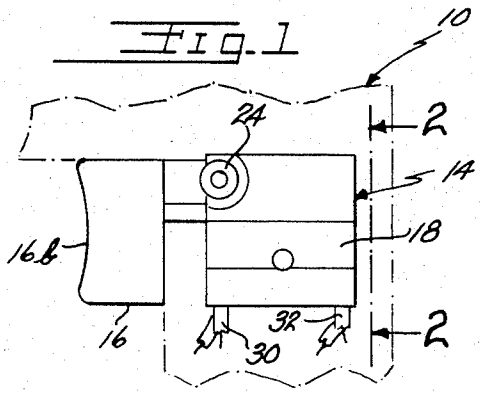
Dec. 10, 1968 B. H. MATTHEWS 3,415,966

ELECTRICAL SWITCH WITH IMPROVED BRIDGE CONTACTOR

Filed May 8, 1967

FIG. 1



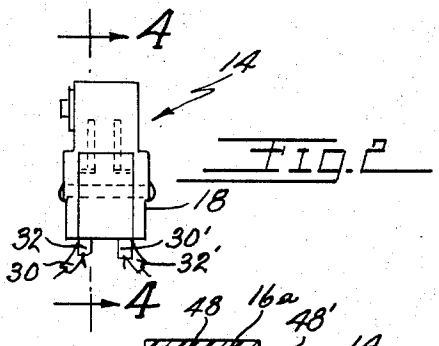


FIG. 2

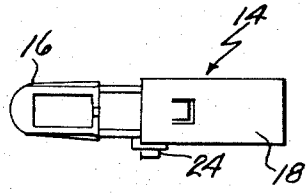


FIG. 3

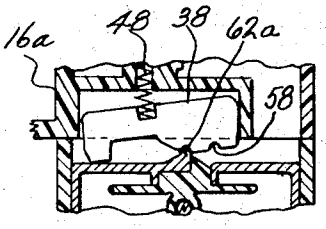


FIG. 8

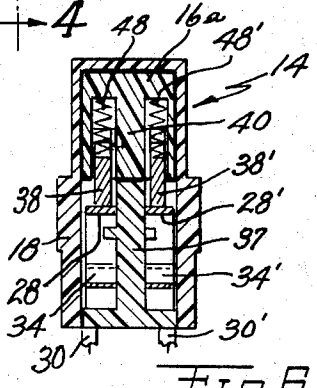


FIG. 6

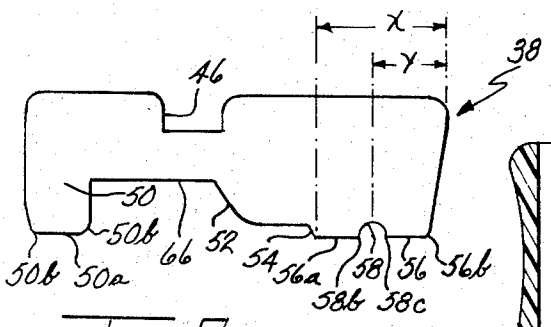


FIG. 7

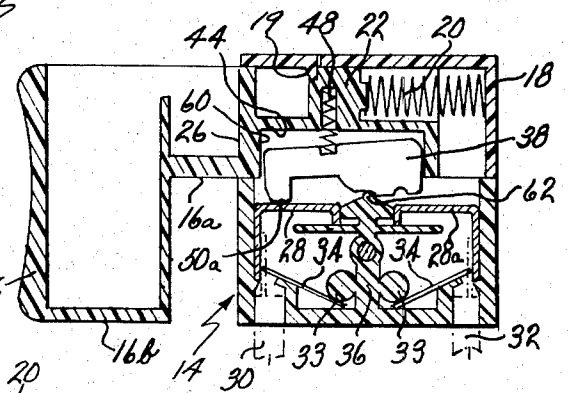


FIG. 4

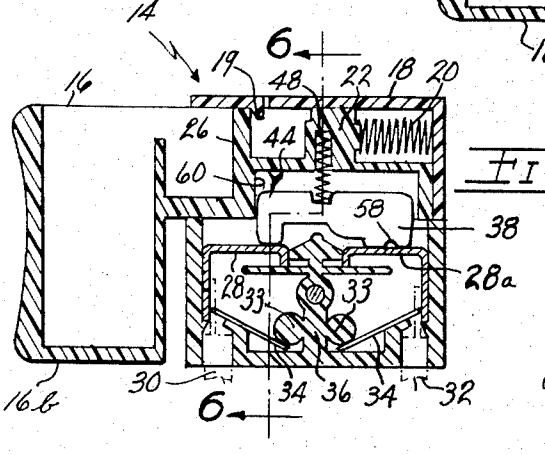


FIG. 5

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ELECTRICAL SWITCH WITH IMPROVED BRIDGE CONTACTOR

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ABSTRACT OF THE DISCLOSURE

An electrical switch having a movable bridging contact which is adapted to slide relative to a pair of spaced stationary switch contacts in order to make and break a circuit. A projection cams one end of the bridging contact upwardly in one position of the latter, above the adjacent stationary contact to open the switch circuit. Upon rearward movement of the bridging contact with respect to the aforementioned projection, the bridging contact moves downwardly off the projection to engage the underlying stationary contact to thereby bridge the stationary contacts and close the switch circuit. The contact face of the upwardly movable end of the bridging contact has a slot or groove formed therein, which slot is adapted to prevent accumulation on the contact face, of material having electrical resistance properties, with such slot materially increasing the life of the switch as well as increasing the current carrying capacity of the switch.

This application relates in general to a compact electrical switch and in particular to a compact electrical switch wherein a bridging contact is slidable with respect to spaced stationary contacts of the switch and between a non-bridging position and a bridging position and vice versa.

In the United States Patent 3,222,488, issued Dec. 7, 1965, to Benjamin H. Matthews, there is disclosed an electrical switch of the general type with which the present invention is especially concerned. Such patented switch comprises a bridging contact member which is adapted to be cammed upwardly by projection means, to move one end of the bridging contact in an upwardly raised position in the "off" condition of the switch, and wherein such raised bridging contact is adapted to move downwardly into engagement with the associated or adjacent stationary contact upon sliding movement of the bridging contact with respect to the stationary contacts, so as to complete the switch circuit and place the switch in "on" condition.

