Nov. 6, 1962 T. Y. KORSGREN, SR., ETAL 3,062,932

SWITCH AND PARTS THEREOF

Filed Oct. 24, 1958

2 Sheets-Sheet 1

FIG. 1

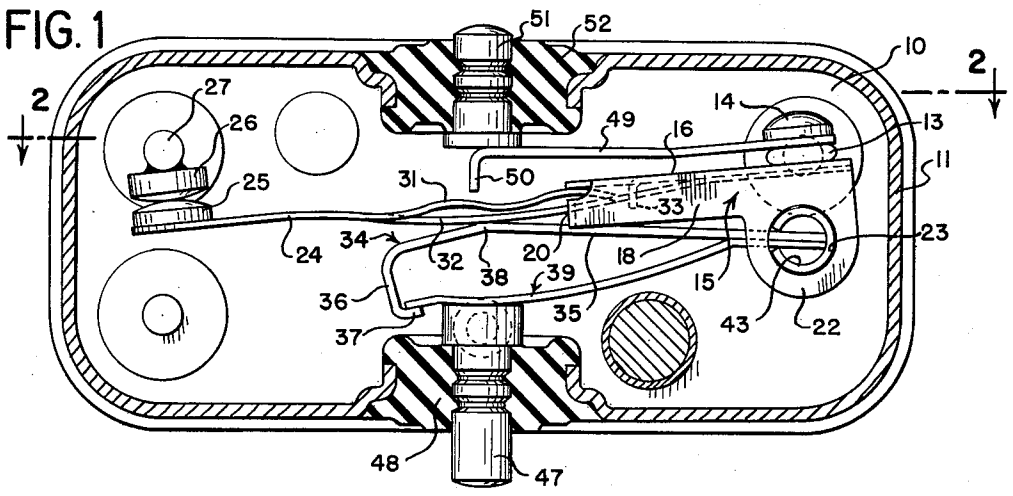


FIG. 2

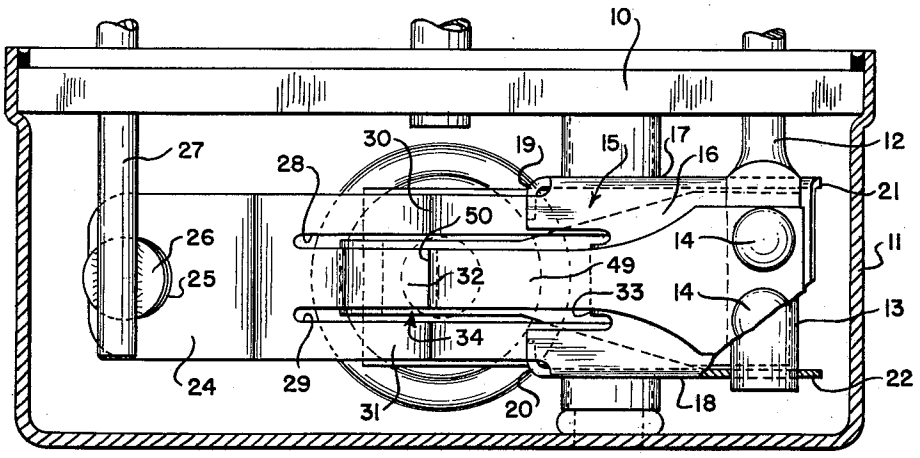
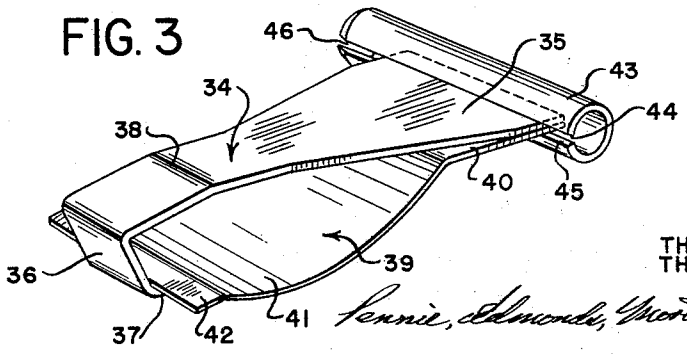


