July 2, 1957 J. O. ROESER 2,798,127

TOGGLE SWITCH MECHANISM

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Fig. 1.

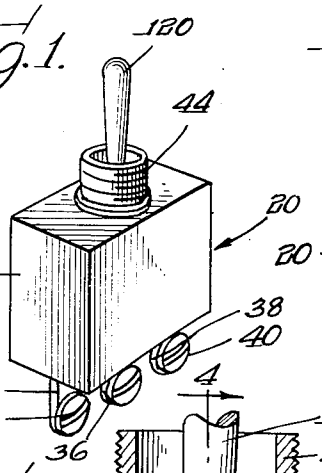


Fig. 2.

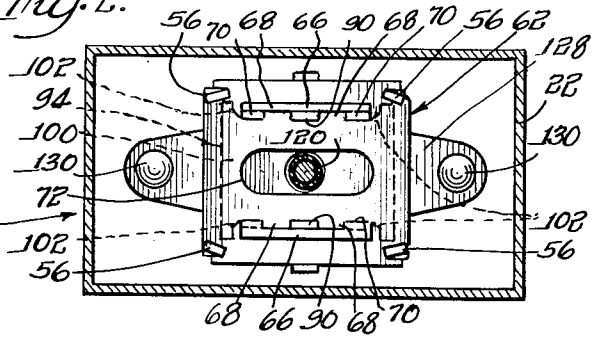
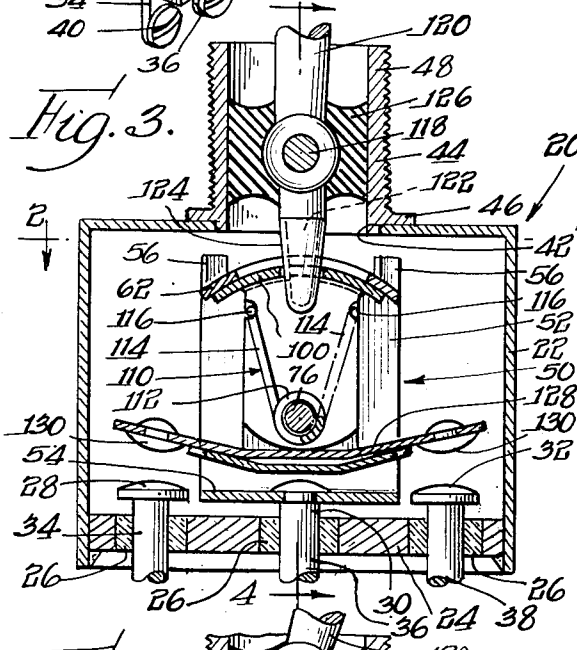


Fig. 3.



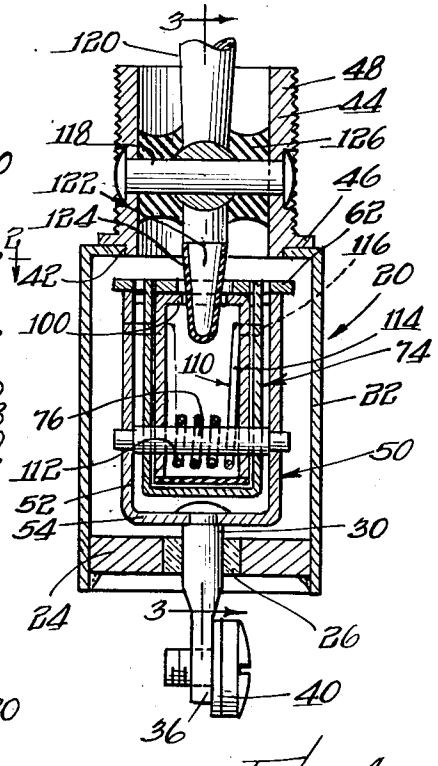
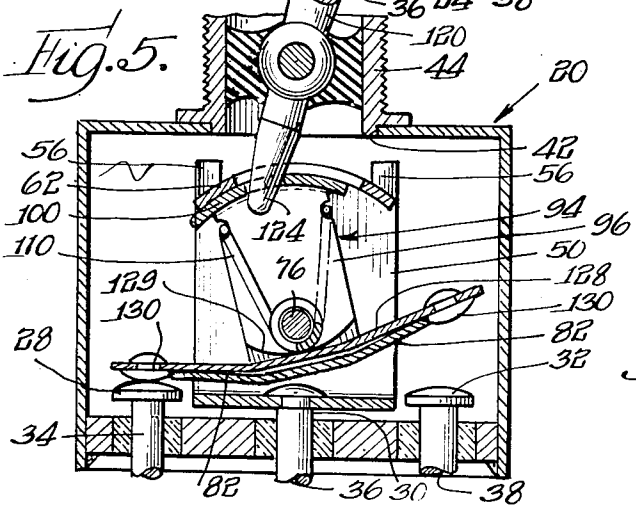


Fig. 4.

