

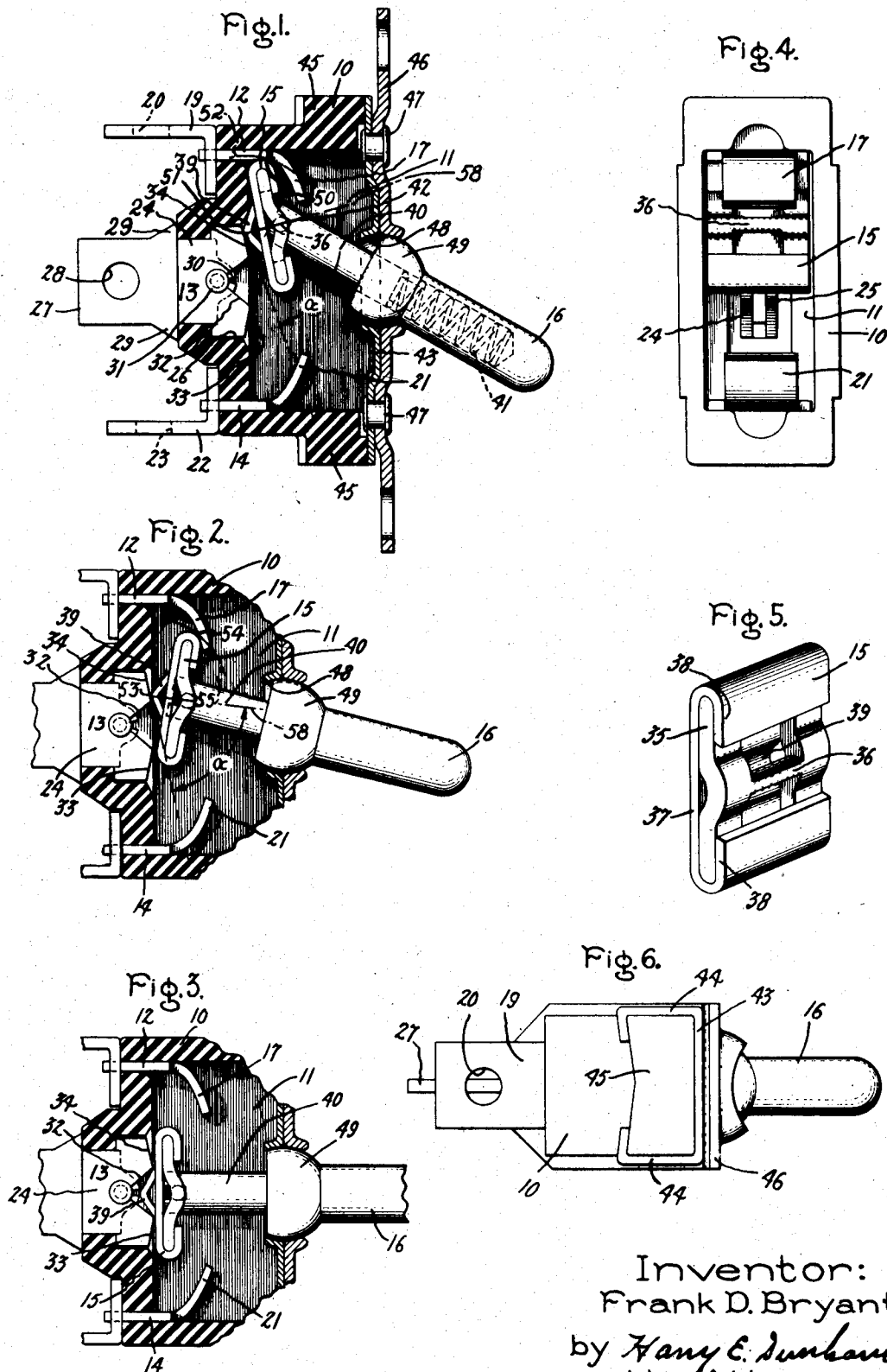
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F. D. BRYANT

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ELECTRIC SWITCH

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Inventor:
Frank D. Bryant,
by *Harry E. Dunham*
His Attorney.