FIG. 3



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FIG. 4

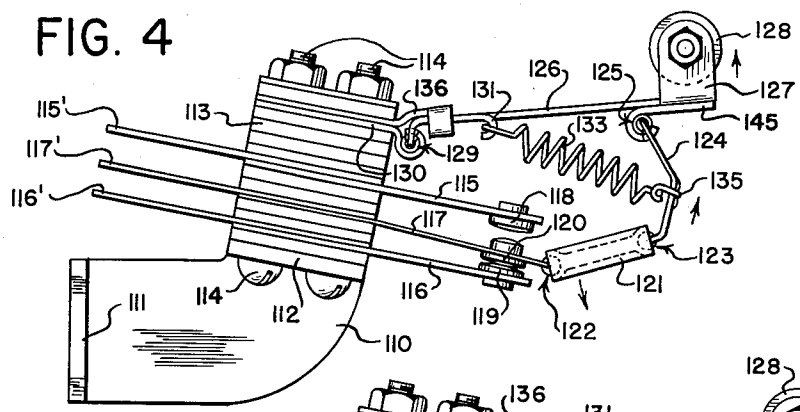


FIG. 5

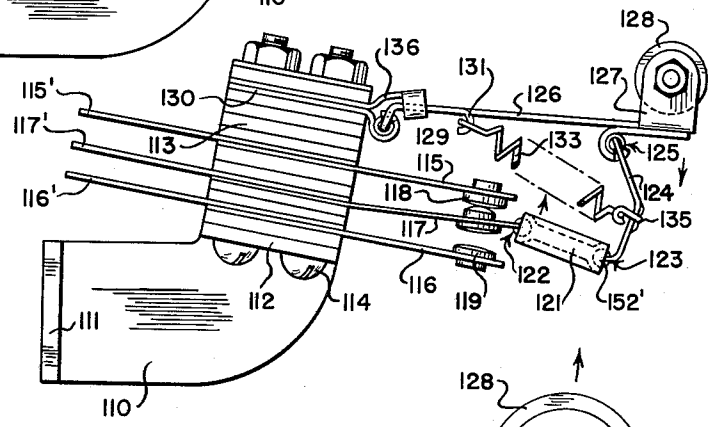


FIG. 6

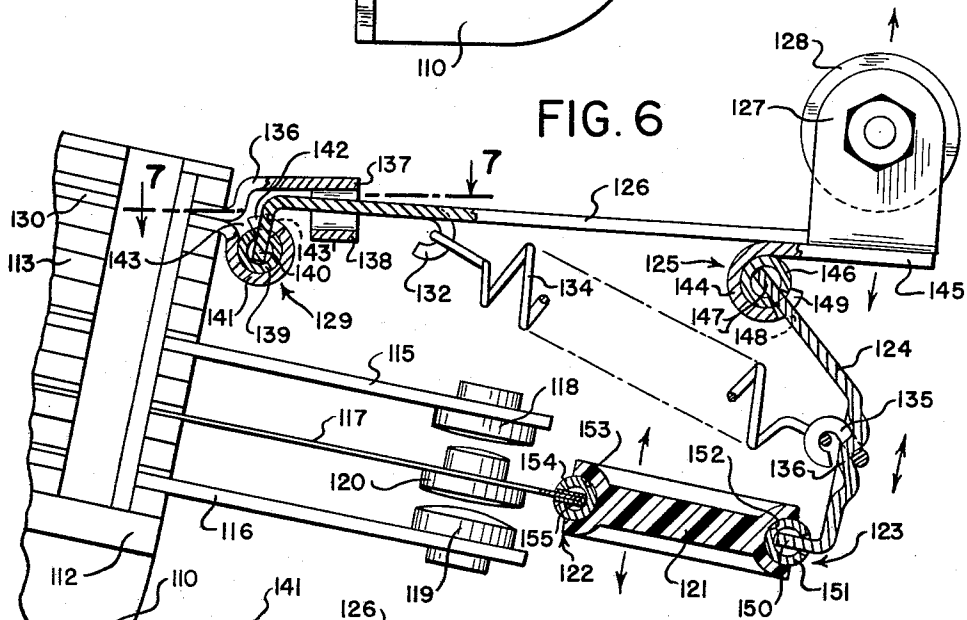
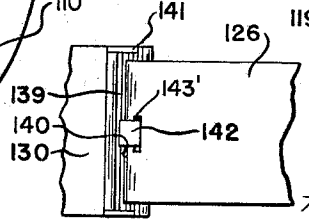


FIG. 7



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United States Patent Office

3,062,932

Patented Nov. 6, 1962

3,062,932

SWITCH AND PARTS THEREOF

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Filed Oct. 24, 1958, Ser. No. 769,469

13 Claims. (Cl. 200—67)

The present invention relates to electrical switches, and more particularly to improvements in snap action switches and in certain of the components thereof.

