United States Patent

[11] **3,594,523**

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[54] **ELECTRIC SWITCH WITH BRIDGING CONTACT**
8 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **200/157,** 200/16 A, 200/164 A
[51] **Int. Cl.** **H01h 13/64**
[50] **Field of Search** 200/157, 16, 164

[56] **References Cited**

UNITED STATES PATENTS

Re. 26,267	9/1967	Matthews	200/76 X
3,456,230	7/1969	Matthews et al.	200/157
3,484,632	12/1969	Opalenik et al.	200/157 (X)

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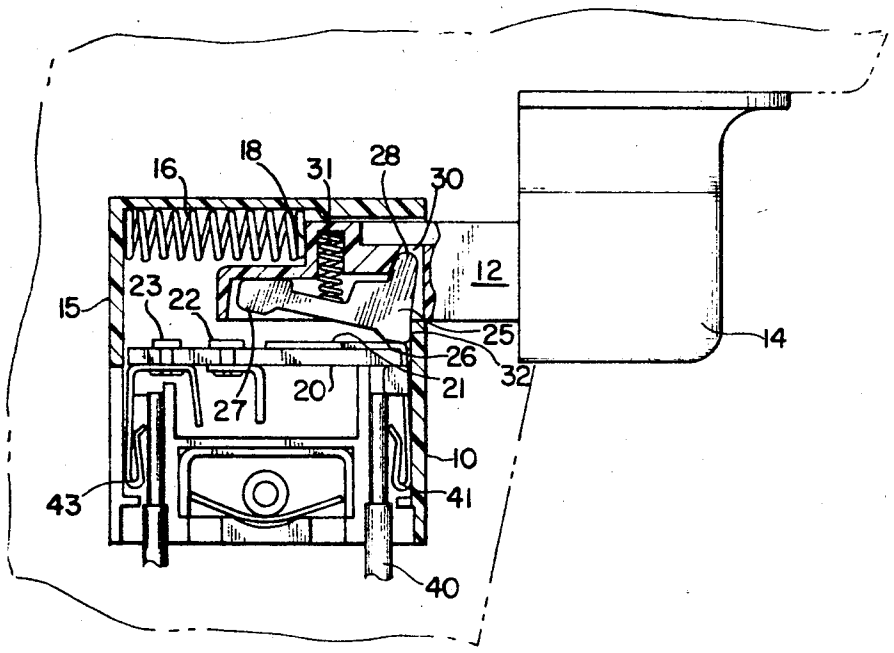
ABSTRACT: An actuator in the form of a trigger moves a bridging contact back and forth between bridging and non-bridging positions with respect to a pair of fixed contacts mounted in spaced relation on a dielectric base. A fixed abutment surface is provided adjacent one of the fixed contacts. The bridging contact includes an abutment surface arranged to engage the fixed abutment surface for defining a fulcrum about which the bridging contact is rocked. The actuator and the bridging contact include respective interengaged formations for rocking the bridging contact about such fulcrum thereby to swing a portion of the bridging contact into and away from engagement with the other fixed contact.