It has been found that with such an arrangement, that the contact face of the leading or upwardly pivotal end of said birdging member may develop a layer of electrical resistance material thereon after a period of operation of the switch which increases the arcing between the bridging contact and the underlying stationary contact during opening and closing of the switch, and which contributes to the breakdown and wearing out of the switch mechanism.

The present invention provides a control switch arrangement of the above discussed type, including a bridging contact which is adapted to be pivoted with respect to a stationary contact when the switch is in "off" position, and which bridging contact is adapted to move or pivot into engagement with an associated stationary contact upon actuation of the switch to move it to its "on" position, and with the contact face of the pivotal end of the bridging member having slot or groove means formed thereon which resists formation of a resistance or electrical insulating layer on the contact face, and which slot means materially increases the life and current carrying capacity of the switch mechanism.

For example, in a switch of the same physical size the approved current carrying capacity of the switch has been known to increase over fifty percent (50%) when using a bridging contact of the type that is incorporated in the switch mechanism of the present invention.

Said slot extends transversely across the surface of the bridging contact which is intended to come into communication with the adjacent surface of the associated stationary contact as to establish a conductive connection therebetween, and its placement is believed operable to channel or direct the flow of current therethrough in such manner as to establish an electromagnetic field in the area of said slot which is also operable to extinguish any arc that may tend to be developed upon opening or closing of the switch contacts.

Accordingly, an object of the invention is to provide a novel electrical control switch.

Another object of the invention is to provide a novel electrical control switch of the type comprising a movable bridging contact slidable with respect to spaced stationary contacts, for making and breaking the switch circuit, together with novel means on the bridging contact for increasing the wear life and current carrying capacity of the switch.

Another object of the invention is to provide an electrical control switch of the aforediscussed type wherein the means on the switch for increasing the wear life of the switch comprises a slot or groove formed on the leading end of the bridging contact, which prevents a build-up or accumulation of electrical resistance or insulating material on said contact face of the bridging contact.