Fig. 5.



INVENTOR.
John O. Roeser
BY: Olson & Trexler
Attys.

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Fig. 6.

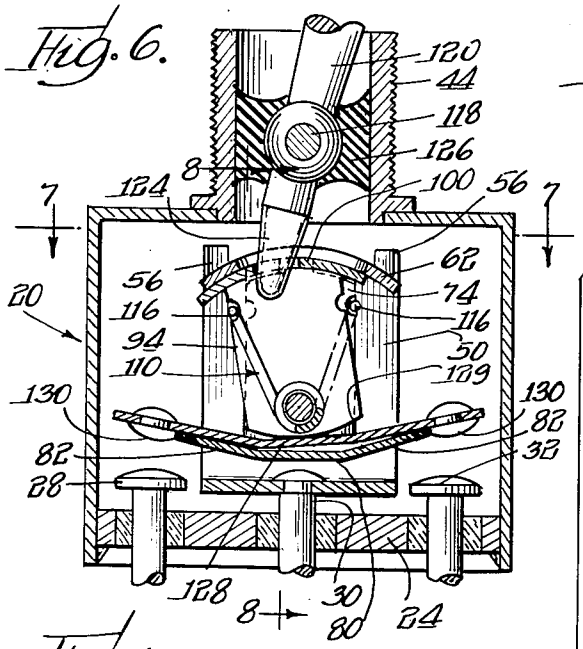


Fig. 7.

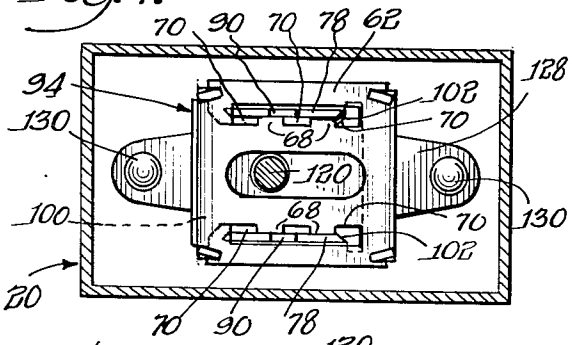


Fig. 8.

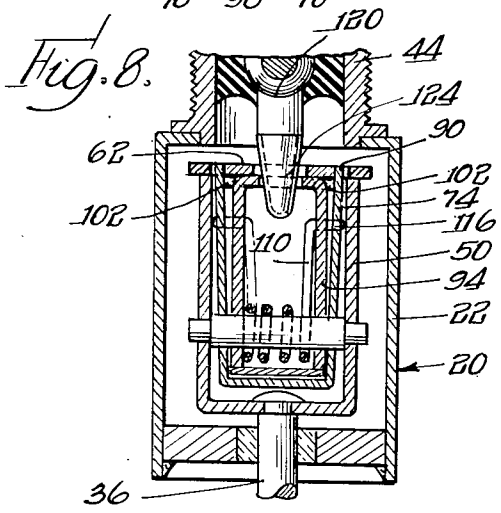
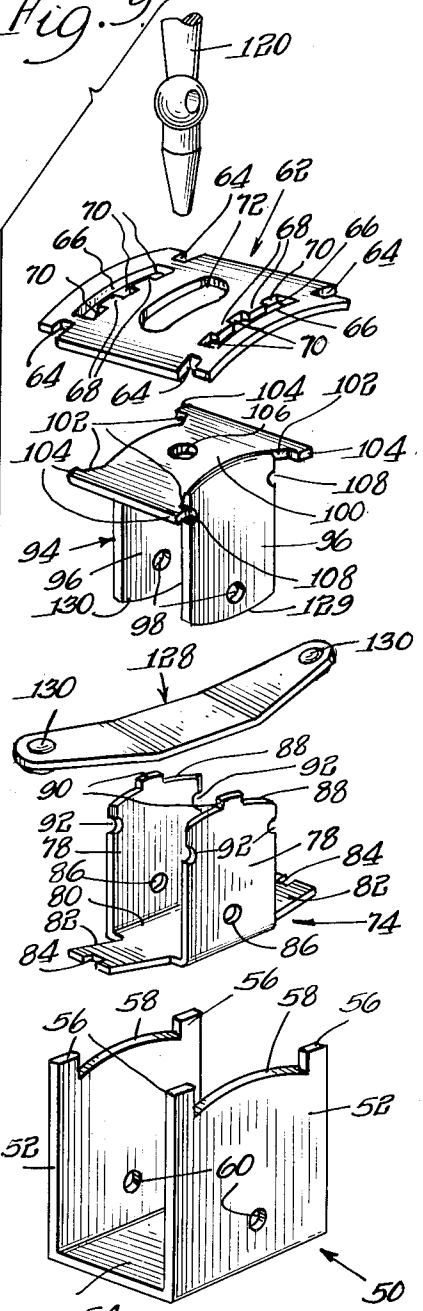


Fig. 9.



