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MOMENTARY ACTUATOR FOR PRECISION SNAP SWITCH

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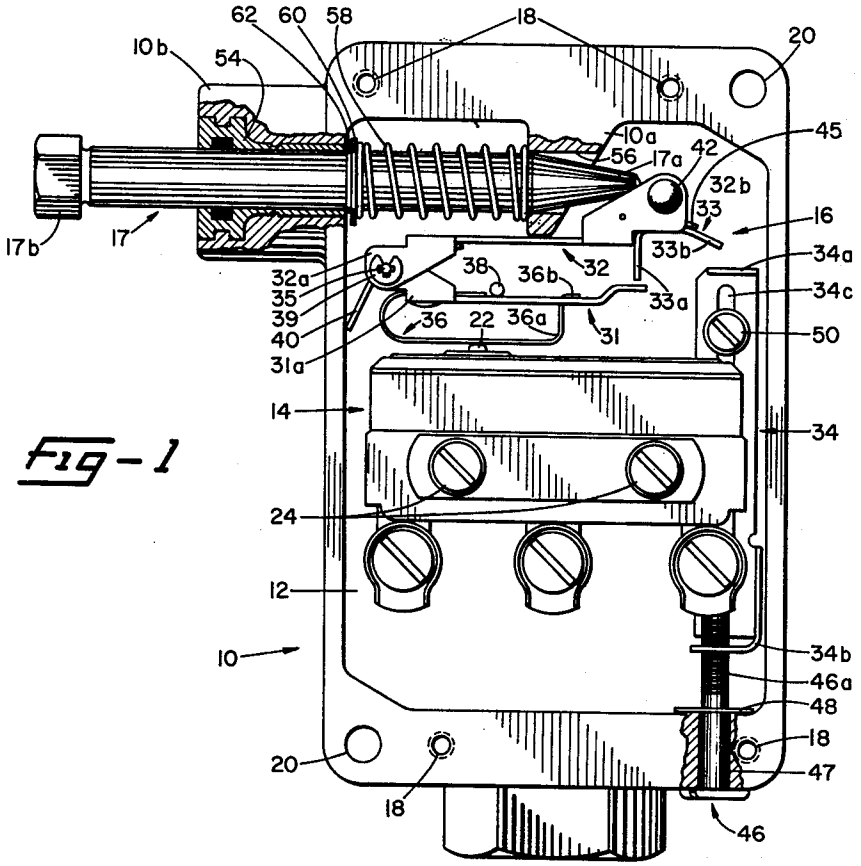


Fig - 1

Fig - 2

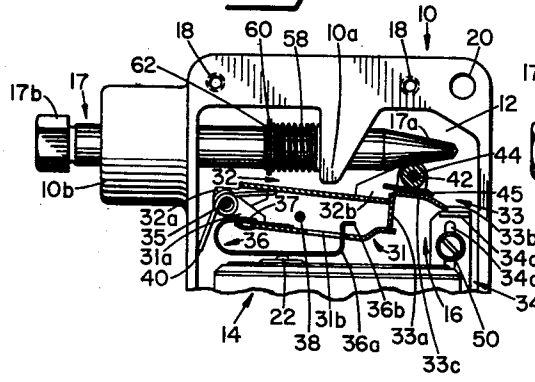
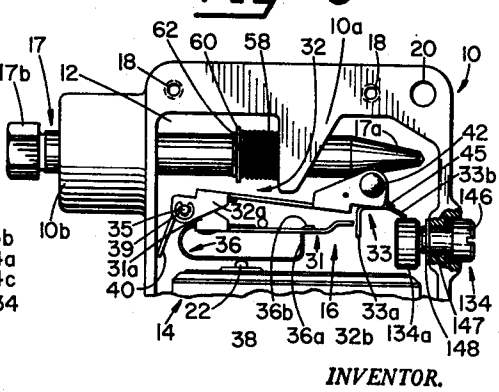


Fig - 3



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MOMENTARY ACTUATOR FOR PRECISION SNAP SWITCH

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The present invention is directed to an actuating arrangement for a switch mechanism whereby initiation of actuation of the switch mechanism occurs upon movement of the actuating arrangement in but one direction only and whereby actuation of the switch mechanism can be adjustably limited in duration to provide "pulse" actuation dependent upon the actuating arrangement achieving a position pre-determined by the adjustment.