Another object of the present invention is to provide an electrical control switch of the aforementioned type and wherein the slot or groove formed on the leading contact end of the bridging contact functions to channel or direct the flow of current between the bridging contact and its associated stationary contact so as to develop an electromagnetic field in the area of said slot which is effective to help extinguish any arc that may form upon opening or closing of the switch contacts.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a side elevation of the switch as assembled with a trigger assembly in for instance, a power tool, with the tool being illustrated in phantom lines;

FIGURE 2 is an end elevational view of the switch taken generally along the plane of line **2—2** of FIGURE 1, looking in the direction of the arrows;

FIGURE 3 is a top plan view of the switch and trigger assembly of FIGURE 1;

FIGURE 4 is an enlarged sectional view taken generally along the plane of line **4—4** of FIGURE 2, looking in the direction of the arrows, and with the switch being in an "off" or open circuit condition;

FIGURE 5 is an enlarged sectional view similar to FIGURE 4, but illustrating the bridging contact member having moved off the camming projection to bridge the stationary contacts and thus close the switch circuit to place the switch in "on" condition;

FIGURE 6 is a sectional view taken generally along the plane of line **6—6** of FIGURE 5 looking in the direction of the arrows;

FIGURE 7 is an enlarged side elevational detail view of the bridging contact member;

FIGURE 8 is a fragmentary, sectional view of a switch illustrating a different embodiment of the invention, and especially as concerns the cam mechanism for moving or pivoting one end of the bridging contact member upwardly.

Referring again to the drawings, there is illustrated in FIGURE 1 a tool **10**, having a switch and trigger assembly

14 mounted therein and embodying the present invention.

Mechanism 14 includes a trigger or switch actuator 16 which includes a portion 16*a* (FIG. 4) extending rearwardly from the trigger portion 16*b*, and which is adapted to be moved inwardly and outwardly with respect to switch housing 18. Stop 19 on switch housing 18 may be provided for limiting outward movement of actuator 16. Trigger 16 and switch housing 18 may be made of electrical insulating material, as shown, and a spring means 20 may be provided coacting between the housing 18 and abutment 22 on the actuator portion 16*a*, for normally maintaining the actuator 16 in an outward position with respect to the switch housing.

A spring biased pin or plunger 24 (FIGURE 1) may be provided which is adapted to be pushed inwardly and be received in holding engagement with abutment wall 26 of actuator portion 16*a* for holding the actuator in switch "on" position. Such spring biased plunger mechanism is well known in the switch art.

Referring now in particular to FIGURES 4 and 5, a pair of stationary electrical conducting contact members 28 and 28*a* are provided in the switch housing 18, with such contact members being adapted for engagement with conducting lines 30, 32, respectively. Clip means 34 may be provided for providing positive engagement of the bared wires of line conductors 30, 32 with the respective stationary contact member, said securement structure being known in the art as a "plug-in" terminal.

As can be seen in FIGURES 4 and 5 said clip means may comprise a flat elongated electrical conducting member held in position in the switch body by means of projections 33 preferably formed integrally with the housing on the switch interior partition 36.

As can be best seen in FIGURE 6, the switch has been illustrated as a type which makes and breaks contacts in both sides of an electrical energy source. In other words, there is a contact assembly including a pair of stationary contacts and a bridging contact, provided in each side of the line of electrical energy. Since the contact assembly is identical on both sides, only one will be described in detail, with those on the other side being designated by identical reference numbers with the prefix prime added thereto. Such contact assemblies are insulated from one another by means of the intermediate center wall or partition 37 of the switch body 18 and coacting longitudinal center wall 40 of actuator portion 16*a*.

The bridging contact member 38 with which the present invention is particularly concerned, comprises an elongated body portion of electrical conducting material, which bridging contact member is adapted to be received in a slot 44 formed in the actuator portion 16*a*, with such bridging member being movable with the actuator during inward and outward movements of the actuator into and out of the switch housing. A recess 46 may be provided in the upper periphery of bridging contact member 38 and is adapted to receive therein spring means 48, for a purpose to be hereinafter described.