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ELECTRIC SWITCH

Frank D. Bryant, Syracuse, N. Y., assignor to
General Electric Company, a corporation of
New York

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My invention relates to electric switches and more particularly to a toggle switch.

An object of my invention is to provide a switch mechanism so arranged that the circuit through the switch is broken and closed at different points on the switch contacts thereby preventing destructive arcing and increasing the capacity and life of the switch.

Another object of my invention is the provision of a new and improved switch mechanism which is of simple and compact design so that the switch may be manufactured at low cost.

In the accompanying drawing, Fig. 1 is a view, partly in section, of the interior of my switch in "on" position; Fig. 2 is another view of the switch interior showing the parts in position just prior to opening of the contacts; Fig. 3 is an interior view of the switch in "off" position; Fig. 4 is a view of the interior of the switch with the cover removed; Fig. 5 is a perspective view of one of the contacts, and Fig. 6 is an end view of the switch.

Referring to the drawing, my switch includes a housing 10 formed of any suitable insulating material, such as a molded plastic, which is provided with a recess 11 for receiving the contact mechanism. This mechanism includes three fixed contacts 12, 13 and 14, a movable contact or contactor 15 and an operating handle 16. The fixed contacts are spaced apart and are traversed by the movable contactor 15.

Fixed contact 12 is formed of heavy sheet material, such as bronze, and is preferably silver plated. One end of the contact is curved inwardly in the form of an arc toward the operating handle 16, as shown at 17, for a purpose to be described later. The other end extends through the bottom wall of the recess and is peened over into engagement with one arm of an angularly shaped terminal member 19. The other arm of the terminal member is provided with an opening 20 for receiving a conductor which is fastened to it in any convenient manner, as by soldering. Manifestly, if desired, the terminal member may be provided with a terminal screw.

The other fixed contact member 14 is spaced from the contact 12 at the other end of the recess. It is similarly formed at one end with an arcuate portion 21, which extends toward the operating handle and faces the other arcuate surface 17. At its other end, it extends through the bottom wall of the recess where it is peened over into engagement with an angularly shaped terminal member 22. The terminal member is pro-

vided with an opening 23 for receiving a conductor although, if desired, it may be provided with a terminal screw.

The third fixed contact member 13 is located between the spaced contacts 12 and 14. It comprises two spaced plates 24 and 25, set in parallel relationship in a well 26 formed in the bottom of the recess 11, and a terminal plate 27 extending through the bottom wall of the recess. One end of the terminal plate 27 extends outside the housing and is provided with an opening 28 for receiving a conductor fastened in any suitable manner as by soldering; the outer end is also provided with projecting lugs 29 engaging the wall of the housing. The other end of the terminal plate extends into the well 26 between the plates 24 and 25 and the end is split, as indicated at 30 in Fig. 1, so that the split end may receive a pin 31 which, in turn, extends between and is carried by the spaced plates 24 and 25. In assembling the contact into position, the spaced plates 24 and 25 carrying the pin 31 are dropped into the well 26 and then the terminal plate 27 is inserted from the outside so that the pin rests in the split end 30; thereafter, the split end is crimped around the pin 31 by a suitable tool so that the assembly is held in position with the lugs 29 engaging the outer wall of the housing. Each of the plates 24 and 25 is provided with a V-shaped recess 32 and slightly inclined contact surfaces 33 and 34 on opposite sides of the V for cooperation with the movable contactor now to be described.

The movable contactor 15, shown in perspective view by Fig. 5, comprises a flat plate 35 formed as a hollow square provided with a central rib 36 struck up somewhat from the plane of the plate. A current conducting strip of metal 37, such as silver plated bronze, is fastened to the plate by having its ends bent around the ends of the plate, as indicated at 38. A central portion of the strip is punched outwardly to form a projection or cam portion 39, having a generally rounded contour which cooperates with the V-shaped groove in the center contact 13 and also with the contact surfaces 33 and 34 on each side of the groove.