One of the specific features of the invention resides in the provision, in a snap action switch, of improved and simplified means for effecting actuation of the switch, providing for substantial overtravel in the movement of an actuating element without causing damage to the switch mechanism. In this respect, the invention resides, in part, in the provision of a novel actuator assembly interposed between a switch blade and a movable actuating plunger, whereby movement of the plunger is transmitted to the blade for effecting the actuation thereof, while excessive movement of the plunger is taken up in the deformation of a pre-stressed resilient member. The pre-stressed member is arranged to effect switch actuation without deformation, so that actuation is sensitive and accurate, while, at the same time, overtravel of the actuator, which would otherwise cause excessive force to be applied to delicate parts of the switch mechanism, is isolated by the pre-stressed member.

A more specific feature of the invention resides in the provision of an actuating means comprising an actuating arm and a leaf spring member attached to the arm and held thereby in a pre-stressed condition. Actuating force is applied to the arm through the spring, whereby actuating movement of the arm may be effected until the resisting forces exceed the pre-stress in the spring, and following which the spring merely deforms if further actuating force is applied.

One of the important features of the invention resides in the provision of a novel and improved pivot joint which, while it finds especially advantageous use in switches of the type contemplated herein, is suitable for use in a variety of applications other than switches. The improved joint comprises a split roll pin which receives and grips, between opposed edges formed by the split, one of a plurality of pivotally connected members. The roll pin is, in turn, journalled for rotary movement in another of the connected members to form a pivot joint which is simplified in nature, yet which has advantageous characteristics.

In the improved switch, mentioned above, the new pivot joint finds particularly advantageous application in the mounting of an actuating assembly comprising an actuating arm and a leaf spring. The arm and spring have flat end portions, which are placed face to face and, together, are received and clamped between opposed edges of the pin.

The invention is also directed to an improved form of toggle switch, incorporating a plurality of pivotally connected parts, some or all of which are engaged at a roll pin pivot joint of the general type mentioned above. In this respect, the new joint provides for the economical use, in a toggle switch assembly, of one or more pivot joints having a large bearing area and, consequently, adapted for very long operating life.

For a better understanding of the invention, reference should be made to the following detailed description and to the accompanying drawings, in which:

FIG. 1 is a longitudtinal, cross-sectional view of a snap acting switch incorporating the improved features of the invention;

FIG. 2 is a cross-sectional view taken generally along line 2—2 of FIG. 1;

FIG. 3 is a perspective view of an improved actuating means for the switch of FIG. 1, incorporating improved pivot mounting means;

FIGS. 4 and 5 are elevational views of an improved toggle switch of the invention;

FIG. 6 is an enlarged, fragmentary view of the switch of FIGS. 4 and 5, partly in section, illustrating features of the improved pivot joint used therein; and

FIG. 7 is an enlarged, fragmentary, sectional view, taken generally on line 7—7 of FIG. 6.

In the switch illustrated in FIGS. 1–3, the reference numeral **10** designates a frame plate which, in combination with a cover **11**, forms a substantially enclosed switch housing. Mounted on the plate **10**, adjacent one end of the housing, is an anchor pin **12**, which projects outward from the plate **10** and has a flat portion **13** at its outer end. The anchor pin **12** has secured thereto, as by rivets **14**, a blade mount **15** formed of sheet material. In the illustrated form of the invention, the blade mount **15** has a flat upper wall **16** and depending side walls **17**, **18**. The side walls **17**, **18** have portions **19**, **20** at their outer ends which are turned inwardly and lie beneath the top wall **15**, in spaced relation thereto. And the back portions of the side walls project downwardly, as at **21**, **22** and have openings **23** forming spaced journal means.

