# United States Patent

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[72] Inventor Clyde F. Robbins
Milwaukee, Wisconsin



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[73] Assignee Cutler-Hammer, Inc.
Milwaukee, Wisconsin
a corporation of Delaware


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[54] **TOGGLE SWITCH WITH PAWL MEANS FOR MOMENTARILY ARRESTING IT IN INTERMEDIATE POSITION**
**12 Claims, 7 Drawing Figs.**


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[51] Int. Cl. ..... H01h 21/50, G05g 5/00
[50] Field of Search ..... 200/169, 76, 78, 153, 166(SD), 1(RV); 74/526, 565



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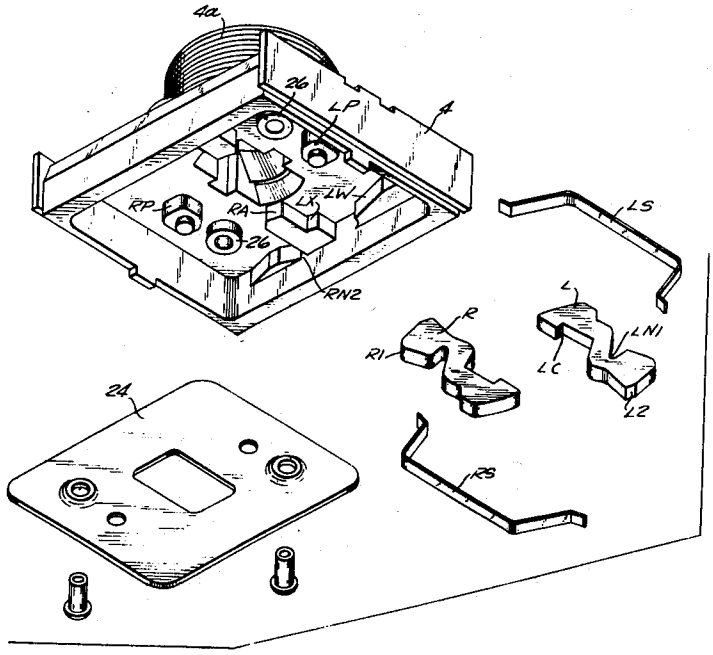
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*Primary Examiner*—R. K. Schaefer
*Assistant Examiner*—Robert A. Vanderhye
*Attorney*—Hugh R. Rather


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**ABSTRACT:** A double-throw switch is provided with a latch mechanism that blocks continuous movement of its toggle lever from either position through center to the other position thereby to allow the switch arc to extinguish before reversing or "plugging" of a motor. The handle of the toggle lever must be released in the center position or slightly moved back before the movement to the other position can be continued. This slight "hesitation" at the center position allows the latch mechanism to release and provides time for the arc to extinguish before reverse contacts are closed. The latch mechanism is a compact flat structure built into the upper portion of the switch and occupies no more space than has sometimes been used for a "momentary" action return spring.