In order to operate the contactor and move it back and forth between the fixed contacts the handle 16 is provided with a plunger 40 formed of insulating material which slides longitudinally within a chamber in the handle and which is biased into engagement with the contactor by a spring 41 housed in the handle chamber. That end of the plunger engaging the contactor is

formed with a slot or recess 42 which receives the rib 36 of the contactor to insure positive movement of the contactor upon pivotal movement of the handle. It should be manifest that the spring 41 forces the contactor firmly into engagement with the fixed contacts thereby insuring a good electrical connection between these elements.

The recess 11 in the housing is closed by a plate 43, opposite ends of which are provided with spaced arms 44 bent around extensions 45 on opposite ends of the housing so that the closure plate is held firmly in position. A mounting strap 46 is carried by the closure plate to which it is fastened by any suitable means, such as the rivets 47. Both the closure plate and mounting strap are formed with outwardly flared flanges providing a socket 48 for receiving an outwardly flared bearing surface 49 spun from the end of the handle 16. The socket 48 and bearing surface 49 form, in effect, a ball and socket joint permitting free pivotal movement of the handle 16. However, movement of the handle is limited by the side walls of the recess 11 acting on the plunger 40 to a simple pivotal action necessary to operate the contactor 15.

As the operating handle is moved back and forth, the contactor 15 slides over the center contact 13 into engagement with either of the fixed contacts 12 and 14. In Fig. 1, the contactor is shown in position to complete an electrical circuit between the contacts 12 and 13. In this position, the cam surface 39 of the contactor rests on the contact surface 34 of the center contact while the end of the contactor is biased by the spring 41 firmly into engagement with the flat portion of contact 12. To open the circuit, the operating handle 16 is moved in a generally counter clockwise direction, in the showing of Fig. 2. Instead of causing the contactor to open immediately the circuit between itself and the fixed contact 12, as would be the case in existing switch constructions, initial pivotal movement of the handle causes the contactor to rock about the cam surface 39 so that the end of the contactor follows the curved surface 17 to a position shown by Fig. 2. In this position, the contactor is ready to snap to open position. Upon further movement of the handle, the contactor snaps to seated position on the center contact 13 with the cam surface 39 resting in the groove 32, as shown by Fig. 3.

By so designing the mechanism that the contactor first moves along the curved surface 17 a greatly improved performance of the switch is obtained. The wiping action of the contactor along the curved surface cleans the contacting surfaces on both the fixed and movable contacts thereby insuring a good electrical connection at all times. When the contactor is quickly moved from engagement with the curved surface to open the circuit, it travels a comparatively long distance from the outer end of the curve, as will be apparent from Figs. 2 and 3, so that the arc is subjected to a large break and will be quickly snuffed out. Such would not be the case if the movable contactor were simply pulled away from the fixed contact 12. Pivotal movement of the contactor is obtained by rocking of the cam surface 39 about the contact surface 34 of the fixed contact. Since the contact surface 34 is slightly inclined away from the V-shaped groove 32, as shown by Fig. 1, rocking movement of the contactor about the cam surface 39 is facilitated before there is a tendency of the contactor to move off the contact surface 34.

Fig. 3 shows the switch in "off" position. When it is desired to close a circuit to either one of the contacts 12 and 14, the operating handle is moved in the appropriate direction to operate the contactor. However, upon closure of the switch the contactor does not pivot into engagement with the curved portions 17 or 21 of the respective fixed contacts. Instead, the cam surface 39 snaps up over the edge of the groove 32 so that the contactor directly engages the flat portions of the contacts. This means that the circuit is made at a different point than that at which the circuit is broken. The advantage of such an arrangement is that the contact surfaces are maintained in good condition since any pitting of the fixed contact takes place on the curved surface at the point where the arc is broken. This greatly increases the life of the switch.