A common form of actuating arrangement for a switch mechanism provides for the actuation and deactuation of the switch mechanism upon each reversal of movement of the actuating arrangement. Another common form of actuating arrangement for a switch mechanism provides for the actuation and deactuation of the switch mechanism dependent upon the position of the actuating arrangement with respect to the switch mechanism. That is, the switch mechanism is actuated upon movement of the actuating arrangement in one direction to and past a certain position and this condition is maintained until the actuating arrangement in its movement in the opposite direction passes this position. However, in some applications, it is necessary to limit initiation of actuation of the switch mechanism upon movement of the actuating arrangement in but one direction only. In other applications, it is necessary to limit initiation of actuation of the switch mechanism upon movement of the actuating arrangement in but one direction and then only until the actuator attains a pre-determined position thus providing "pulse" actuation. In still other applications, it is necessary to provide "pulse" actuation of the switch mechanism as just set forth but the "pre-determined position" must be adjustable. It is these latter aspects to which the present invention is directed.

As disclosed in the preferred embodiment herein a switch mechanism and the actuating arrangement for the switch mechanism are supported in a housing. The actuating arrangement comprises a pivotal, collapsible lever system arranged to be driven by an actuator supported in and operable from without the housing. One of the levers is associated with an adjustable abutment located in the housing but easily accessible for adjustment from without the housing. The combination is so arranged that engagement of the lever system by the actuator upon movement thereof in one direction followed by pivotal movement of the lever system results in actuation of the switch mechanism and further movement results in engagement of the adjustable abutment by the appropriate lever and ultimately the collapse of the lever system and deactuation of the switch mechanism. Movement of the actuator in the opposite direction has no effect on the switch mechanism as the lever system is in a collapsed condition and cannot again assume its original condition until the actuator has almost assumed its initial position preparatory for another cycle of operation.

Therefore, it is an object of the present invention to provide an actuating arrangement for a switch mechanism to cause initiation of actuation of the switch mechanism in but one direction of movement of the actuating arrangement with the duration of actuation or "pulse" actuation dependent upon the attainment of a pre-determined position by the actuating arrangement.

It is another object of the present invention to provide an actuating arrangement as above set forth wherein the duration of actuation or "pulse" actuation can be varied by adjustable means.

A further object is to provide the switch mechanism and the actuating arrangement as above set forth in a housing wherein the adjustable means is easily accessible from without the housing.

These and other objects will become more apparent from a reading of the following specification and appended claims taken in conjunction with the drawing wherein:

FIGURE 1 is a view, partially in section, of an embodiment of the invention comprising a switch mechanism and an actuating arrangement therefor disposed in a housing, the combination being in an initial or "at rest" condition;

FIGURE 2 is a partial view, on a reduced scale and partially in section, of the upper portion of FIGURE 1 with the combination in an intermediate condition wherein the switch mechanism is actuated and the appropriate lever of the actuating arrangement is in engagement with the adjustable abutment of the actuating arrangement; and

FIGURE 3 is a partial view, on a reduced scale and partially in section, of the upper portion of FIGURE 1, which includes a modified form of the adjustable abutment, with the combination in an extreme condition wherein the lever system of the actuating arrangement is in a collapsed condition and the switch mechanism is deactuated.

Referring to FIGURES 1, 2, and 3 of the drawing, a housing **10** includes a cavity **12** in which a precision snap acting switch mechanism **14** of the general type disclosed in the McGall Patent 1,960,020 and an actuating arrangement **16** are disposed. Supported by the housing is an actuator plunger **17** for actuating the actuating arrangement **16** and the switch mechanism **14**. The housing **10** is arranged to have a cover plate, not shown, fastened thereto by screw fasteners, not shown, disposed in threaded openings **18** to enclose the elements within the cavity **12**. The housing **10** is further arranged to be mounted to a structure, not shown, by means of appropriate fasteners, not shown, disposed through mounting holes **20**.