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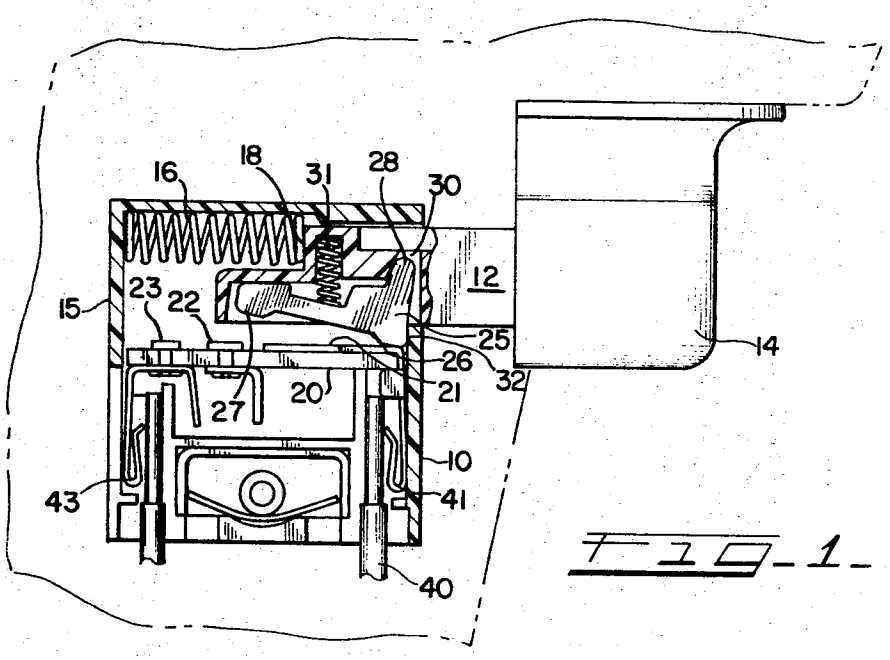