The construction is one which is simple and easy to manufacture since it comprises relatively few parts. The spring 41 is strong enough to give a very quick break of the contactor from either of the fixed contacts thereby prolonging the life of the switch. Manifestly, if desired, one of the fixed contacts 12 or 14 may be omitted to adapt the switch to control only a single circuit. Thus, a switch according to my invention comprises a housing or base forming a chamber with two stationary spaced metallic contacts or contact members 12, 13 supported on the base and projecting into the chamber and a movable contact bridging member or contactor 15 for electrically connecting and disconnecting the stationary contacts. The bridging member has a projection or cam surface 39 for engaging the adjacent contact surface of the stationary contact 13 in the "on" position. The contactor is pivotally supported on means including a spring-biased plunger 40, which latter projects into the bore of a handle 16 pivotally supported on the cover of the switch housing by means of a ball and socket connection. In the "on" position, as shown in Fig. 1, the bridging member or contactor 15 is biased towards the adjacent contact surfaces of both stationary contacts 12 and 13 engaging the stationary contacts 12 and 13 at points 50 and 51 respectively. These points 50 and 51 may be termed "normal contact points." In order to prevent opening of the electric circuit at these normal contact points 50, 51 the contacts 12 and 13 must have a certain shape. Their adjacent surfaces are non-parallel. The contact surface of the contact 12 must be located substantially within a circle about the normal contact point 51 of the contact 13 and through the point 50. In Fig. 1 I have indicated an arc of this circle by a dash-dotted line 52. If the contact surface of the contact 12 were to coincide with said circle, then actuation of the handle 16 would cause rotation of the contactor about the normal contact point 51. The contactor then would leave the normal contact point 50 and the circuit might be opened at a point other than the point 50 with regard to the contact 12, but it would not be opened at a point other than the point 51 with regard to the contact 13 which would lead to rapid pitting and a poor electrical connection through the normal contact point 51. With applicant's invention the contactor must leave both normal contact points 50, 51 before opening of the circuit can be effected because, as stated above, the contact surface of the contact 12 is located within the circle 52 about the normal contact point 51.

In the intermediate position of Fig. 2 the contactor 15 connects intermediate contact points

53 and 54 of the contacts 13 and 12 respectively, both being spaced from the normal contact points 51 and 50 respectively. If the free end portion of the contact 12 beyond the point 54 were cut off, the electric circuit would be opened at or very close to the point 54 and the switch would satisfy the requirement of effecting opening at contact points spaced from the normal contact points 51 and 50. The opening in the position of Fig. 2 would be comparatively slow. In order to effect quick opening the cam portion 39 of the contactor is permitted to drop into a recess or slot upon movement of the handle 16 from the position in Fig. 2 into that of Fig. 3. During such movement the contactor is accelerated with considerable force into the recess of the contact 13 by action of the spring 41.

During movement of the contactor from the position shown in Fig. 1 to that shown in Fig. 3 the contactor 15 rotates about the pivot or central rib 36 and at the same time glides or wipes along the contact surface of the contact 13. As described above, this gliding or wiping along the contacts 13 during movement from the position in Fig. 1 to the intermediate position in Fig. 2 is due to the fact that the contact surface of the contact 12 is located substantially within the circle 52 about the normal contact point 51. The gliding or wiping of the contactor 15 upon movement from the intermediate position in Fig. 2 to the "off" position in Fig. 3 is due to the fact that the contact surface of the contact 12 from the contact point 54 towards its free end is located inside of a circle 55 (Fig. 2) about the intermediate contact point 53 through the point 54.

What has been said about the relation between the contacts 12, 13 and the contactor 15 applies to the relation between the contacts 13, 14 and the contactor 15. The stationary contacts 12, 14 are symmetrically arranged with regard to the contact 13 on opposite sides thereof.