The switch mechanism **14** which is arranged to be actuated by actuating element **22** is supported on a boss, not shown, provided on the bottom wall of the cavity **12** by means of screw fasteners **24**.

The actuating arrangement includes a collapsible lever system comprised of levers **31**, **32**, and **33** and an adjustable abutment member (**34**, FIGURES 1 and 2, and **134**, FIGURE 3).

Lever **31** includes a pair of spaced upstanding ears **31***a* through openings in which pin **35**, staked to the bottom wall of the cavity **12**, is disposed so as to allow pivotal movement of the lever about the pin as an axis. A looped spring member **36**, fastened to the lever **31** by rivet **37**, extends over the actuating element **22** of the switch mechanism **14** and includes an upstanding leg **36***a* for passage through opening **31***b* in the lever **31** and a lip **36***b* for engagement with a portion of the lever **31** so as to act as a stress relief or overtravel mechanism. The lever **31** is constantly under a bias, tending to rotate it counterclockwise, provided by both the precision snap acting arrangement of the switch mechanism **14** and the spring member **36**. With the combination in an initial or "at rest" condition, the lever **31** is biased against a stop pin **38** also staked to the bottom wall of the cavity **12**.

Lever **32** extending in the same general direction as the lever **31** includes a pair of spaced upstanding ears **32***a* which straddle the upstanding ears **31***a* of the lever **31** and through openings in which pin **35** is disposed so as to allow pivotal movement of the lever **32** about the pin as an axis. The levers **31** and **32** are maintained on the pin **35** by retaining ring **39**. The lever **32** is constantly under a bias, tending to rotate it counterclockwise, pro-

vided by torsion spring 40 which is supported on the pin 35, one extremity of which bears against a side wall of the cavity 12 and the other extremity of which bears against the underside of the lever 32. With the combination in an initial or "at rest" condition, the lever 32 is biased against the lower surface of pad 10*a* of the housing 10. At the free end of the lever 32, a pair of upstanding ears 32*b* are provided through openings in which is disposed a riveted pin 42.

Lever 33 which is of bell crank form includes a leg 33*a* which extends toward the free extremity of the lever 31 and a leg 33*b* which extends toward adjustable abutment member (34, FIGURES 1 and 2, and 134, FIGURE 3) and further includes a pair of spaced upstanding ears 33*c*, which are straddled by the upstanding ears 32*b* of lever 32, through openings in which pin 42 is disposed so as to allow pivotal movement of the lever 33 about the pin as an axis. Disposed on the pin 42 and straddled by the upstanding ears 33*c* is a roller 44. The lever 33 is constantly under a bias, tending to rotate it clockwise, provided by torsion spring 45 supported by the upstanding ears 32*b* of the lever 32 and engaging the upper surface of the lever 33. With the combination in an initial or "at rest" condition, the leg 33*a* of the lever 33 is biased against lever 32.

The adjustable abutment member 34 of FIGURES 1 and 2 includes a forwardly extending leg 34*a* at its upper extremity for engagement with leg 33*b* of the lever 33 and a forwardly extending angular leg 34*b* at its lower extremity which includes a threaded opening for reception of threaded portion 46*a* of slotted adjustment screw 46. The adjustment screw 46 is maintained in opening 47 of housing 10 by retaining ring 48 but of course is free to be rotated for adjustment purposes from without the housing 10. A slot 34*c* is provided in the adjustable abutment member 34 and a shouldered screw 50 which acts as a guide is disposed therethrough and fastened to the bottom wall of the cavity 12. With such an arrangement and since the switch mechanism 14 is disposed on a boss, not shown, provided on the bottom wall of the cavity 12, the adjustable abutment member 34 is free to be moved upwardly and downwardly with respect to the leg 33*b* of the lever 33 dependent upon the direction of rotation of the adjustment screw 46.

