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I. STRAUSS

3,284,594

ELECTRICAL SWITCH WITH EXTENDING CONTACT ARM

Original Filed Aug. 24, 1959

Fig. 1.

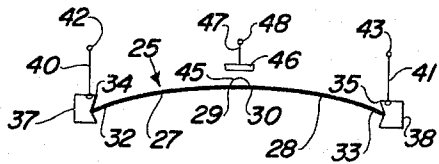


Fig. 2.

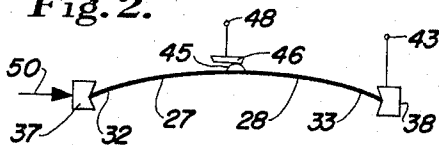


Fig. 3.

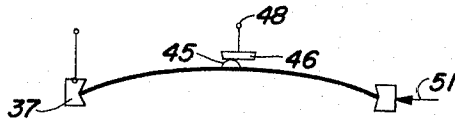


Fig. 4.

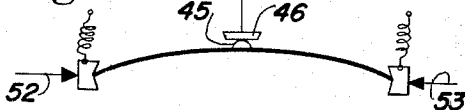


Fig. 5.

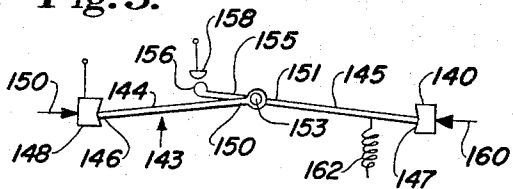


Fig. 6.

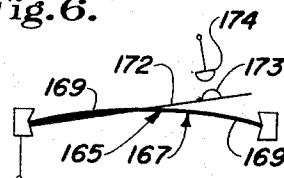


Fig. 7.

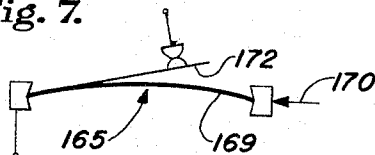


Fig. 8.

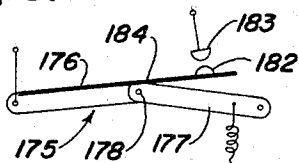
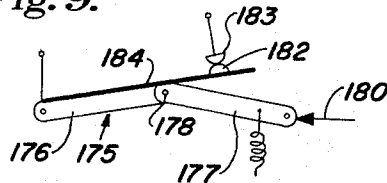


Fig. 9.



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ELECTRICAL SWITCH WITH EXTENDING CONTACT ARM

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Original application Aug. 24, 1959, Ser. No. 835,631, now Patent No. 3,109,901, dated Nov. 5, 1963. Divided and this application Nov. 4, 1963, Ser. No. 321,205 2 Claims. (Cl. 200-67)

This application is a division of my co-pending application Ser. No. 835,631, filed August 24, 1959, now Patent No. 3,109,901.

This invention relates to electrical switches, and more particularly to switches of the general class wherein the contact making member or means has a rate and extent of movement which is different from that of the operator member to which the operating force is directly applied.

An object of the present invention is to provide an improved electrical switch device wherein there is a large ratio between the movements of the contact-carrying member and the switch operating member while at the same time the switch structure is extremely simple, uncomplicated and economical to fabricate and manufacture.

Another object of the invention is to provide an improved and simplified quick-acting type electrical switch, wherein only a relatively small and slow operating movement is required to effect a quick-acting, large-magnitude movement of the contact means.

A further object of the invention is to provide an improved electrical switch in accordance with the foregoing, wherein one or several circuits may be controlled to either open or close the same with but extremely little force being required on the switch operator.

An additional object of the invention is to provide an improved switch mechanism as above characterized, having a large ratio of movement together with extreme simplicity, wherein there is obtained a desirable wiping action of the contacts, thereby to normally maintain the same in relatively clean and operative condition throughout an extended period of use.

A still further object of the invention is to provide an improved electrical switch device as set forth above, which may employ either a direct or indirect actuating or operating system and which is characterized by an elongate actuator device placed in operation by the application of a longitudinally directed force to either one or both ends of said device, to translate said force into a lateral movement of a portion of the device for causing circuit-controlling movement of one or several electrical contacts carried thereby.

Still another object of the invention is to provide an improved momentary-contact switch construction employing an elongate actuating device as outlined, wherein an inherent spring action is had, thereby to obviate the necessity for additional components for the purpose of returning the switch to an initial or starting position.

An additional object of the invention is to provide an improved simplified elongate switch actuator device as characterized, wherein a large ratio of movement exists between the relatively longitudinally directed end force which is applied to the device and the resultant lateral movement of the contact or contacts carried by the device.

A further object of the invention is to provide a novel and improved switch construction involving opposed or balanced operating forces, wherein a self-locking action is had for one position of the switch operator, and wherein the switch may be tripped either to open or close the circuit with but the application of a very small operating force.

