaft will move about the main axis of the shaft so as to withdraw the movable contacts 10 and 11 from their position between the fixed contacts 12 and 13. In Fig. 5 the shaft 22 has been rotated one-quarter revolution in the clockwise direction and the support 20 has been swung upwardly tilting the wedge contact between the fixed contacts 12 and 13. Throughout this movement of the shaft the wedge contact is maintained in engagement with the fixed contacts but the faces of the wedge contact have wiped across the fixed contact surfaces from directly opposite points to diagonally opposite points. Upon rotation of the shaft 22 the fixed contacts 12 and 13 at first prevent the contact support 20 from turning with the shaft 22 and act to guide the notch 30 onto the fixed contact 15, as shown in Fig. 6. In this figure the shaft has been rotated clockwise another quarter revolution and the wedge contact has been moved to the inoperative position, clear of the fixed contacts. Since the support portion 24 having the bifurcated projection 29 is of insulating material, no conductive circuit is established from the fixed contact 15 through the support to one of the other fixed contacts during the tap changing operation of the switch. Continued clockwise rotation of the shaft 22 results in a pivotal movement of the support 20 in the counterclockwise direction about the bifurcated end shifting the wedge contacts to the next succeeding contact making position, as illustrated in Fig. 7.

In the initial contact making position the movable contact engages with the fixed contacts at diagonally opposite points of the wedge faces. This is due to the fact that the wedge contact approaches the pair of fixed contacts at an acute angle with respect to the plane of the two fixed contacts. Movement of the shaft 22 through the next quarter revolution pivots the support 20 counterclockwise about the movable contact end wiping the faces of the wedge contact across the fixed contact surfaces to directly opposite points. In the second normally operative position illustrated in Fig. 8 the wedge contact is substantially at right angles to the plane of the fixed contacts 12 and 17 and is in the same relative position as shown in Fig. 4, except one step advanced.

In a manner similar to that described, the wedge contacts may be progressively shifted through the remaining operative positions to change the number of effective turns in the transformer winding 28 and thus to change the voltage ratio of the transformer as desired. It will be noted that as the wedge contact is shifted from one position to the next, in either direction, substantially the entire faces of the wedge are wiped across the surfaces of the fixed contacts. Thus the cooperating contacting surfaces are kept clean of any particles of foreign matter or small protuberances of metal which may be caused by an abnormal condition of arcing. The contact pressure is relatively great due to the wedging action of the rigid wedge contact being forced between the parallel fixed contacts by the springs 27 which may be comparatively strong in view of the rugged nature of the assembly. Due to the improved contact arrangement, the contact resistance of the switch is low and its current carrying capacity is therefore high.

The invention has been explained by describing a particular construction of switch contacts assembled in a particular switch structure, but it will be apparent that changes may be made without departing from the spirit of the invention and the scope of the appended claims.

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

1. An electric switch having a plurality of approximately parallel cylindrical contacts uniformly spaced about a common axis, a shaft rotatable about said axis and having an offset portion, a movable support rotatable about said offset portion of said shaft and having a pin extending outwardly therefrom, a wedge contact loosely mounted on said pin, spring means biasing said wedge contact away from said support, said wedge contact being actuable into engagement with a pair of said cylindrical contacts by a predetermined rotation of said shaft, a bifurcated member of insulating material secured to said support opposite to said wedge contact, said bifurcated member being adapted to engage one of said cylindrical contacts as said wedge contact is actuated to an inoperative position and whereby said support and said movable contact are shifted by the continued rotation of said shaft to carry said wedge contact to the next operative position.

2. An electric switch having a plurality of generally parallel cylindrical fixed contacts uniformly spaced about a common axis, a crank shaft rotatable about said axis, a movable support carried by the crank portion of said shaft, a rigid wedge-shaped movable contact block on said support, a bifurcated insulating guide member extending from said support on the opposite side thereof with respect to said contact block for engaging with one of said fixed contacts as said contact block is withdrawn from contact making position, said bifurcated member maintaining engagement with said one fixed contact while said movable contact is shifted to the next succeeding contact making position and means loosely mounting said contact block on said support whereby the opposite faces of said block will in the contact making position thereof engage over substantially their full width with said fixed contacts irrespective of the exact alignment of said fixed contacts.

3. An electric switch having a plurality of generally parallal fixed cylindrical contacts spaced about a common axis, a shaft rotatable about said axis and having an offset portion, a support rotatably arranged on said portion, a contact mounted on said support and movable thereby into bridging relation in consecutive order with pairs of adjacent fixed contacts, an insulating part extending outwardly from said support on the opposite side of said shaft with respect to said movable contact for engaging with one of said fixed contacts as said movable contact is withdrawn from a contact bridging position, said last mentioned part maintaining

engagement with said one fixed contact for effecting shifting of said movable contact to a next contact bridging position upon a predetermined rotation of said shaft.

4. An electric switch having a plurality of generally parallel fixed contacts arranged about a common axis, said fixed contacts having convexly curved facing contact surfaces, a support rotatable eccentrically about said axis and having a portion movable between a pair of adjacent contacts, a rigid wedge shaped contact loosely and slidably mounted on said portion, resilient means biasing said contact outwardly on said support, said wedge shaped contact being movable into engagement with said pair of adjacent fixed contacts by a predetermined movement of said support about said axis.

5. An electric switch having a plurality of generally parallel fixed cylindrical contacts spaced about a common axis, a shaft rotatable about said axis and having an offset portion, a support rotatably arranged on said portion including an outwardly extending pin, a rigid wedge contact loosely mounted on said pin for rocking movement in any direction thereupon, spring means biasing said wedge contact outwardly on said pin, said wedge contact being actuable into engagement with a pair of adjacent fixed contacts by a predetermined rotation of said shaft.

LOUIS F. BLUME.