While the adjustable abutment member 34 disclosed in FIGURES 1 and 2 is satisfactory, a simpler approach is shown in FIGURE 3 wherein the adjustable abutment member 134 comprises a slotted adjustment pin 146, maintained in opening 147 of the housing 10 by retaining ring 148, having an eccentric 134*a* disposed on the inner extremity thereof for engagement with leg 33*b* of lever 33. Again, the adjustment pin 146 is free to be rotated from without the housing 10 to position the eccentric 134*a* with respect to the leg 33*b* of the lever 33.

The plunger 17 which has a tapered inner extremity 17*a* and an enlarged outer extremity 17*b* is journaled in bearing 54 provided in boss 10*b* of the housing 10 and opening 56 located in pad 10*a*. The plunger 17 is biased outwardly by coil spring 58, one end of which engages surface of pad 10*a* and the other end of which engages washer 60 which is maintained on the plunger by means of retaining ring 62. Inward movement of the plunger 17 is limited by the extremity 17*b* whereas outward movement is limited by retaining ring 62.

With the combination as shown in FIGURE 1 at an initial or "at rest" condition, inward movement of the plunger 17 first results in engagement of the roller 44 disposed on the pin 42 by the tapered portion 17*a* followed by pivotal clockwise movement of the levers 32 and 33 about the pin 35 as an axis. Subsequent inward movement of the plunger 17 causes engagement between the leg 33*a* of the lever 33 with the free extremity of the lever 31 thereby resulting in pivotal movement of the lever 31 about the pin 35 as an axis. Still further movement of the plunger 17 results in initiation at actuation of the switch mechanism 14 followed by strain release between the spring member 36 and the lever 31 as is shown in FIGURE 2. Further, as is shown in FIGURE 2, engagement between the leg 33*b* of the lever 33 and the leg 34*a* of the abutment member 34 takes place. As the plunger 17 continues its inward movement with the switch mechanism 14 in an actuated condition, the lever 33 rotates in a counterclockwise direction about pin 42 as an axis so that ultimately the leg 33*a* of the lever 33 moves clear of the free extremity of the lever 31 thereby allowing the lever 31 and the spring member 36 to return to the position shown in FIGURE 1 resulting in the deactuation of the switch mechanism 14 to provide a "pulse" actuation. Of course further inward movement and outward movement of the plunger 17 have no effect on the switch mechanism 14 and to again actuate the switch mechanism, the plunger must be moved outwardly to such an extent that leg 33*a* of the lever 33 again assumes the relative position with respect to lever 31 shown in FIGURE 1.

It will be evident from a consideration of the operation above described that to increase the duration of actuation or "pulse" actuation of the switch mechanism the adjustable abutment members 34 and 134 need merely be positioned so as to increase the distance between the leg 33*b* of the lever 33 and the leg 34*a* and the eccentric 134*a*, respectively, and to decrease the duration of actuation or "pulse" actuation to decrease the distance.

From the above, it will be apparent a combination has been disclosed wherein initiation of actuation of a switch mechanism occurs upon movement of the actuating arrangement in but one direction only and whereby the actuation can be variably limited in duration.

While the invention has been disclosed in a preferred embodiment, it is obvious that a number of modifications are possible. Therefore, the scope of the invention should be determined from the following claims.

I claim:

1. In combination, a housing supporting a switch mechanism; an actuating arrangement for said switch mechanism, the actuating arrangement comprising: a first lever pivotal about a first axis and engageable with the actuating element of said switch mechanism; a second lever extending in the same direction as said first lever pivotal about the first axis and supporting a bell crank lever pivotal about a second axis, said bell crank lever including a first arm engageable with said first lever near its free extremity and a second arm engageable with an abutment adjustable with respect thereto and from without said housing; and an actuator supportable in and operable from without said housing and initially movable to engage a portion of said second lever to cause pivotal movement of said second lever and said bell crank lever about said first axis and engagement of said first lever by the first arm of said bell crank lever, said actuator and said second lever and said bell crank lever further movable to cause pivotal movement of said first lever about said first axis to engage the actuating element of and actuate said switch mechanism, said actuator and said second lever and said bell crank lever and said first lever still further movable to cause engagement of said adjustable abutment by the second arm of said bell crank lever and pivotal movement thereof about said second axis to cause the first arm thereof to become disassociated from said first lever resulting in disengagement of said first lever from the actuating element of and deactuation of said switch mechanism, return movement of said actuator and said second lever and said bell crank lever being independent of said first lever.