Yet another object of the invention is to provide an im-

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proved switch construction having opposed or balanced forces as above stated, wherein the switch may be sustained in one operative position by the application of only very small or minute forces.

A feature of the invention resides in the provision of an improved switch construction which is extremely sensitive in its response and may be operated by the application of relatively small forces while at the same time there are produced high contact pressures between the cooperable contact elements.

Another feature of the invention resides in the provision of a novel and improved switch adapted for momentary contact service, wherein either single or multiple circuits may be controlled and switched either on or off by an actuator mechanism involving either balanced or unbalanced operating forces, such switch mechanism having a "dead center" position and being operable either to one side or both sides of the said center position.

A further feature of the invention resides in the provision of a novel and improved switch arranged for sustained-contact service, which may handle either single or multiple electrical circuits to switch the latter on or off utilizing a switch actuator mechanism having either balanced or unbalanced operating forces.

Other features and advantages will hereinafter appear.

In the drawings accompanying this specification similar characters of reference are used to designate like components wherever possible throughout the several views, in which:

FIG. 1 is a diagrammatic representation of a simple, single pole single throw switch mechanism shown in open-circuit position.

FIG. 2 is a view like FIG. 1, but showing the switch as having been actuated to closed-circuit position by a longitudinal force on one of the switch blade mounting means, shifting said means toward the other blade mounting means.

FIG. 3 is a view like FIGS. 1 and 2, but showing the switch in closed-circuit position in response to the application of a longitudinal actuating force to the other end of the blade mounting means.

FIG. 4 is a view like FIGS. 1, 2 and 3, but showing the switch as having been closed in response to longitudinal actuating forces applied to both of a blade mounting means.

FIG. 5 is a diagrammatic representation of a single-circuit switch device as provided by the invention using rigid members or arms in place of resilient or bowed members as disclosed in the previous figures.

FIG. 6 is a diagrammatic representation of a single-circuit switch mechanism, illustrating yet another embodiment of the invention characterized by a very large ratio of movement between the switch contact and the switch operator.

FIG. 7 is a view like FIG. 6, but showing the switch in its closed-circuit position.

FIG. 8 is a diagrammatic representation of still another switch mechanism as provided by the invention, having a very high ratio of movement utilizing non-resilient or rigid pin-connected actuator arms.

FIG. 9 is a view similar to that of FIG. 8, but showing the switch in its closed-circuit position.

An understanding of the basic action underlying the switch mechanism of the present invention may be readily had by first referring to the structures shown in FIGS. 1-4. As illustrated in these figures, the switch comprises an elongate resilient blade member indicated generally by the numeral 25, said member being also hereinafter referred to as an "elongate actuator device." While in FIGS. 1-4 and in other illustrated embodiments of the invention the elongate actuator device is constituted of a single resilient strip, the invention is not limited to such

construction since the actuator device may be formed of a number of separate parts, as for example rigid arms pivotally connected together as described in detail below.

The elongate actuator device 25 may thus be considered as constituted of a pair of substantially aligned actuator arms 27 and 28, having juxtaposed ends or end portions 29 and 30 respectively, the said end portions being operatively connected together. In the illustrated embodiments of FIGS. 1-4 the end portions 29, 30 of the arms 27, 28 are integral with each other, and accordingly the operable connection between said end portions is characterized by a certain degree of flexibility but with no looseness, free pivotal movement or play of any kind. As will be hereinafter brought out, in other forms of the invention the two arms making up the elongate actuator device may be pivotally secured together as by means of suitable pin connections.

As shown, the remote ends 32 and 33 of the arms 27, 28 are received in sockets 34 and 35 respectively provided in end mounting means or members 37, 38. The end mounting means 37 and 38 may be connected by suitable leads 40 and 41 with electrical terminals 42, 43, as shown.

In order to illustrate the wiping action of the contacts in a simple way, juxtaposed end portions 29, 30 of the arms 27, 28 are shown with an electrical switch contact 45 secured to them. This contact is cooperable and engageable with a stationary electrical contact 46 connected by means of a lead 47 with an electrical terminal 48. It is to be noted that while for illustrative purposes the contact 45 is described as a separate part secured to the arms, the present invention nevertheless contemplates the provision of a contact surface which is on a separate arm or extension.

The elongate actuator device comprising the bowed flexible strip 25 may be formed of any suitable material, such as spring steel, spring brass or bronze, beryllium copper, stainless steel, etc. As illustrated in the figures, the actuator or strip 25 is always bowed, either to a greater or lesser extent, regardless of whether the switch contacts 45, 46 are engaged or separated. In FIG. 1 the switch contacts are shown in their separated positions, and in accordance with the present invention closure of the switch and engagement of the contacts 45, 46 is effected in response to the application of a longitudinally directed operating force on either one or else both of the mounting means 37, 38.