FIG. 1

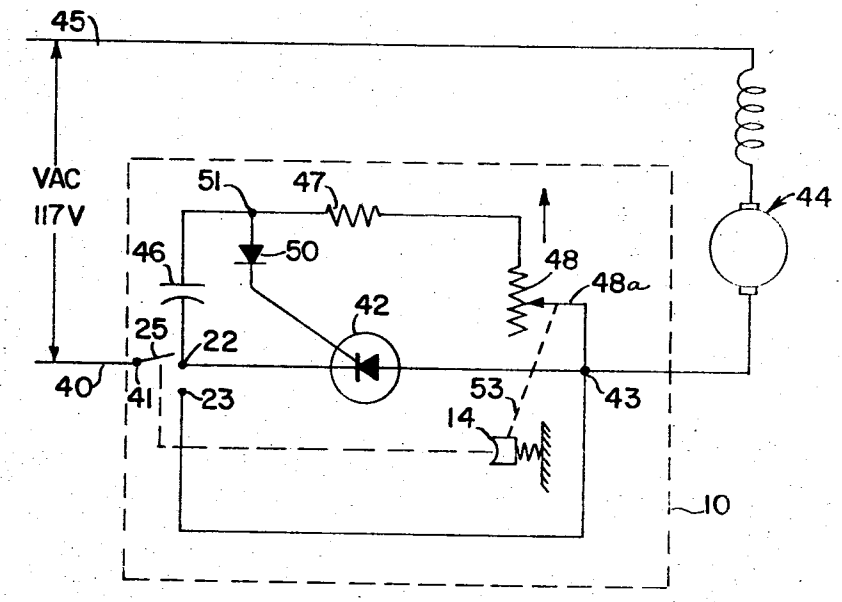

FIG. 2

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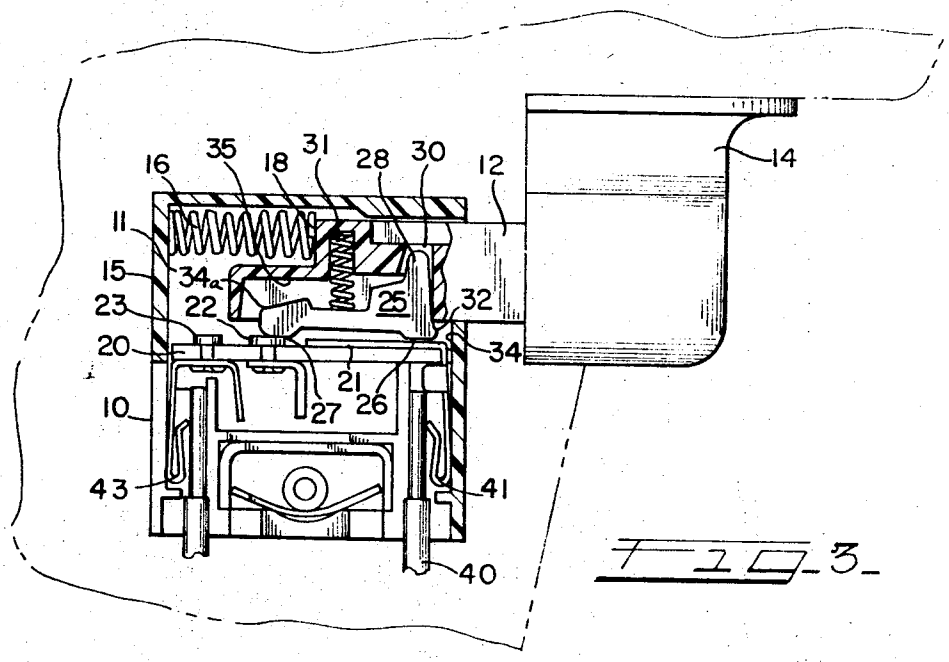

FIG. 3

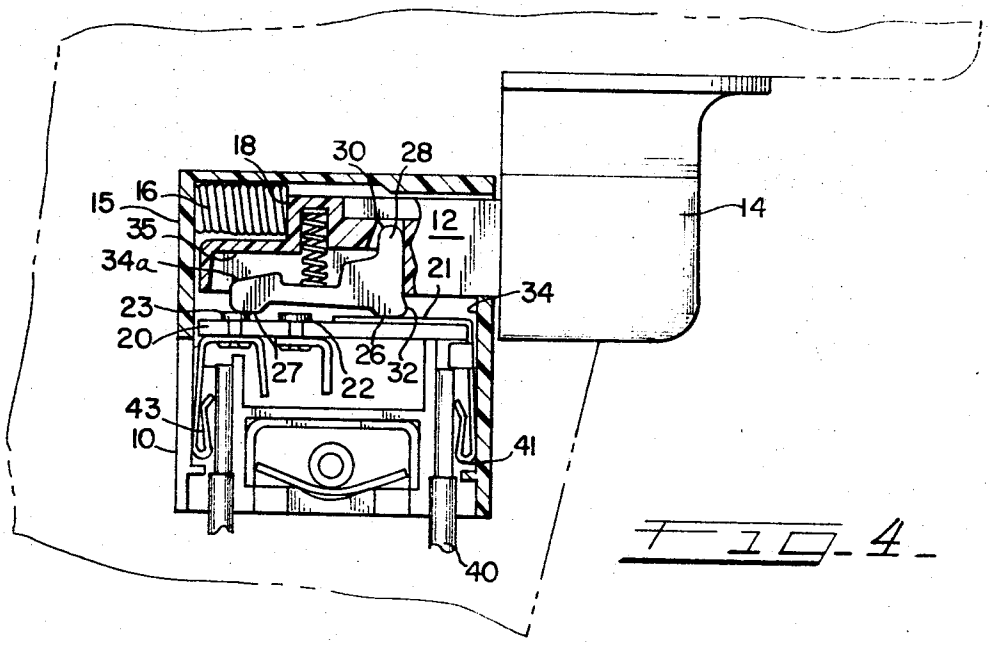

FIG. 4

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ELECTRIC SWITCH WITH BRIDGING CONTACT

BACKGROUND OF THE INVENTION

The present invention has to do with improvements in electric switches of the type e.g., as shown in Matthews U.S. Pat. No. Re. 26,267, wherein a bridging contact is slid between bridging and nonbridging positions with respect to a pair of fixed contacts mounted in spaced relation on a dielectric base. The bridging contact includes a pair of spaced contact faces arranged for simultaneous engagement with respective fixed contacts thereby to define the bridging position of the bridging contact. One of these contact faces may slide along the associated fixed contact and remain in engagement with the same at all times. When the other of these contact faces engages the other fixed contact, the switch is closed for closing the associated circuit and energizing a load device, such as an electric motor. It is desirable that this other contact face be maintained in substantial spaced relation from the other fixed contact to define the open or "off" position of the switch. When it is desired to close the switch and circuit, it is desirable that such other contact face be brought into engagement with the other fixed contact in a quick and positive manner. This same quick and positive action is also desirable upon opening of the switch.