2. An actuating arrangement for a switch mechanism comprising: a first lever pivotal about an axis and engageable with the actuating element of the switch mechanism; a second lever pivotal about an axis and supporting a bell crank lever pivotal about an axis, said bell crank lever including a first arm engageable with said first lever near its free extremity and a second arm engage-

able with an abutment adjustable with respect thereto; and an actuator initially movable to engage a portion of said second lever to cause pivotal movement of said second lever and said bell crank lever about the axis of said second lever and engagement of said first lever by the first arm of said bell crank lever, said actuator and said second lever and said bell crank lever further movable to cause pivotal movement of said first lever about its axis to engage the actuating element of and actuate the switch mechanism, said actuator and said second lever and said bell crank lever and said first lever still further movable to cause engagement of said adjustable abutment by the second arm of said bell crank lever and pivotal movement thereof about its axis to cause the first arm thereof to become disassociated from said first lever resulting in disengagement of said first lever from the actuating element of and deactuation of the switch mechanism.

3. An actuating arrangement for a switch mechanism comprising: a first lever pivotal about an axis and engageable with the actuating element of the switch mechanism and a second lever pivotal about an axis and supporting a third lever pivotal about an axis, said third lever including a first portion to one side of the axis thereof engageable with said first lever near its free extremity and a second portion to the other side of the axis thereof engageable with an abutment adjustable with respect thereto; said second lever and said third lever pivotally movable about the axis of said second lever to cause engagement of said first lever by the first portion of said third lever, said second lever and said third lever further movable to cause pivotal movement of said first lever about its axis to engage the actuating element of and actuate the switch mechanism, said second lever and said third lever and said first lever still further movable to cause engagement of said adjustable abutment by the second portion of said third lever and pivotal movement thereof about its axis to cause the first portion thereof to become disassociated from said first lever resulting in disengagement of said first lever from the actuating element of and deactuation of the switch mechanism.

4. An actuating arrangement comprising: a driven member and a first lever pivotal about a first axis and supporting a second lever pivotal about a second axis, said second lever including a first portion to one side of said second axis engageable with said driven member near an extremity thereof and a second portion to the other side of said second axis engageable with an abutment adjustable with respect thereto; said first lever and said second lever pivotally movable about said first axis to cause engagement of said driven member by the first portion of said second lever, said first lever and said second lever further movable to cause movement of said driven member, said first lever and said second lever and said driven member still further movable to cause engagement of said adjustable abutment by the second portion of said second lever and pivotal movement thereof about said second axis to cause the first portion thereof to become disassociated with said driven member.

5. An actuating arrangement comprising: a driven member and a driving member supporting a lever pivotal about an axis, said lever including a first portion to one side of said axis engageable with said driven member and a second portion to the other side of said axis engageable with an abutment adjustable with respect thereto; said driving member and said lever movable to cause engagement of said driven member by the first portion of said lever, said driving member and said lever further movable to cause movement of said driven member, said driving member and said lever and said driven member still further movable to cause engagement of said adjustable abutment by the second portion of said lever and pivotal movement thereof about said axis to cause the first portion thereof to become disassociated from said driven member.

6. An actuating arrangement comprising: a driven member and a driving member supporting a lever pivotal about an axis, said lever including a first portion to one side of said axis engageable with said driven member and a second portion to the other side of said axis engageable with an abutment; said driving member and said lever movable to cause engagement of said driven member by the first portion of said lever, said driving member and said lever further movable to cause movement of said driven member, said driving member and said lever and said driven member still further movable to cause engagement of said abutment by the second portion of said lever and pivotal movement thereof about said axis to cause the first portion thereof to become disassociated from said driven member.

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