In FIG. 2, such operating force is represented by the arrow 50, applied to the left mounting member 37. In FIG. 3 the arrow 51 represents the longitudinal operating force applied to the right mounting means 38. In FIG. 4 the arrows 52 and 53 represent operating forces applied to both of the end mounting means 37, 38. Referring to FIG. 2, the application of the force 50 will cause an increased flexing of the actuator device 25, whereby the center portion thereof, constituted of the arm ends 29, 30 and the switch contact 45, will be shifted laterally of the actuator device and in an upward direction until the contact 45 engages the cooperable stationary contact 46.

It will be noted that the movable contact 45 has shifted edgewise a slight extent to the right from a centralized position, and part of such shifting will occur after engagement of the contacts 45, 46 has occurred, thereby resulting in a wiping action of the contacts which is desirable in maintaining the same in a clean and bright condition, and in removing foreign particles and matter which might collect at the contacts.

In FIG. 3 the movable contact 45 has been shifted from its centralized position to the left, effecting a left wiping action when the switch is closed. In FIG. 4, the operating forces 52, 53 may be substantially balanced whereby the movable contact 45 will shift neither to the right nor to the left, and with this construction there is no appreci-

able wiping action present. In circumstances where extremely small currents and voltages are being handled, the absence of a wiping action is not a disadvantage, and accordingly the embodiment illustrated in FIG. 4 would find an application for such uses.

It will be seen that with the switch construction illustrated in FIGS. 1-4, a relatively small movement of either or both of the end mounting means 37, 38 will result in a correspondingly greater lateral movement of the movable contact 45 whereby a desirable movement multiplying action is had. Thus, in response to a relatively short travel of one or both of the end mounting means, the movable contact may be caused to travel a correspondingly greater extent, and also to more rapidly move into engagement with the stationary contact 46. Conversely, upon the removal of the operating force from the mounting means, the spring action of the actuator device 25 will restore it to the initial flexed condition shown in FIG. 1, and opening of the switch will be characterized by a relatively rapid movement of the contact 45 together with a great extent of movement, as compared with the movements of the end mounting means 37, 38. As is well-known in certain applications, the rapid separation of contact points or surfaces is beneficial in minimizing arcing, sparking and the like, and the present switch construction by virtue of the quick-break action, also has an advantage in this respect. In conjunction with the large ratio of movements, the quick-acting make and break and the wiping action of the contacts, the switch construction shown in FIGS. 1-4 has the added advantage of an inherent return force without requiring the utilization of separate springs or other biasing means, since the bowed member 25 may be formed with the desired bias to effect separation of the contacts 45, 46 upon removal of the operating force from the end mounting means.

While the basic principles of operation of the switch have been described with reference to the simplified embodiments shown in FIGS. 1-4, the invention is shown more exactly in FIGS. 5-9. In accordance with the invention, the electrical contact indicated by reference character 45 in FIGS. 1-4 is not carried on the juxtaposed arms directly but instead is mounted on a separate arm which is attached to one of the juxtaposed arms, thus permitting a great variety of choices of material and arrangements of arms to be made in order to arrive at the best mechanical and electrical operation and in order to achieve an improved operation over that of the simple structure of FIGS. 1-4.

One embodiment of the invention is illustrated in FIG. 5, wherein the elongate actuator device 143 comprises a pair of rigid arms 144, 145, the remote ends of said arms being received in sockets 146, 147 respectively of and mounting means 148, 149. The juxtaposed end portions 150, 151 of the rigid arms 144, 145 may be operatively connected together by a pivotal connection employing a pivot pin 153. One actuator arm, as for example, the arm 145 shown in FIG. 5 may have an extension 155 provided with a movable contact 156 which is cooperable with a stationary contact 158. Upon the application of an operating force to one or both of the end mounting means, as indicated by the arrows 160 in FIG. 5, the movable contact 156 will be shifted laterally with respect to the actuator device, and will be brought into engagement with the stationary contact 158, thereby to close the switch circuit. With this construction, a greater mechanical advantage or multiplication of movement is had than in the simple arrangements of FIGS. 1-4, whereby a larger and faster movement of the contact 156 is experienced with respect to the movement of the end mounting means 148, 149 as effected by the operating force 160. A return spring 162 may be provided, to effect opening of the switch circuit and straightening of the actuator arms 144, 145 upon removal of the operating force 160.