INVENTOR.
John O. Roeser
BY:
Olson & Trexler
Attys.

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TOGGLE SWITCH MECHANISM

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Fig. 10.

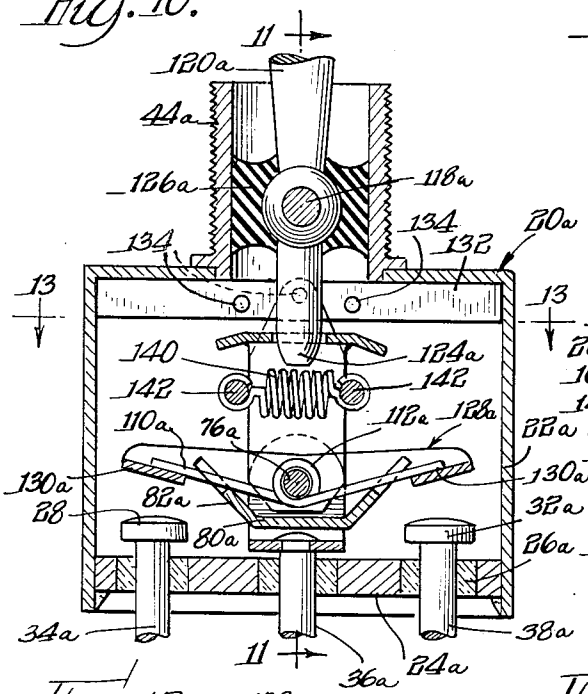


Fig. 11.

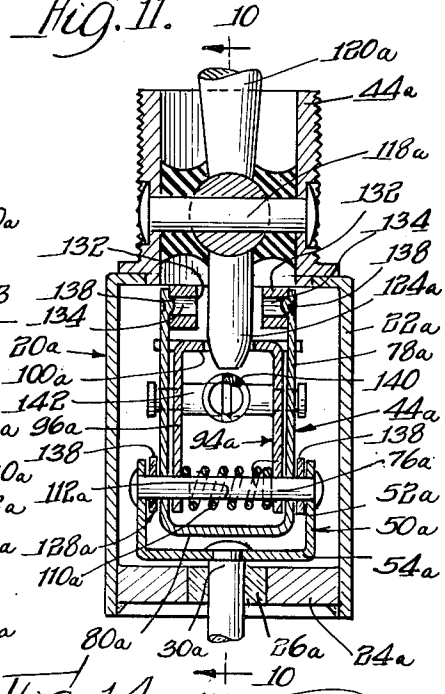


Fig. 12.

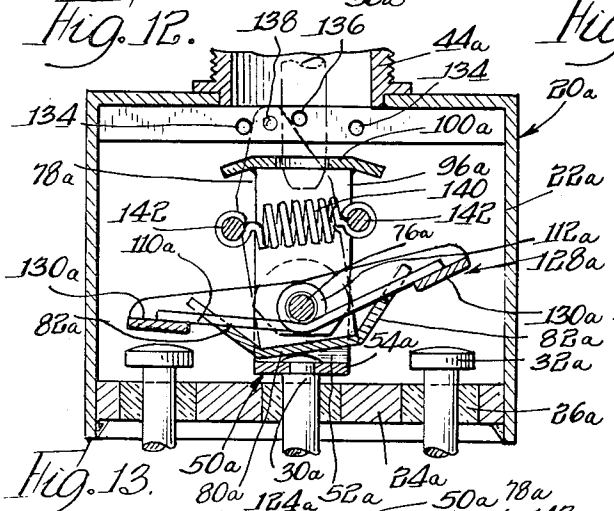


Fig. 13.

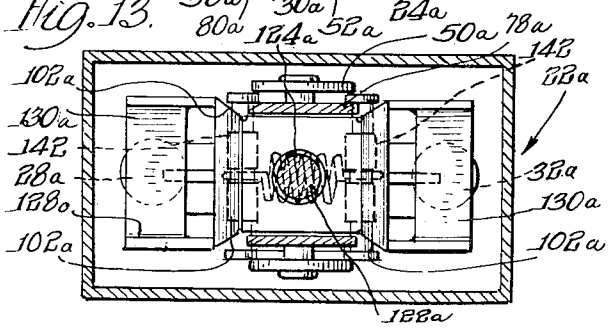
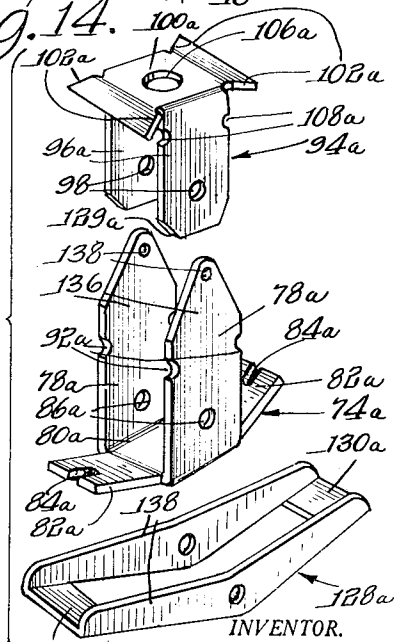


Fig. 14.