OBJECTS OF THE INVENTION

A primary object of the present invention is the provision of an electric switch including a bridging contact movable with respect to a pair of fixed contacts, wherein one end of the bridging contact is moved into and out of engagement with one of the fixed contacts in a fast and highly effective manner.

Another object of the present invention is the provision of a switch of the type described wherein the bridging contact includes a pair of spaced contact faces and wherein means are provided for rocking such bridging contact about one of its contact faces thereby to move the other contact face into and out of engagement with an associated fixed contact.

Still another object of the present invention is the provision of a switch according to the foregoing object wherein a fixed abutment surface engages an abutment surface on the bridging contact thereby to define a fulcrum for rocking the bridging contact thereabout.

Another object of the present invention is the provision of a switch of the type described wherein the bridging contact cooperates with the fixed abutment surface and with formations on the actuator to define a positive stop for the latter.

These and other objects and advantages of the invention will become apparent from the following specification disclosing a preferred embodiment shown in the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial side elevation and partial section of an electric switch embodying the present invention, the switch being shown "off" position;

FIG. 2 is an electrical schematic showing a circuit for utilizing the switch shown in FIG. 1;

FIG. 3 is a partial side elevation and partial section similar to FIG. 1 and showing the switch in the "on" position; and

FIG. 4 is a partial side elevation and partial section similar to FIG. 3 and showing the switch in a "bypass" position.

DESCRIPTION OF A PREFERRED EMBODIMENT

For purposes of illustration, the present invention is shown embodied in a trigger actuated speed control switch for a power device, such as a hand-operated electric drill. The switch device includes a casing or housing **10** having an upper portion defining a slideway or tunnel **11** slidably receiving the stem **12** of a trigger **14**. The casing has a backwall **15** in abutting engagement with one end of a coil spring **16**. The other end of this spring is in abutting engagement with a surface **18** on the stem **12**. The spring **16** acts to urge the trigger **14** to its outward or extended position, i.e., to the right as viewed in FIG. **1**.

The casing **10** mounts a dielectric base **20** supporting an elongated contact strip **21**. This base also supports a pair of contact buttons **22, 23** in longitudinal alignment with the contact strip **21**.

The stem **12** includes a cavity receiving a bridging contact **25**. This bridging contact has a pair of spaced contact faces **26, 27**. The bridging contact also has an upstanding formation in the nature of an ear **28**; this ear is received within a pocket or cavity **30** formed in the stem **12**. The pocket is somewhat larger than the ear thereby permitting the latter to rock in the former for defining a pivotal connection between the bridging contact and the trigger. A coil spring **31** has one end thereof received within a blind bore in the stem **12**; the other end of this spring engages the bridging contact for urging the same downwardly in the position shown in FIGS. **3** and **4**.

The bridging contact **25** has an abutment surface **32** arranged for abutting engagement with a fixed abutment surface **34** which is constituted by a portion of the front wall of the casing **10**. The bridging contact includes another formation or abutment surface **34*a*** which is arranged to abut a surface **35** formed in the cavity in the stem **12** of the trigger **14**.

The spring **16** urges the trigger **14** to the right, i.e., to the extended position shown in FIG. **1**. Movement of the trigger in this direction is stopped by reason of engagement of the bridging contact surface **34*a*** with the trigger surface **35**, by engagement of the ear **28** with the pocket **30**, and by engagement of the abutment surfaces **32, 34**. At this time, it should be pointed out that the engagement between the surfaces **32, 34** defines a fulcrum for rocking or pivoting movement of the bridging contact **25**. As just explained, it is understood the bridging contact serves to define a stop for limiting outward movement of the trigger **14**.