Another embodiment of the invention is illustrated in

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FIGS. 6 and 7. In this form, an elongate actuator device 165 is provided, in the form of a bowed strip, and such strip may be considered as being constituted of two actuator arms, each arm comprising a half of the strip. Thus, the center portion 167 of the strip 165 may be thought of as the junction or connection between the two actuator arms, which latter have been labeled 168 and 169 in the figures. Therefore, the juxtaposed end portions of the actuator arms 168, 169 may be thought of as being operatively connected together at the mid-point 167 of the actuator device 165, insofar as the action and functioning of the said device is concerned. For, the center portion 167 of the actuator device will be shifted laterally at a greater speed and with a greater travel than one of the end mounting means of the switch mechanism, upon the application of an operating force (as shown by the arrow 170 in FIG. 7) thereto. Thus, the action of the elongate actuator device 165 is similar in many respects to the other forms of the invention described above. In FIGS. 6 and 7 a separate contact carrying arm 172 is provided, having a movable contact 173 cooperable and engageable with fixed contact 174, the arm 172 being secured to an end portion of the actuator device 165. In the figures, the contact carrying arm 172 is shown as secured to the left end portion of the actuator device. With this organization there is retained the resilient or spring action characteristic of a bowed actuator device, while at the same time an even greater ratio of movement exists between the movable contact and the end mounting means to which the operating force is applied. Also, there is present a wiping action of the contacts upon their being engaged, and dimensions need not be critical inasmuch as the contact carrying arm 172 may also be made resilient, whereby it can yield after effecting engagement between the contacts 173 and 174. A single operating force is indicated at 170, resulting in an unbalanced arrangement. It will be understood, however, that with regard to the structures shown in FIGS. 5, 6 and 7, a balanced organization may be provided by duplicating these structures and arranging them in alignment with each other. A toggle-type operator may then be employed, or else a cam-type operator. Thus, a balanced force or opposed force system may be had with the attendant advantages already mentioned above.

Still another embodiment of the invention is illustrated in FIGS. 8 and 9, wherein an elongate actuator device 175 is provided, having rigid arms 176, 177 which are pin connected together with a pin 178. The arms 176, 177 may be pivotally mounted at their remote ends, and an operating force 180 may be applied to one of the pivotal mounting pins, to effect lateral movement of the center portion of the actuator device, where the pivot pin 178 is located. A contact carrying arm 182 may be provided, secured to one of the actuator arms 176, 177, said carried being provided with a movable contact 182 which is cooperable with a stationary contact 183, as shown. In FIGS. 8 and 9 the contact carrying arm or extension 184 is illustrated as carried by the left actuator arm 176 of the switch mechanism, and the contact carrier may be either rigid or else resilient, as will be understood. With this organization as with the embodiment of FIGS. 6 and 7, an added mechanical advantage is had in that an even greater ratio of movement exists between the operating force 180 and the movable contact 182. As shown, a return spring is provided to open the switch circuit and straighten the actuator arms 176, 177 upon removal of the operating force 180.

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While in the description the contacts have been usually set forth as comprising separate parts, it is to be understood that the contacts may be an integral part of the switch arms, which themselves will then provide contact surfaces to equal advantage.

From the foregoing it will now be understood that I have provided by the present invention an extremely simple, sensitive and efficient electrical switch mechanism wherein relatively small operating forces are required while at the same time effecting high contact pressures. The switch mechanisms are characterized by rapid make and break, and a high ratio of movement between the cooperable contacts and the operating force applied to operate the switch. In conjunction with these advantages there is also had a wiping action of the contacts, together with a simple, inherent spring action for effecting return of the members to their initial positions. Switch mechanisms employing opposed or balanced operating forces and also unbalanced forces are illustrated, and the balanced or opposed-force type of mechanism may be self-locking in one position and may be tripped with the application of a very small operating force, and also maintained in one position by a small operating force.

Variations and modifications may be made within the scope of the claims, and portions of the improvement may be used without others.

I claim:

1. In an electrical switch, an elongate actuator device comprising a pair of substantially aligned actuator arms having juxtaposed ends operatively connected together, at least one of the said arms being conductive; electrical terminal means mounting the remote end of said one of said arms and means mounting the remote end of the other of said arms to enable the arms to have relative, substantially angular movement whereby the said juxtaposed ends may shift laterally of the device, at least one of said mounting means being movable in directions substantially directly toward and away from the other mounting means to effect the said lateral shifting of the juxtaposed ends and angular movement of the arms; a conductive extension on said one actuator arm and having a free end extending beyond the juxtaposed end of said one actuator arm; and an electrical switch contact on said extension near said free end to move therewith for controlling an electrical circuit.

2. The invention as described in claim 1, in which the actuator arms are rigid and relatively inflexible and have their said juxtaposed ends pivotally connected together, and in which the means mounting the remote ends includes hinge pins engaged with the said ends.

References Cited by the Examiner

UNITED STATES PATENTS

1,215,665	2/1917	Landis.	
1,439,231	12/1922	Erickson.	
2,077,362	4/1937	Holm.	
2,639,352	5/1953	Watson	----- 200—83 X
2,917,932	12/1959	Kline.	
2,923,787	2/1960	Nelson.	

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