INVENTOR.

John O. Roeser

BY:

Olson & Trevilla

Attys

United States Patent Office

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TOGGLE SWITCH MECHANISM

John O. Roeser, Chicago, Ill., assignor to Illinois Tool Works, Chicago, Ill., a corporation of Illinois

Application December 3, 1954, Serial No. 472,883

9 Claims. (Cl. 200—67)

This invention is concerned generally with the art of electrical switches, and more particularly with a toggle switch.

Toggle switch mechanisms for making and breaking contacts with some degree of rapidity to minimize arcing and for other purposes are well known in the art. The toggle switches heretofore known have been simple in construction, but they have been of an old and primitive design, having many limitations. The switches are somewhat unreliable in operation. For one thing, they can be "teased." If the operating handle of a conventional toggle switch is moved slowly, the contacts may be made to hover in close vicinity to one another with the result that much sparking and welding occurs. This leads to unreliable switching and causes the mechanism to deteriorate rapidly. Furthermore, the prior art toggle switch mechanisms rely exclusively upon a spring mechanism for imparting a snap action to contact movement. In the event of spring failure, the contacts either will remain in the position to which they last were set, or the contacts will be left in a loose condition where they might not engage one another at all, or in which they might engage one another in a random manner.

Accordingly, it is an object of this invention to provide a toggle switch mechanism of rugged construction which is not susceptible to the failures and short service life of prior art toggle switch mechanisms.

It is a further object of this invention to provide a toggle switch mechanism having an insured snap action, thereby preventing "teasing" of the switch mechanism.

A further object of this invention is to provide a toggle switch mechanism having a latch mechanism locking the switch mechanism in any of a plurality of positions.

More specifically, it is an object of this invention to provide a toggle switch mechanism having a latch positively locking the switch mechanism in any of a plurality of predetermined positions.

A further object of this invention is to provide a toggle switch mechanism which is self-locking in any of a plurality of positions, and which automatically unlocks upon movement of the actuating member or handle.

Yet another object of this invention is to provide a toggle switch mechanism having a spring snap action, and further having positive means for effecting movement of the contacts in event of spring failure.

A still further object of this invention is to provide a toggle switch mechanism of improved sheet metal construction.

Yet another object of this invention is to provide a toggle switch mechanism in accordance with the objects heretofore set forth wherein the toggle switch mechanism is hermetically sealed.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view of a toggle switch mechanism constructed in accordance with the principles of my invention;

Fig. 2 is a horizontal sectional view through the mechanism taken substantially along the line **2—2** in Fig. 3;

Fig. 3 is a vertical longitudinal sectional view through the toggle switch mechanism taken substantially along the line **3—3** in Fig. 4;

Fig. 4 is a vertical cross sectional view taken substantially along the line **4—4** of Fig. 3;

Fig. 5 is a sectional view similar to Fig. 3 showing the contacts closed in one position;

Fig. 6 is a view similar to Fig. 5 showing the parts just before snapping of the contacts into the closed position of Fig. 5;

Fig. 7 is a horizontal sectional view taken along the line **7—7** of Fig. 6;

Fig. 8 is a vertical sectional view taken substantially along the line **8—8** of Fig. 6;

Fig. 9 is an exploded perspective view of the operating parts of the toggle switch mechanism;

Fig. 10 is a vertical longitudinal sectional view of a modified form of the invention as taken along the line **10—10** in Fig. 11;

Fig. 11 is a vertical cross sectional view of the modified form of the invention as taken along the line **11—11** in Fig. 10;

Fig. 12 is a view similar to Fig. 10 showing the parts moving from a neutral position to one contact engaging position;

Fig. 13 is a horizontal sectional view taken substantially along the line **13—13** in Fig. 10; and

Fig. 14 is an exploded perspective view of the internal parts of the modified form of the invention.

Referring now in greater particularity to the drawings, and first to Figs. 1–4 and 9, there will be seen a toggle switch mechanism generally indicated by the numeral **20**. This toggle switch mechanism comprises a generally rectangular outer case or housing **22** preferably formed of steel. The case or housing is provided with one open side which is sealed by a hermetic header **24** having compression glass beads **26** therein for insulatedly mounting a plurality of contacts respectively numbered **28**, **30** and **32**. Each of the contacts is provided with a terminal extending through the respective glass beads, the terminals being numbered **34**, **36** and **38**, and being provided with screws **40**, or other suitable means for securing lead wires thereto.

Opposite to the side of the case or housing **22** from the hermetic header **24** there is provided an aperture **42** which conveniently may be cylindrical. A cylindrical tube **44** having a collar **46** adjacent the end thereof is fitted into this aperture and brazed or otherwise suitably affixed to the case or housing. The exterior of this tube is provided with threads **48** for mounting the toggle switch mechanism in a panel by means of a suitable nut as is commonly done in the electrical arts.