The switch as shown is a 3-position switch, one position being the "off" position shown in Fig. 3, another position being that shown in Fig. 1 establishing connection between contacts 12 and 13. In the third position, not shown, the contactor 15 bridges the contacts 13, 14. When moved from "off" to "on" position the switch is in a stable position only when moved into one of its end positions, such as shown in Fig. 1, in which the contactor 15 connects the contacts 12, 13 and rests against the bottom of the insulating housing which acts as a stop. The contactor will always be moved into this end position whenever the handle 16 is rapidly thrown out of the position in Fig. 3. If the handle 16 were moved slowly from the position in Fig. 3 into that of Fig. 2 the contactor might remain in that position. This intermediate position is not stable or fixed. A slight pressure on the handle 16 in clockwise direction, Fig. 2, will snap the contactor into its end position, Fig. 1. If ever the contactor 15 should remain in an intermediate position, as shown in Fig. 2, no harm would result as a good electrical circuit is established through the intermediate points 53, 54 and these intermediate points 53, 54 too are spaced from the points at which the circuit is interrupted upon movement of the contactor into the "off" position.

The portions of the contactor 15 for engaging the stationary contacts are curved. In the "on" position the line 58 through the pivotal support and the normal contact point 51 of the contactor (Fig. 1) forms an angle α with the tangent through the normal contact point 51 of the con-

tact 13, which angle is not more, preferably less, than 90° (Fig. 1). Upon movement of the contactor towards the "off" position the angle α becomes smaller (Fig. 2). The contactor not only wipes along the stationary contact surfaces but at the same time is turned about its pivotal support to roll along said surfaces so that opening of the switch takes place at points of the contactor which are spaced from the normal contact points of the contactor in the "on" position. In other words, with a switch according to my invention the normal contact points of both the stationary and the movable contact engaged in the "on" position are spaced from the respective contact points of both the stationary and movable contact in which breaking or opening of the switch takes place. This assures good contact in the "on" position and accordingly long life of the switch.

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

1. In a switch mechanism, spaced contact members, a center contact disposed between said spaced contacts and having a slot therein, each of said spaced contact members having a curved surface extending in an arc toward the center contact, a slidable contactor having a cam surface, said contactor being carried by said center contact with the cam seated in said slot, a pivoted operating member, a movable plunger carried by said operating member and a spring biasing said plunger into engagement with said contactor, said operating member being movable in one direction to move the contactor cam surface out of said slot so that the contactor slides along said center contact into engagement with a corresponding one of said spaced contact members to close a circuit between it and the center contact, said operating member being movable in the opposite direction to cause said contactor to pivot about its cam surface on said center contact so that one end of it is moved into engagement with and travels along the curved surface of the corresponding contact as the contactor slides back along the center contact, the cam surface dropping into said slot to open the circuit at a point spaced from that at which the circuit was made.

2. In a switch mechanism, a contact having a slot therein, a second contact spaced from and having a curved surface extending in an arc toward the first-mentioned contact, a slidable contactor having a cam surface adapted to be carried by said first-mentioned contact with the cam seated in said slot, a pivoted operating member including a plunger and spring biasing said plunger into engagement with said contactor, said operating member being movable in one direction to move the contactor cam surface out of said slot so that the contactor slides along said first-mentioned contact into engagement with the second contact, said operating member being movable in the opposite direction to cause said contactor to pivot about its cam surface so that one end of it travels along the curved surface of the second contact as the contactor slides back along the first contact surface, the cam surface dropping into said slot to open the circuit through the switch at a point spaced from that at which the circuit was made.

3. In a switch mechanism, a contact having a slot therein and an inclined surface adjacent thereto, a second contact spaced from and having a curved surface extending in an arc toward the first-mentioned contact, a slidable contactor hav-

ing a cam surface, said contactor being normally mounted on said first-mentioned contact with the cam surface seated in said slot, pivoted operating means including a spring biased plunger engaging said contactor, said operating means being movable in one direction to move the contactor cam surface out of said slot so that the contactor slides along said inclined surface into engagement with the second contact, said operating means being movable in the opposite direc- 10

tion to cause said contactor to pivot about its cam on the inclined surface so that one end of it travels along the curved surface of the second contact as the contactor slides back along the first contact, the cam surface dropping into said slot to effect a quick opening of the switch at a point spaced from that at which the circuit was made.

FRANK D. BRYANT.