Secured to the blade mount **15**, advantageously by the rivets **14**, is an elongated, flat blade **24** carrying at its outer end a contact **25** adapted for coaction with a contact **26** mounted in fixed relation to the frame plate **10** by a post **27**. The switch blade **24** is advantageously divided over a portion of its length by longitudinal slots **28**, **29** to form, at the inner end of the blade, outer blade sections **30**, **31** and a central blade section **32**. The outer blade sections **30**, **31** may be deformed, somewhat in the manner illustrated in FIG. 1, and the central blade portion **32** is engaged by a tab **33** projecting downward from the upper wall **16** of the blade mount, so that the blade section **32** is maintained under compression. Accordingly, the blade **24** will tend to have stable operating positions, in which the central blade portion **32** lies on one side or the other of the general plane of the blade. Thus, when the blade section **32** lies below the plane of the blade, substantially as shown in FIG. 1, the blade is bowed upward, causing the contact **25** to move upward into engagement with the contact **26**. On the other hand, when the blade section **32** lies above the plane of the blade, the blade is bowed downward and the contact **25** is spaced away from the contact **26** (and engages a second fixed contact, not shown, in a double throw switch).

In accordance with one aspect of the invention, an improved switch actuating means is provided which includes an actuating arm **34** formed of flat, sheet material and advantageously of relatively rigid construction. In the illustrated apparatus, the actuating arm **34** has a wide, flat end portion **35**, which may be referred to as the inner end of the arm, and the outer end of the arm includes a hook-like portion **36** forming a tab **37** which projects back toward the inner end of the arm. Advantageously, the main portion of the arm is bent to form a bearing ridge **38** adapted to engage the center portion **32** of the blade. And, in this respect, the outer portions of the arm are of such width that they may be received between the outer blade sections **30**, **31**, substantially in the manner indicated in FIG. 2.

Coacting with the actuating arm **34** is a spring member **39** having a wide, flat base portion **40**, which may be referred to as its inner end, and having an arcuate outer end portion **41** terminating in a tab **42** adapted to be received in the hook portion of the actuating arm and en-

gaged by the tab 37 thereof. In accordance with one aspect of the invention, when the inner end portions 35, 40 of the actuating arm 34 and spring 39 are placed in flat, face-to-face relation, the tab end of the spring is urged outwardly, so that the tabs 37 and 42 are engagement and the spring 39 is under a predetermined tension or pre-stress.

As one of the important features of the invention, the actuating assembly, comprising the arm 34 and spring 39 is mounted for pivotal movement in the switch assembly by means of a roll pin 43, best illustrated in FIG. 3. The roll pin per se is a conventional, commercially available element, and is made out of sheet material rolled into cylindrical form and having a split along one side, where the opposed edges of the sheet material meet face to face. Such pins are commonly used in the same capacity and in the same manner as are solid pins, i.e., as pivot means. However, in accordance with the present invention, the roll pin 43 is employed in a novel and advantageous manner, in that, in an assembly of members, one of which pivots with respect to the other, the roll pin 43 is journalled in one of the members and grips the other members between the opposed edges formed by the split. Thus, in the illustrated device, the inner end portions 35, 40 of the actuating arm 34 and spring 39 are placed face to face and are inserted between the opposed edges 44, 45 formed by the split 46 in the roll pin. The combined thickness of the arm and spring portions is greater than the initial or normal width of the split 46, so that the opposed edges 44, 45 must be separated to receive the elements 34, 39. Accordingly, the elements 34, 39 are firmly gripped by the pressure of the edges 44, 45 tending to close to their normal or initial spacing. Moreover, as shown best in FIG. 1, the edges of the roll pin, being square before the pin is rolled or formed, lie at angles to the arm and spring elements 34, 39 and form sharp ridges which enhance the gripping action.

In the illustrated apparatus, the roll pin 43 is of greater axial length than the width of the arm and spring elements 34, 39, so that portions of the pin project from the opposite sides of the actuating assembly comprising the arm and spring. The projecting ends of the pin are received in the openings 23 in the side wall portions 21, 22 of the blade mount 15, the pin being freely received in the openings, whereby the actuating assembly may pivot freely with respect to the blade mount. The location of the openings 23 are such that the bearing ridge 38 of the arm 34 is adapted to bear against the central blade section 32 near the midpoint thereof.