A generally U-shaped trunnion **50** is mounted on the top of the contact **30**. The trunnion **50** comprises a pair of side flanges **52** and an interconnecting web **54**. The web is provided with a central aperture through which the upper portion of the contact **36** projects, this portion being slightly reduced in diameter and peened over on top of the web. The flanges are provided at their upper outer corners with upstanding tabs or lugs **56**, there being four such tabs or lugs in all. Each flange between its pair of tabs is provided with a convex arcuate upper surface **58**. The flanges also are provided adjacent their lower extremities with a pair of aligned apertures **60** for journaling a pivot pin as hereinafter will be brought out.

An arcuate detent plate **62** is mounted on top of the trunnion. The plate is provided with four notches **64**

adjacent its corners, and the tabs or lugs 56 extend upwardly through these notches and are appropriately twisted or bent over to lock the arcuate detent plate on top of the arcuated surfaces 58 of the trunnion.

Along its opposite lateral edges the detent plate 62 is provided with slots 66. The inner edges of these slots are provided with a pair of teeth 68 defining three notches 70. It will be understood that the number of notches is determined in accordance with the number of switch positions, either contact engaging or neutral positions, and that the three notches are provided for an illustrative switch having two contact engaging positions and an intermediate neutral position. Instead of the three positions illustrated, there could be two positions or there could be more than three. The detent plate 62 is completed by an elongated opening or aperture 72 lying along the center line of the detent plate and parallel to the slots 66.

A latch 74 is rockably mounted on a pivot pin 76 extending between the two apertures 60 of the trunnion 50. The latch 74 is of generally U-shape, having a pair of spaced apart side flanges 78 and an interconnecting web 80. The web is provided along its opposite edges with a pair of slightly upturned flanges 82 having notches 84 in the outer edges thereof. The flanges 78 are provided with apertures 86 through which the pivot pin 76 passes, and the flanges further are provided at their upper ends with arcuate edges 88 having locking tabs or detents 90 extending upwardly therefrom. The flanges also are provided adjacent their upper ends and along the sides thereof with notches 92.

It is to be understood that the latch 74 is made of resilient metal, whereas the trunnion and detent plate heretofore described preferably are more or less rigid.

A driver 94 also is pivotally mounted on the pin 76. The driver comprises a generally U-shaped member which is mounted in inverted position. The driver is provided with a pair of flanges or legs 96 depending between and in close proximity to the flanges 78 of the latch. The flanges near their bottom edges are provided with apertures 98 through which the pivot pin 76 extends. The driver 94 also is provided with a web or bight 100 of generally arcuate configuration, and fitting closely beneath the detent plate 62. The edges of the web 100 are generally straight where they join the flanges 96, but are curved outwardly in cam surfaces or edges 102 on opposite sides of the flanges. The cam surfaces 102 are terminated by outwardly extending positive driving lugs 104. The driver is completed by a generally circular aperture 106 in the center of the web 100. The flanges 96 also preferably are provided with notches 108, which align with the notches 92 of the latch.

The toggle switch mechanism is provided with a spring generally indicated by the numeral 110. This spring comprises several turns 112 wrapped around the pivot pin 76, and a pair of arms 114 extending upwardly therefrom at the opposite ends of the coil or turns 112, the outline of the arms being generally V-shaped. Each of the arms 114 at its extremity is provided with a right angularly disposed finger or tip 116, the fingers or tips 116 extending outwardly away from one another and being received in the notches 108 of the driver and 92 of the latch.

A cross pin 118 is provided in the cylindrical mounting sleeve 48, and the heads of the pin are recessed to avoid any interference with a nut being threaded over the sleeve. An actuating lever or handle 120, sometimes called a bat handle actuator by virtue of its physical resemblance to a baseball bat or the like, is pivotally mounted on this pin. A substantial portion of the actuator 120 extends outwardly of the sleeve 44 for manual manipulation, and the generally conical tip thereof extends into the housing or case 20. The tip is provided with a portion 122 (Figs. 3 and 4) of reduced diameter. An insulating tip 124 fits over this reduced end portion, and conveniently is made of plastic such as nylon or polyethylene having the requisite electrical insulating and physical abrasion resistant qualities. The tip 122, 124 of the actuator 120 extends through the elongated slot 72 in the detent plate into the aperture 106 of the driver. Thus, when the actuator 120 is urged in one direction or the other by manual manipulation, the driver 94 is urged in the opposite direction. It will be observed that a seal 126 bonds the actuating member 120 to the threaded sleeve 44 for sealing the actuator to the sleeve. The bonding material 126 preferably is a silicone rubber which allows hermetic sealing of the case or housing, and which is not subject to undue fatigue and consequent short service life.