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SHEET 1 OF 2

Fig. 1

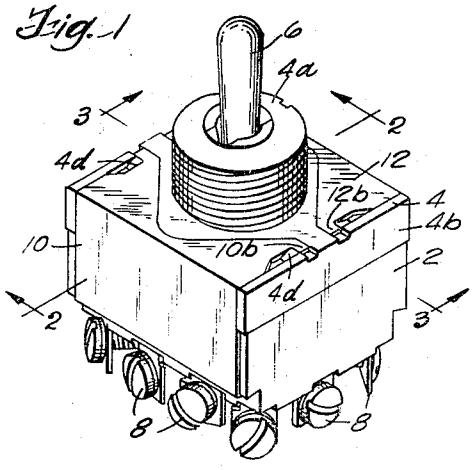



Fig. 2

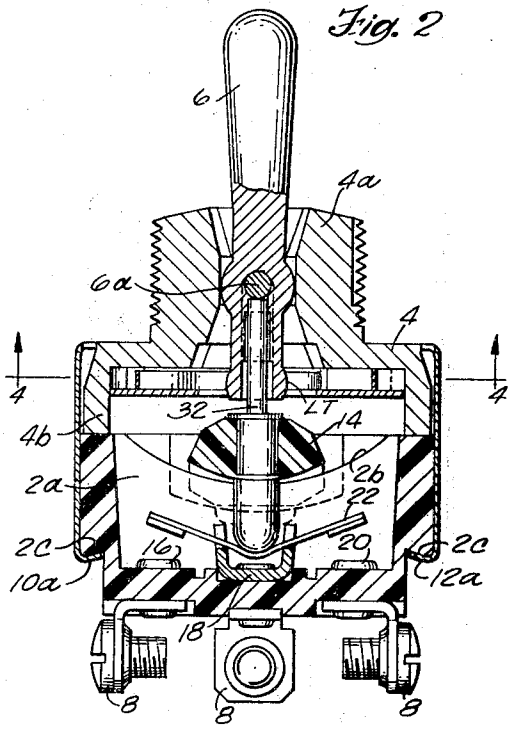
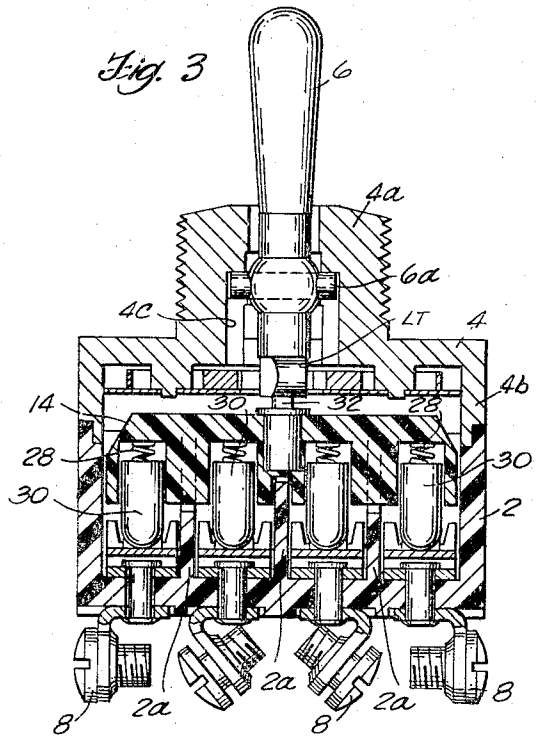