For effecting actuating movement of the actuating assembly, there is provided a plunger 47 mounted in a diaphragm 48, formed of silicone rubber or other suitable material. The diaphragm 48 is bonded at its periphery to the casing 11, forming a seal therewith, so that movement of the plunger 47 may be accommodated even though the interior of the switch assembly is completely sealed. A portion of the plunger 47 projects into the interior of the switch casing and is adapted to engage the spring element 39, adjacent the outer end thereof. Accordingly, upon inward movement of the plunger 47, the actuating assembly, comprising the arm 34 and spring 39, is pivoted in a counterclockwise direction, causing the bearing ridge 38 to move upward against the central blade section 32, whereby the blade is actuated from one operative position to the other. Thus, in the illustrated device, upward movement of the plunger 47, with the apparatus conditioned as shown in FIG. 1, causes the switch blade 24 to snap to a downwardly bowed position, opening the contacts 25, 26.

As one of the features of the invention, the pre-stress in the spring 39, occasioned by the fact that the tab 37 limits outward movement thereof, is such that the actuating assembly as a whole is moved by the plunger to

effect actuation of the switch. That is, the force required to snap the blade 24 is less than the force required to overcome the pre-stress in the spring 39. However, if inward movement of the plunger 47 continues, after actuation of the blade 24, the application of excessive forces to the blade and to related parts of the switch is avoided by deflection of the spring 39. The improved arrangement is advantageous, in that the required movement of the plunger 47 necessary to effect switch actuation may be accurately predetermined, while substantial overtravel is provided for to accommodate inaccuracies in the external actuating mechanism, for example.

The illustrated switch apparatus incorporates a switch blade having two stable operating positions. Accordingly, means must be provided for resetting the blade at desired times, following actuation thereof to an open condition by the plunger 47. To this end, a resilient reset arm 49 may be secured at one end to the anchor pin 12, so that an end 50 thereof overlies the central blade section 32. Directly above the outer end of the reset arm 49 is a reset plunger 51 carried by a diaphragm 52 bonded to the switch casing in the usual manner. The plunger 51 bears against the arm 49 and is adapted, when depressed, to move the reset arm downward and snap the central blade section 32 from its upper position (not shown) to its lower position, as illustrated in FIG. 1.

One of the important features of the invention is the improved pivot means, comprising a roll pin journalled for rotational movement and a member received and gripped between the opposed edges of the roll pin. The new arrangement greatly simplifies and facilitates the assembly of small devices, such as switches, since a flat, pivoted member may be readily inserted in the split roll pin to form a complete assembly. In addition, the gripping action of the roll pin may be utilized to assemble a plurality of parts forming a pivoting assembly. Thus, in the switch device illustrated in FIGS. 1–3, the actuating arm 34 and spring 39 are held in the desired, assembled relation by the gripping action of the roll pin 43.

Another advantageous feature of the invention resides in the improved actuating arrangement of the switch of FIGS. 1–3, including a pivoted actuating arm and spring, arranged so that actuating force or movement is applied through the pre-stressed spring. The pre-stress in the spring is sufficient to enable normal switch actuation to occur without deflection of the spring. However, excessive overtravel of the actuating plunger, which might otherwise cause excessively high forces to be applied to the switch parts, is absorbed by spring deflection, as soon as the actuating force exceeds the pre-stress.

In the form of the invention shown in FIGS. 4–6, a single-pole, double-throw toggle switch is provided with an actuating mechanism including a plurality of the improved roll pin pivot joints, whereby the operating life of the switch is greatly increased. The second illustrated form of the switch comprises a mounting post 110 adapted to be secured by a flange 111 to a suitable housing or casing (not shown) and having a supporting flange 112 upon which are mounted a plurality of insulating elements 113. The insulating elements 113 are secured by bolts 114 and serve to clamp, in spaced relation, a pair of fixed contact members 115, 116 and a switch blade 117. The members 115, 116 carry contacts 118, 119, respectively, and the switch blade 117, positioned between the contact members, carries adjacent its free end a contact 120 adapted to engage alternatively the fixed contacts 118, 119. Portions 115′–117′ of the contact members and switch blade extend to the rear of the insulating elements 113 and form terminal connections.