A contact rocker 128 is trapped beneath the lower ends 129, these ends being rounded off, of the driver flanges 96 and above the web 80 and upwardly deflected flanges 82 of the latch. The contact rocker is formed of spring metal and is generally complementary in shape to the web 80 and flanges 82, but tending toward a greater flatness so the contact rocker may be resiliently trapped between the ends 129 and the web 80 and the flanges 82. Contact elements or buttons 130 are provided on the opposite ends of the contact rocker 128. The undersides or ends of the contact elements or buttons 130 engage in the notches 84 at the opposite ends of the flanges 82 of the latch to hold the contact rocker 128 against endwise movement relative to the latch. The contact elements or buttons 130 preferably are made of silver due to its superior electrical properties, and the contacts are aligned for engagement with the contacts 28 and 32 referred to earlier.

When the switch mechanism is in any one of its rest positions, that is, one of the two switch contact engaging positions or the neutral position, the detents 90 fit into corresponding ones of the notches 70 associated with the slots 66 in the detent plate. Thus, with the switch mechanism in neutral position as shown in Figs. 1–4, the detents 90 are in the central notches 70. Thus, the switch mechanism is positively locked against accidental movement from one position to another, or against "teasing" of the switch mechanism. Similarly, when the switch mechanism is in the position for one of the contacts 130 to engage the contact 28, the detents 90 fit in the notches 70 at the corresponding end of the detent plate. The resiliency of the contact rocker 128 allows the contact button 130 to be pressed tightly against the contact 28, thereby assuring a firm contact without the necessity of overly close tolerances.

Movement from the position of Figs. 1–4 to the position of Fig. 5 is illustrated in Figs. 6, 7 and 8. The actuator 129 is pivoted by the fingers or thumb, and when this is done, the insulated tip 124 urges the driver in a counterclockwise direction. The driver has moved partway in Figs. 6–8, and it will be seen in these figures that the cam surfaces 102 engage inside of the arms or flanges 78 of the latch and flex them outwardly to remove the detents 90 from the notches 70. It will be apparent from Fig. 6 that as the driver moves ahead of the latch, and it must move ahead of the latch since the latch cannot move until the cam surfaces or edges have been brought into action, the spring 110 is cocked. The spring at all times attempts to maintain the driver and latch in alignment. Thus, when the detents 90 are cammed completely out of the central notches 70, the spring snaps the latch in a counterclockwise direction, and the detents move into the left notches 70. This pivoting or rocking movement of the latch carries the left contact 130 into engagement with the contact 28. Since the movement is spring controlled, there is a snap action which insures rapid making of the contacts with a minimum of sparking or arcing.

In the event that the spring should break or otherwise fail, it would not move the latch and hence the contact rocker. It also is possible that a burr or other imper-

fection in or on the parts would tend to cause the latch to stick in a given position even after withdrawal of the detents from the notches. In this case, the operator merely forces the actuator **120** and consequently brings the driving lugs **104** at the ends of the cams **102** into engagement with the edges of the latch to apply a positive driving force to the latch, thus moving the latch even if the spring fails or if the latch tends to stick.

It will be apparent that action from any one of the two contact positions or the neutral position will be the same as that illustrated. In short, the cam surfaces of the driver flex the arms or flanges of the latch outwardly to move the detents from the notches, thereby freeing the latch for snap action by the spring, or for positive driving by the lugs **104** in the event of malfunctioning of the toggle switch mechanism. It will be understood that when the spring snaps the latch from one position toward another, the outward camming force on the latch flanges or arms will be relieved. Accordingly, the detents will snap into the first notches that they come to. Thus, there is no danger of moving from one of the contact positions through the neutral to the other contact engaging position.

The foregoing illustrative embodiment of my invention comprises the preferred form of the invention due to its relative simplicity and ease of fabrication. However, this does not represent the only embodiment of my invention inasmuch as a modification is illustrated in Figs. 10–14. Similar parts of the modification are identified by the same numerals as those heretofore used with the addition of the suffix *a*. Utilization of the same numerals with this distinguishing suffix eliminates the necessity of extended description of parts which readily will be understood from the foregoing description.

Referring now in greater particularity to Figs. 10–14, it will be seen that the case or housing **22***a* and the parts affixed thereto are substantially identical with those previously described. Consequently, it is thought that the use of the same identifying numerals with the addition of the suffix *a* renders the necessity of extended description unnecessary. The toggle switch mechanism **20***a* contains a trunnion **50***a* generally similar to that heretofore described, with the difference that the side flanges **52***a* are much lower in height.

A pair of spaced apart bars **132** extends longitudinally across the undersurface of the top of the case or housing **20***a*, and each of these bars is provided with three arcuately spaced depressions **134** which conveniently may comprise holes or apertures extending completely through the bars. The depressions **134** take the place of the notches in the detent plates of the previous embodiment of the invention, and their co-operation with the latch will be set forth shortly hereinafter.