When the trigger is in the fully extended position, it is noted that the contact face **26** is in engagement with the contact strip **21**. However, when the trigger is in this position, the contact face **27** is in substantial spaced relation with the contact button **22**. This arrangement of the various parts defines the open or "off" position of the switch.

As the trigger is squeezed or depressed, by reason of the engagement of the pocket **30** with the ear **28**, the bridging contact **25** will be rocked or swung about the fulcrum point just described, bringing the contact face **27** into engagement with the contact button **22**; this establishes the closed or "on" position of the switch. The contact face **27** will be brought into engagement with the contact button **22** in a rapid and positive manner. In this respect, it will be noted that the contact face **27** is at a much greater distance from the fulcrum point than the ear **28**. FIG. **3** illustrates the condition of the parts when the switch is in the "on" position. The spring **31** aids in maintaining the contact faces of the bridging contact in engagement with respective contacts **21, 22**.

As the trigger **14** is continued to be depressed, the bridging contact **25** slides along the fixed contacts **21, 22** until the contact face **27** passes from the contact button **22** and comes into engagement with the contact button **23**. This arrangement of the parts is illustrated in FIG. **4**. In this position, the trigger is fully depressed or squeezed to establish a "bypass" position as will be explained hereinbelow.

The switch which incorporates the present invention may be used in association with the speed control circuit shown and claimed in Gawron U.S. Pat. No. 3,209,228; this circuit is shown in FIG. **2** herein. One line **40** of conventional house or line alternating current is connected to a terminal **41**. The contact **22** is connected to the cathode of a silicon controlled rectifier or other controllable semiconductor **42**. The anode of the silicon controlled rectifier **42** is connected to a terminal **43**; this terminal is connected to one terminal of a series wound motor **44**. The other terminal of this motor is connected to the other line **45** of the alternating current power source. A capacitor **46**, a fixed resistor **47** and a variable re-

sistor **48** are connected in series between the contact **22** and terminal **43**. A diode **50** is connected in a line between the gate of the silicon controlled rectifier **42** and a point **51** between the fixed resistor **47** and capacitor **46**.

It will be understood that the movable element **48***a* of the variable resistor **48** is moved in a direct or positive manner by the trigger **14** by means of a suitable mechanical element **53**. This element **48***a* may be a contact slider similar to the bridging contact **25** and arranged for sliding movement (in response to trigger movement) along a carbon strip (not shown) mounted on the dielectric base **20** in spaced parallel relation with the elongated contact strip **21**.

As the trigger **14** is initially depressed, the bridging contact face **27** engages the contact button **22** (the bridging contact face **26** is always in engagement with the contact strip **21**) for energizing the motor **44** through the speed control circuit. As more fully explained in the aforementioned Gawron patent, operation of the trigger varies the resistance of the variable resistor for controlling the firing angle of the SCR **42** thereby to vary the current supplied to the motor **44** for controlling the speed thereof in a continuously variable manner in response to trigger movement. As the trigger **14** reaches its fully depressed position, the bridging contact face **27** engages the contact button **23** thereby bypassing the speed control circuit and energizing the motor directly from the current source.

At this time it should be mentioned that the present invention is not to be limited for use with a variable speed control switch; the invention has applicability inn a switch which simply opens and closes a circuit, i.e., an on-off switch.

It should be apparent the present invention provides a new and improved means for making and breaking contacts in a switch of the type described. By reason of the positive action achieved by rocking the bridging contact **25** about the fulcrum defined by the abutment surfaces **32**, **34**, the circuit is closed in a positive manner preventing arcing and pitting of the contact faces **22**, **27**. During return movement of the trigger, the contacts are separated abruptly, again to prevent arcing and pitting. The bridging contact according to the present invention also serves as a stop to limit outward movement of the trigger.