In its general operation, the switch of FIGS. 1–6 is conventional, and includes a toggle element 121, which engages the outer end of the switch blade 117 and extends generally outward therefrom. The toggle element 121 is urged generally toward the switch blade, but the outer end of the element is manipulated to lie either above

or below the plane of the switch blade, whereby the contact **120** is held in engagement with one or the other of the fixed contacts **118**, **119**. Thus, when the outer end of the toggle element is moved from a position above the plane of the blade, as illustrated in FIG. 4, to a position below the plane of the blade, as illustrated in FIG. 5, the inward pressure of the toggle element on the blade causes the blade to snap from one operative position to the other with an over-centering or toggle action.

In accordance with the invention, the toggle element **121** is engaged with the end of the switch blade **117** at a pivot joint **122**, to be described in greater detail, and the outer end of the toggle element is engaged at a pivot joint **123** with a toggle link **124**. The link **124** extends upward from the toggle element **121** and is connected to a pivot joint **125** with the outer portion of an actuating arm **126**. The actuating arm **126** may have a U-shaped bracket **127** at its outer end, which journals a suitable roller **128**, and the inner end of the arm is connected at a pivot joint **129** to a support **130** clamped by the insulating elements **113**. The actuating arm **126** is advantageously formed of sheet or strip material, and is shaped to provide a pair of hooks **131**, **132** at opposite sides thereof adapted to engage springs **133**, **134** respectively, which extend generally forward and are engaged with the toggle link **124** by means of a yoke **135** received in a suitable indentation **136** in the toggle link.

Actuation of the switch is effected by pivotal movement of the actuating arm **126** between limit positions determined by a stop member **136**, which is clamped by the insulating elements **113** and has portions **137**, **138** lying above and below the actuating arm **126** to limit the pivoting movement thereof in either direction. The springs **133**, **134** tend to pivot the toggle link **124** in a clockwise direction, to maintain the desired inward pressure upon the toggle element **121**, and the force of the spring is applied in such a direction that, in all positions of the actuating arm **126**, the springs tend to urge the arm to its upper limit position. The normal condition of the switch is thus as illustrated in FIG. 4, with the contact **120** of the switch blade **117** engaging the lower fixed contact **119**.

When the actuating arm **126** is depressed, as by the action of a cam, for example, on the roller **128**, the outer end of the toggle element **121** is carried below the plane of the blade **117**, and the blade is snapped upwardly, so that the contact **120** engages the upper fixed contact **118**. Upon subsequent release of the actuating arm **126**, the springs **133**, **134** return the arm to its upper position, and effect the reclosure of contacts **119**, **120**.

In accordance with the invention, the various pivot joints **122**, **123**, **125** and **129**, or some of them, include, as one element of the joint, a split roll pin which is journalled for rotary movement and receives and grips one of the parts of the joint between opposed edges formed by the split in the pin. The roll pins per se may be of a commercially available type, and are usually formed by the rolling or otherwise bending a flat section of sheet material into cylindrical form, providing a slight space or spilt between opposed edges of the material. The material of which the pins are formed is usually a good grade of steel, providing sufficient resilience to accommodate limited expansion or contraction of the pin.

In the pivot joint **129**, at the base of the actuating arm **126**, a split roll pin **139** receives and grips between its opposed edges the flat end portion **140** of the actuating arm which, in the illustrated device, is bent substantially at right angles to the main portion of the arm and extends downward. The dimensions of the roll pin **139** are such, in relation to the thickness of the end portion **140**, that the split in the pin is opened somewhat by insertion of the end portion **140** therein. Accordingly, the portion **140** is tightly gripped by inner corners of the opposed edges of the pin.

The assembled roll pin **139** and actuating arm **126** constitute one part of the joint **129**, the other part being constituted by journal means for the roll pin. To this end, the support **130** is advantageously formed of sheet or strip material and has an end portion **141** bent to form a socket shaped like a partial cylinder. The socket is of such diameter as to receive loosely the roll pin **139** and is open at both ends to accommodate axial insertion of the pin, and the arc covered by the socket is such as to provide an open side sufficient to accommodate the contemplated range of pivotal movement of the actuating arm **126**. Advantageously, the end portion of the actuating arm, the roll pin **139** and the socket **141** are of substantially the same width, although this is by no means necessary.