The latch **74***a* is generally similar to the latch **74** previously described, one slight difference being that the flanges **82***a* are deflected upwardly at a greater angle than are the corresponding flanges **82**. The top end of each of the flanges **78***a* of the latch is not provided with an upwardly extending lug or tab forming a detent, but rather the entire flange is extended upwardly in a generally triangular shape as is indicated at **136**. Near the top of each of the triangular portions **136** there is provided an inwardly projecting protuberance **138** forming a detent co-operable with one or another of the depressions **134**.

The driver **94***a* is generally similar to the driver **94** previously described. The bottom edge **129***a* thereof is beveled at the corners rather than being in the form of an arc, and the web **100***a* comprises a generally flat surface with the outer ends thereof downwardly deflected as distinguished from the arcuate web of the first embodiment described. The web is provided with camming edges **102***a* similar to those previously described, and although no positive driving lugs similar to the lugs **104** are shown, it is contemplated that they could be provided.

The contact rocker **128***a* is slightly different from that previously described, being of more or less rigid construction, and comprising a pair of side flanges **138** interconnected at the ends by webs forming the contacts **130***a* and pivotally mounted on the pin **76***a*. The side flanges **138** of the contact rocker **128***a* embrace the latch **74***a*, and the ends of the coil spring **110***a* engage the contact webs **130***a* to centralize the contact rocker relative to the latch. The spring **110***a* includes a central coil portion **112***a* surrounding the pivot pin **76***a*, and the arms of the spring project outwardly through notches **84***a* in the upwardly deflected flanges **82***a* of the latch. These notches serve to position the arms of the spring **110***a* and since these arms press against the contact webs **130***a* of the contact rocker, the contact rocker also is positioned thereby. However, the contact rocker is not rigidly fixed in position relative to the latch and one or the other of the arms of the spring may yield slightly to allow the rocker to give when one of the contact webs **130***a* thereof engages one of the contacts **28***a* or **32***a*. It will be observed that the spring **110***a* does not serve as the power spring as it did in the previous embodiment of the invention.

Power is supplied to the toggle mechanism by a helical spring **140**. This spring is stretched between a pair of pins **142** fitting in the notches **108***a* of the driver and **92***a* of the latch.

When the driver is moved from one rest position to another, as toward the neutral position in Fig. 10, the movement being illustrated in Fig. 12, the cam edges **102***a* of the driver cam the arms or flanges **78***a* of the latch outwardly to remove the detent protuberances **138** from the recesses **134** similar to the manner previously described. As the driver moves ahead of the latch before camming of the detents from the locking recesses, the spring **140** is stretched. Such stretching causes the pins **142** to urge the latch into alignment with the driver. Thus, when the detents are released, the latch moves to catch up with the driver with a snap action. It will be apparent from the description from the first embodiment of the invention that when the latch snaps ahead to catch up with the driver, the cam edges no longer urge the latch flanges or arms apart, and the detents **138** therefore snap into the next succeeding recesses to lock the switch mechanism in the next position. It will be understood that in both embodiments of my invention the power springs, namely the springs **110** and **140**, are preloaded. Accordingly, the slight displacement of the driver relative to the latch in either case is quite sufficient to produce a rapid snap action.

From the foregoing description of two illustrative embodiments of my invention it will be apparent that I have invented a toggle switch mechanism overcoming the difficulties of the prior art. The switch mechanism is of rugged construction, and by way of illustration, it might be noted that a model constructed in accordance with the first embodiment of the invention survived a half million cycle test with no signs of wear or aging. The model worked with the same efficiency at the end of the test as at the beginning. There is an insured snap action in my toggle switch mechanism, completely eliminating the possibility of "teasing" the switch mechanism. The switch mechanism is positively locked in any of a plurality of operating positions, and it is automatically unlocked upon manual manipulation of the actuating member or lever. In accordance with the preferred form of my invention, there is a positive action insuring operation of the switch mechanism in the event of failure of the power or toggle spring, or in the event of the tendency of the parts to stick. The sheet metal construction of the switch insures simplicity and economy of fabrication, while the hermetic sealing of the mechanism guards against excessive burning and welding of the contacts.

It is to be understood that the two embodiments herein shown and described are by way of illustrative example

only. Various changes in structure will no doubt occur to those skilled in the art and are to be understood as forming a part of my invention insofar as they fall within the spirit and scope of the appended claims.

I claim:

1. A snap action mechanism comprising supporting means, a manually operable actuating member movably supported by said supporting means, driving means movably supported by said supporting means and operatively connected to said actuating member for actuation thereby, driven means movably supported by said supporting means, said driven means having at least two idle positions, holding means supported by said supporting means tending to hold said driven means in any of said idle positions, means carried by said driving means and acting on said holding means to overcome said holding tendency upon predetermined movement of said driving means, said means acting on the holding means including a cam on the driving member, positive moving means including a stop terminating said cam and engageable with said driven member, and resilient means means acting between said driving means and said driven means and acting upon movement of said driving means to snap said driven means from one to another of said positions when said holding tendency is overcome, said positive means carried by said driving means effecting positive movement of said driven means by said driving means by movement beyond their normal relative movement.