I claim:

1. In an electric switch, in combination, a dielectric base, at least a pair of fixed contacts mounted on said base in spaced relation, a first abutment surface fixed with respect to said base and being adjacent one of said fixed contacts, a bridging contact having ends defining a pair of contact faces which are spaced for simultaneous engagement with said fixed contacts, respectively, said bridging contact having a first formation defining a second abutment surface which is nearer one of said contact faces than the other of said contact faces, said bridging contact having a second upstanding formation adjacent the end thereof defining said one contact face, an actuator movable relative to said base to and from an off position, means on said actuator connecting the latter with said upstanding formation such that movement of said actuator to its off position brings said first and second abutment surfaces into engagement with each other thereby to define a fulcrum for rocking said bridging contact in a first direction in a plane perpendicular to said base about said one contact face with the latter in engagement with said one fixed contact whereupon said other contact face is swung away from the other of said fixed contacts, said connecting means serving to rock said bridging contact said plane in a second direction opposite said first direction in response to movement of said actuator from its off position thereby to swing said other contact face into engagement with said other fixed contact with said one contact face in engagement with said one fixed contact.

2. The combination according to claim **1** wherein said second formation includes an ear integral with said bridging contact and wherein said connecting means includes a pocket in said actuator with said ear received therein.

3. The combination according to claim **1** further defined by, spring means engaged with said actuator for urging the same to its off position wherein said other contact face is rocked away from said other fixed contact, said bridging contact having another formation adjacent said other contact face, said actuator having a formation arranged to be engaged by said another formation on said bridging contact only when said actuator is in its off position and thereby acting as a stop for limiting movement of said actuator under the influence of said spring means.

4. The combination according to claim **2** further defined by, spring means interposed between said actuator and said bridging contact for urging said other contact face into engagement with said other fixed contact.

5. In an electric switch including a dielectric base, at least a pair of fixed contacts mounted on said base in spaced relation, a bridging contact having ends defining contact faces spaced for simultaneous engagement with said fixed contacts, respectively, an actuator slidably movable relative to said base to and from an off position, the improvement for rocking said bridging contact about one of said contact faces when such face is in engagement with one of said fixed contacts thereby to raise and lower the other of said contact faces away from and into engagement, respectively, with the other of said fixed contacts comprising, a fixed abutment surface adjacent said one fixed contact, said bridging contact having an abutment surface spaced nearer said one contact face than said other contact face, said bridging contact having an upstanding formation, means on said actuator and engaged with said upstanding formation thereby defining a pivotal connection between said bridging contact and said actuator such that sliding movement of the latter imparts corresponding sliding movement to the former and permits rocking movement of said bridging contact in its own plane which is perpendicular to said base, movement of said actuator to its off position serving to bring said first and second abutment surfaces into engagement with each other thereby to define a fulcrum for rocking said bridging contact in said plane in a first direction about said one contact face with the latter in engagement with said one fixed contact whereupon said other contact face is swung away from the other of said fixed contacts, movement of said actuator away from its off position serving to rock said bridging contact in said plane in a second direction opposite said first direction whereupon said other contact face is swung into engagement with said other fixed contact with said one contact face in engagement with said one fixed contact.

6. The improvement according to claim **5** wherein said second formation includes an ear integral with said bridging contact and wherein said pivotal connection means includes a pocket with said ear received therein.

7. The improvement according to claim **5** further defined by, spring means engaged with said actuator for urging the same to its off position wherein said other contact face is rocked away from said other fixed contact, said bridging contact having another formation adjacent said other contact face, said actuator having a formation arranged to be engaged by said another formation on said bridging contact only when said actuator is in its off position and thereby acting as a stop for limiting movement of said actuator under the influence of said spring means.

8. The improvement according to claim **6** further defined by, spring means interposed between said actuator and said bridging contact for urging said other contact face into engagement with said other fixed contact.