Depending from adjacent the forward end of the bridging contact member 38 may be a foot portion 50 providing a generally flat contact face 50*a* on its underside, with the face being generally rounded as at 50*b* at the longitudinal ends thereof. A camming surface 52 is provided extending downwardly in a generally smooth curve from the body portion and ending at generally diagonal abutment 54. Rearwardly of abutment 54 there is provided generally flat contacting face 56 of the bridging contact member.

In accordance with the present invention the leading contact face 56 of contact 38 is provided with a recess 58 therein which recess configuration is preferably of the arcuate nature illustrated. Recess 58 is preferably located a distance Y from the rearward extremity of the bridging contact, which distance Y is approximately one-half the distance X. Accordingly, contact face portion 56*a* disposed forwardly of recess 58 is of a greater length than contact face portion 56*b* disposed rearwardly of recess 58.

Operation of the switch may be as follows: Inward movement of the actuator 16 causes abutment face 60 on the actuator to engage the bridging contact member 38 and move it forwardly or inwardly of the switch housing, with the forward movement of the actuator. Such forward movement causes the contact face 50*a* on the bridging contact to slide along and relative to the surface of stationary contact 28 and from the "off switch" position shown in FIGURE 4 wherein the projection 62 formed on housing partition 36 and extending upwardly therefrom maintains the bridging contact in an upwardly swung position with respect to the underlying stationary contact 28*a*, to the "on switch" position wherein the leading face 56 of bridging contact swings or pivots downwardly about the trailing contact end 50*a* under the influence of spring 48 into engagement with the surface of stationary contact 28*a*. It will be understood of course that during the movement of the actuator 16 and associated bridging contact 38 in the forward direction or to the right as shown in FIG. 4, the bridging contact slides over upon and relative to the projection 62 to thence carry the cam surface 52 of the bridging contact over said projection until the projection is received within the recessed area 66 (FIG. 7) of the bridging contact. Spring 48 causes the bridging contact to pivot or swing downward so as to enable the forward contact face 56 to drop onto the stationary contact 28*a* after which the said face 56 slides upon the surface of the contact 28*a*.

Outward movement of the actuator 16 and associated bridging contact members 38, 38′ with respect to the switch housing as caused by spring 20, causes the projection 62 to engage the cam surface 52 on the bridging contact and swing its leading contact face 56 upwardly out of engagement with the underlying stationary contact 28*a*. Such an arrangement and as set forth in the aforementioned U.S. Patent 3,222,488, provides for bringing the bridging contact into engagement with the stationary contact 28*a* without causing engagement of contacting face 56 on the bridging contact, with any insulating material of the switch housing.

Slot or groove 58 in contact face 56 has been found to prevent any build-up of a layer of electrical insulating or resistance material between the mating surfaces of the bridging contact and the stationary contact 28*a* which may be produced as a result of the making and breaking of the bridging contact with the stationary contact 28*a*. This resistance material layer has been heretofore known to collect on the contacting faces of said mating contacts and has shortened the service life of the switch as well as reducing the current carrying capability of the switch mechanism. It is believed that such resistance layer which heretofore may build up on the contacting faces of the contacts now is permitted to move into the aforementioned slot 58 during making and breaking of the switch contacts, thus maintaining the actual contacting face portions 56*a* and 56*b* in clean conditon.

Slot or groove 58 as best seen in FIG. 7, extends upward into the bridging contact to define or form separate contact face portions 56*a* and 56*b* thereon.

With this structural arrangement current flowing through the bridging contact is confined to said face portions 56*a* and 56*b* and around the slot or groove 58.

The sharp edges formed in the contacting face of contact 38 by slot 58 as identified at 58*b* and 58*c* also act to scrape the surface of the stationary contact 28*a*, 28*a*′ to retain said surface in a clean condition.

Inasmuch as the flow of current at any instant is in the same direction through each of said face portions 56*a* and 56*b* an electromagnetic field is believed to be generated in the area of the slot or groove 58 which is of sufficient density to prevent or extinguish any arc from developing or which tends to develop across the contact

making faces as the bridging contact is moved toward and away from the stationary contact **28***a*.