To prevent relative axial movement between the movable parts of the joint **129**, the socket **141** is provided at its end extremity with a tongue **142**, of limited width, which continues the cylindrical outline of the socket, leaving sufficient space, however, as at **143**, to permit insertion of the end **140** of the actuating arm. The tongue **142** is received in an opening **143'** in the arm end portion **140**, so that the arm and tongue are engaged throughout the contemplated range of movement of the arm, preventing relative axial displacement between the arm and the socket **141**.

The pivot joint **125** is advantageously substantially similar to the joint **129** and includes a socket **144** in the form of a partial cylinder bent from a section **145** of strip material, which may be integral with or attached to the actuating arm **126**. The socket **144** is adapted to receive loosely a roll pin **146**, which receives and grips between opposed edges formed by the split therein a flat end portion **147** of the toggle link **124**. The end portion of the link **124** is provided with an opening **148** in which is received a tongue **149**, which projects from one edge of the socket and continues the cylindrical outline thereof.

At the lower end of the toggle link **124** there is a flat end portoin **150**, which is bent in toward the end of the switch blade **117** and is received and gripped between opposed edges formed by the split in a roll pin **151**. The pin **151**, forming part of the pivot joint **123**, is received in a socket **152**, in the form of a partial cylinder, provided in the end of the toggle element **121**. Advantageously, the toggle element **121** is formed of a self-lubricating plastic material, such as Nylatron G.S., manufactured by the Polymer Corporation, Reading, Pennsylvania, or Teflon, manufactured by Du Pont. The element **121** may be of molded construction, and the socket **152** provided in the outer end thereof is closed at each end by end walls **152'**. Advantageously, the socket **152** covers an arc slightly less than 180°. The radial and axial dimensions of the socket are, of course, such that the roll pin **151** may pivot freely therein.

The joint **122** is substantially similar to the joint **133** and includes a socket **153**, in the form of a partial cylinder closed at both ends, which is molded in the toggle element **121**. A roll pin **154** is received in the socket and grips between its opposed edges the outer and portion of the switch blade **117**. In this respect, the thickness of the switch blade **117** may be less than is desired for proper gripping action between the opposed edges of a commercially available roll pin. Accordingly, a U-shaped shim **155** may be placed over the end of the switch blade **117**, so that the nominal thickness of the blade and shim assembly is slightly greater than the normal spacing between the opposed edges of the roll pin.

The improved switch of FIGS. 4–6, while being of relatively inexpensive design, is characterized by its extremely long operating life achieved by the use of roll pin pivot connections. Thus, the various roll pins, journalled for limited rotary movement in cylindrical sockets, provide a large bearing area at each pivot connection and thereby reduce wear between moving parts to a practical minimum.

In switches of known design, the provision of a plurality of bearing joints for connecting moving parts of

the switch would render the cost of the switch prohibitive. However, the improved roll pin joint is capable of easy and economical assembly and utilizes low cost, commercially available components (i.e., the roll pins) so that the improved joints may be used extensively without incurring excessive expense.

It should be understood that the specific forms of the invention herein illustrated and described are intended to be representative only, as certain changes may be made therein without departing from the clear teachings of the disclosure. Accordingly, reference should be made to the following appended claims, in determining the full scope of the invention.

We claim:

1. A switch comprising an elongated, generally flat switch blade, a blade mount mounting said blade at one end, said blade mount being formed of sheet material and having a flat portion to which said blade is secured and side portions adjacent the opposite edges of said blade forming journal means for receiving a roll pin therein, said blade having a stressed portion adapted upon the application of actuating force thereto generally at right angles to the plane of the blade to snap said blade from one of its operative positions to another, actuating means for said switch blade comprising an actuating arm positioned on one side of the plane of the blade and mounted for pivoting movement with respect thereto, said actuating arm being mounted at one end by a split roll pin which receives and grips said arm between opposite edges formed by the split in the pin, said roll pin being journalled at its ends by said journal means for limited rotational movement, and reset means for said blade comprising a reset arm mounted on the opposite side of said plane for resiliently restrained movement toward said blade.