2. A snap action mechanism as set forth in claim 1 wherein the resilient means comprises a tension spring extending between a pair of cross members abutting corresponding sections of said driving means and said driven means.

3. A snap action mechanism set forth in claim 1 wherein said holding means consists of a cam element on the driving member and a series of complementary shaped detents on the driven member to retain the driven member in predetermined position relative to said driving member in any of said aforementioned idle positions.

4. A snap action mechanism comprising supporting means, a manually operable actuating member movably supported by said supporting means, driving means movably supported by said supporting means and operatively connected to said actuating member for actuation thereby, driven means movably supported by said supporting means, said driven means having at least two idle positions, holding means supported by said supporting means tending to hold said driven means in any of said idle positions, means carried by said driving means and acting on said holding means to overcome said holding tendency upon predetermined movement of said driving means, said means acting on the holding means including a cam on the driving member, positive moving means including a stop terminating said cam and engageable with said driven member, said holding means including means providing a series of recesses and a projection on said driven means interfitting selectively with said recesses, and resilient means acting between said driving means and said driven means and acting upon movement of said driving means to snap said driven means from one to another of said positions when said holding tendency is overcome, said positive means carried by said driving means effecting positive movement of said driven means by said driving means by movement of said driving means relative to said driven means beyond their normal relative movement.

5. A snap action mechanism comprising supporting means, a manually operable actuating member movably supported by said supporting means, driving means pivotally supported by said supporting means and being operatively connected to said actuating member at a position remote to the pivotal mounting for actuation of the driving means of said actuating member, driven means pivotally supported coaxially with said driving means by said supporting means, said driven means having at least two idle positions, means supported by said supporting means tending to hold said driven means in any of said idle positions, means on said driving means releasing said holding means upon a predetermined movement of said driving means relative to said driven means, spring means acting between said driving means and said driven means and acting upon movement of said driving means to snap said driven means from one to another of said positions when said holding tendency is overcome, said spring means having associated therewith portions engaging corresponding sections of said driving means and said driven means whereby said spring acts to align said driving means and said driven means regardless of the direction of motion imparted to said driving means by said actuating member.

6. A snap action mechanism comprising supporting means, a driving member movably supported by said supporting means, manually operable means on said driving means for moving the same, driven means movably carried by said supporting means adjacent said driving means, locking means coacting between said driven means and said supporting means adjacent said manually operable means for holding said driven means in any of a plurality of predetermined positions, said locking means including a fixed member carried by said supporting means and providing a succession of notches and a tab on said driven means selectively engageable with any of said notches, means operatively connected to said manually operable means for releasing said locking means, said lock releasing means comprising cam means on said driving means and resilient means acting on said driven means for moving said driven means with a snap action from one to another of said positions upon release of said locking means.

7. A snap action mechanism comprising supporting means, pivot means carried by said supporting means, driving means pivotally mounted on said pivot means adjacent one extremity of said driving means, manually operable means adjacent the opposite extremity of said driving means for pivotally moving said driving means, driven means pivotally mounted on said pivot means, means coacting between said driven means and said supporting means for locking said driven means in any of a plurality of predetermined positions, means operatively connected to said manually operable means for releasing said locking means following predetermined movement of said manually operable means, and spring means acting on said driven means and on said driving means in the vicinity of said manually operable means tending to align said driven means and said driving means whereby to move said driven means with a snap action upon release of said locking means, said spring means including a spring having a generally V-shaped outline with a coil at the apex thereof encircling said pivot pin, the outer ends of said spring engaging corresponding parts of said driving means and said driven means for urging the same into alignment.

8. A snap action mechanism comprising supporting means, a manually operable actuating member movably supported by said supporting means, driving means movably supported by said supporting means and operatively connected to said actuating member for actuation thereby, driven means movably supported by said supporting means, said driven means having at least two idle positions, holding means supported by said supporting means tending to hold said driven means in any of said idle positions, means carried by said driving means and acting on said holding means to overcome said holding tendency upon predetermined movement of said driving means, said means acting on the holding means including a cam on the driving member, positive moving means including a stop terminating said cam and engageable with said driven member, and resilient means acting between said driving means and said driven means and acting upon movement of said driving means to snap said driven means

from one to another of said positions when said holding tendency is overcome, said positive means carried by said driving means effecting positive movement of said driven means by said driving means by movement beyond their normal relative movement, said resilient means including a spring having a generally helical configuration having its terminal end portions engaging corresponding parts of said driving means and said driven means for constantly urging the same into alignment.

9. A snap action mechanism as set forth in claim 8, wherein the holding means comprises means fixedly supported by said supporting means and providing a succession of recesses, and a detent carried by said driven means and selectively engageable with said series of recesses.

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