It is also believed that this electromagnetic field is operable to dislodge and pull the loose material forming the aforesaid resistance layer from between the contact making faces of contacts **38** and **28***a* to thus assist in maintaining the contacting surfaces of said contacts in a clean condition.

Referring now to FIGURE 8, there is shown a modification of the switch mechanism, and wherein the projection **62***a* for camming the bridging contact member upwardly in spaced relation with the underlying stationary contact **28***a* is formed integrally with the stationary contact **28** instead of being formed of electrical insulating material, as is projection **62** in the first described embodiment. In other respects, the FIGURE 8 embodiment is generally identical to the first described embodiment.

From the foregoing description and accompanying drawings it will be seen that the invention provides a novel electrical switch of the stationary and bridging contact type, wherein the bridging contact is adapted to be cammed upwardly to open the switch in the "off" position of the switch, and is adapted to drop or move downwardly to engage an underlying stationary contact in the "on" position of the switch to thus bridge the stationary contact in electrical conducting relation, and wherein the contacting face of the pivotal end of the bridging contact member is provided with means for preventing the accumulation of electrical energy resistance means thereon, thereby increasing the service life of the switch mechanism and increasing the current carrying capability of the switch.

In actual tests performed on the instant switch assembly for purposes of obtaining underwriter's approval, the accepted current carrying capacity of said switch for use in 110 volt environment is sixteen (16) amperes as compared to the accepted current capability of ten (10) amperes for a prior similar switch structure with a bridging member without the slot or groove **58** of the instant assembly; the accepted increase in capacity being over fifty percent.

The terms and expressions which have been used are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of any of the features shown or described, or portions thereof, and it is recognized that various modifications are possible within the scope of the invention claimed.

I claim:

1. In a electrical switch of the type comprising spaced stationary contacts and a movable bridging contact adapted to move relative to the stationary contacts, with the bridging contact being movable from an off position wherein the bridging contact is spaced from at least one of the stationary contacts, to an on position wherein the bridging contact engages the stationary contacts in electrical conducting relation, the combination therewith of the bridging contact having at least one contacting face adapted to engage one of the stationary contacts and a recess formed in said contacting face, said recess being spaced forwardly therein with respect to the rearward extremity of said bridging contact approximately one-half

the distance between the rearward extremity of said bridging contact and the forward extremity of said one contacting face.

2. In an electrical switch of the type comprising spaced stationary contacts and a movable bridging contact adapted to move relative to the stationary contacts, with the bridging contact being movable from an off position wherein the bridging contact is spaced from at least one of the stationary contacts, to an on position wherein the bridging contact engages the stationary contacts in electrical conducting relation, the combination therewith of a projection formed integral with one of the stationary contacts postioned to engage said bridging cotnact and cam it upwardly away from engagement with said one stationary contact.

3. A switch in accordance with claim **2** and wherein said projection is of electrical conducting material.

4. In an electrical switch of the type comprising spaced stationary contacts and a movable bridging contact adapted to move relative to the stationary cotnacts, with the bridging contact being movable from an off position wherein the bridging contact is spaced from at least one of the stationary contacts, to an on position wherein the bridging contact engages the stationary contacts in electrical conducting relation, the combination therewith of means on said bridging cotnact for preventing accumulation of electrical resistance material theeron, cam means for camming said bridging contact away from said one stationary contact and resilient means coacting with the bridging contact for urging the bridging contact into engagement with said one stationary contact, said resilient means being disposed forwardly of said camming means with the bridging contact in said off position, the forward one of said contacting faces is of a lesser lengthwise dimension than the rearward of said contacting faces, said means for preventing the accumulation of electrical resistance material comprising a recess extending inwardly of said bridging contact from said rearward contacting face and intermediate the lengthwise extremities of said rearward contacting face.

5. A switch in accordance with claim **4** and wherein means defining a slot in said bridging contact receives said resilient means therein in retained relation.

6. A swtch in accordance with claim **4** and wherein the bridging contact comprises lengthwise spaced contacting faces thereon, means on said bridging contact intermediate said faces coacting with said resilient means in retaining relation, the last mentioned means being disposed forwardly of the transverse center plane of said bridging contact.

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H. BURKS, *Assistant Examiner.*

U.S. Cl. X.R.

200—157, 166