2. The switch of claim 1 in which said blade is divided over a portion of its length by spaced longitudinal slots forming outer blade sections and a central blade section, said outer blade sections being secured to said blade mount and said central section being engaged by said blade mount and placed under compression thereby.

3. The switch of claim 1 including a frame plate, an anchor pin extending from said frame plate and having a flat outer portion, said blade mount being secured to said flat portion, and said reset arm being formed of resilient material and being mounted at one end of said flat portion.

4. In a switch of the type having a switch blade adapted for actuation between operative positions, an actuating member operatively related to said switch blade and movable for effecting actuation of said blade, and pivot means for pivotally mounting said member for actuating movement; the improvement in said pivot means characterized by said actuating member having a flat end portion, and comprising a split roll pin receiving the flat end portion of said actuating member and gripping said end portion between opposed edges formed by the split, said opposed edges yieldably closing upon said end portion to maintain said roll pin and member in assembled relation, and means journalling said split roll pin for pivoting movement with said actuating member.

5. The improvement of claim 4, which includes a leaf spring member, said spring member has a flat end portion arranged face to face with the end portion of said actuating member and received and gripped between said opposed edges, said leaf spring member has a portion spaced away from said blade, and said leaf spring member is adapted upon the application of actuating force to said portion to effect actuating movement of said member.

6. The improvement of claim 5, in which said actuating member has means engaging said spring portion and placing the spring under a predetermined pre-stress, said switch blade is adapted to actuate upon the application to said spring portion of a force less than the pre-stressing force, and said spring portion is adapted to move independently of said actuating member upon the application of force greater than said pre-stressing force.

7. The improvement of claim 4, in which said blade comprises a flat member divided over a portion of its length by spaced longitudinal slots forming outer blade section and a central blade section, said outer blade sections are secured to a mounting plate, said plate has a tongue projecting into the plane of the blade and engaging the central section thereof to place said central section under compression, and said mounting plate includes portions at opposite sides of said blade extending at right angles to the blade and journalling said roll pin at its ends for limited rotational movement.

8. The improvement of claim 4, in which said roll pin has end portions extending beyond the edges of said actuating member, and means are provided for journalling the end portions of said roll pin for limited rotational movement.

9. An assembly of members pivotable one with respect to the other, comprising a first member having journal means therein, a split roll pin received in said journal means and adapted for rotational movement therein, and a second member having a flat portion received and gripped between opposed edges formed by the split in said roll pin said opposed edges yieldably closing upon said flat portion to maintain said roll pin and second member in assembled relation.

10. The assembly of claim 9, in which said second member comprises a plurality of flat elements placed face to face, said elements being clamped together by the gripping action of said roll pin.

11. The assembly of claim 9, in which the axial length of said roll pin exceeds the width of said flat portion, and said journal means comprises means engaging the roll pin at its ends.

12. A switch actuator, comprising a relatively rigid actuating arm, means mounting said actuating arm at one end for pivotal movement, a leaf spring member secured at one end to said actuating arm and having a free end portion spaced from said arm, said free end portion being urged away from said arm, said arm having limiting means engaging said free end portion and limiting the spacing between said end portion and said arm, said limiting means holding said spring member in a condition of predetermined pre-stress, and means to move said actuating arm comprising a member acting on said leaf spring member.

13. The switch actuator of claim 12, in which said spring member is secured to said actuating arm by a split roll pin, and said arm and spring member have flat portions placed face to face and received and gripped between opposed edges formed by the split in said roll pin.

References Cited in the file of this patent

UNITED STATES PATENTS

862,114	Skinner	July 30, 1907
1,695,943	Bally	Dec. 18, 1928
1,934,528	Faries	Nov. 7, 1933
2,374,986	Fetter	May 1, 1945
2,385,887	Shaw	Oct. 2, 1945
2,448,230	Miller	Aug. 31, 1948
2,728,826	Lauder	Dec. 27, 1955
2,773,955	Haydon et al.	Dec. 11, 1956
2,790,869	Hanson	Apr. 30, 1957
2,897,308	Fergus	July 28, 1959

FOREIGN PATENTS

180,921	Switzerland	Feb. 1, 1936
104,832	Australia	Aug. 16, 1938