Fig. 3



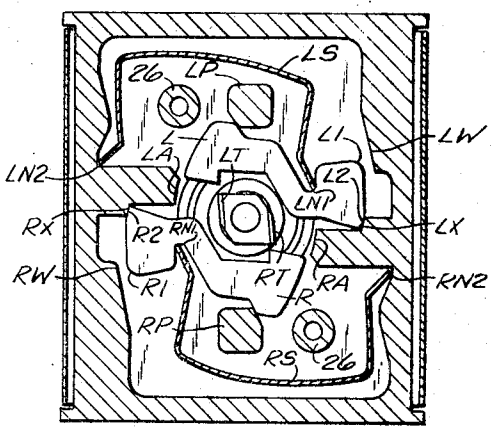




Fig. 4

Inventor
Clyde F. Robbins
By Wm. A. Autio
Attorney

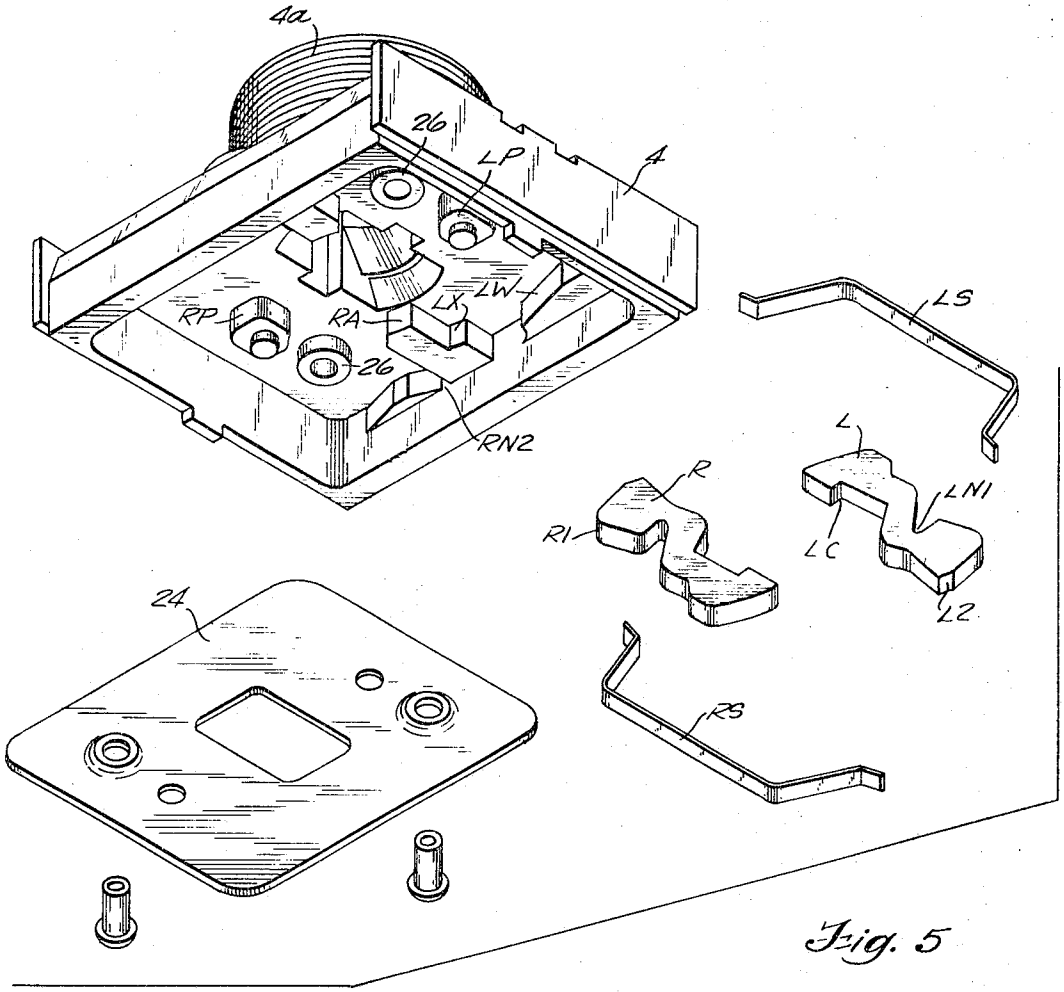



Fig. 5

Fig. 6

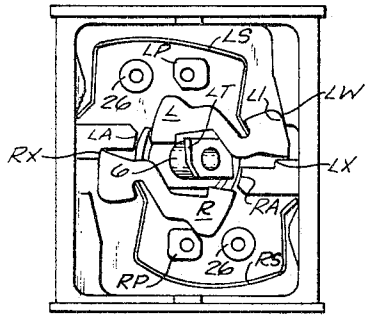
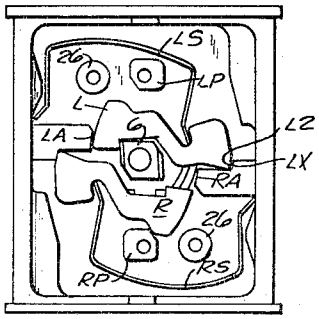



Fig. 7




Inventor
Clyde F. Robbins
By Wm. A. Autio
Attorney

# TOGGLE SWITCH WITH PAWL MEANS FOR MOMENTARILY ARRESTING IT IN INTERMEDIATE POSITION

## BACKGROUND OF THE INVENTION

This invention relates to the art of small motor switches of the double-throw or motor reversing type that provide a momentary time delay between forward and reverse operations to prevent rapid reversal of the electric power before the arc at the opened contacts has had time to extinguish.

Latch mechanisms that provide momentary stopping or blocking of a switch actuator when through-movement is attempted have been known heretofore. In one form, the actuator is arranged so that following restoration of one switch the actuator must be moved a short distance laterally like an automobile shift before it can be reactuated forward to operate the other switch. In another form, a toggle lever is arranged to cam a spring-biased actuator out of one end position notch to a center notch and then out from the center notch to another end position notch. A spring-centered, limited movement slide having a tooth on it that is engaged by the actuator as it enters the center notch is carried thereby to its limit of movement to block further movement of the actuator, requiring a momentary relaxation of the toggle lever to allow the slide to center and its tooth to clear the actuator permitting continued movement to the other notch.

While these prior known mechanisms have been satisfactory for their intended purposes, none of them has had the simplicity and economy of construction, compactness and flatness of configuration and efficiency of operation and durability allowing inclusion thereof in a switch housing without conspicuous change in shape or increase in size thereof according to the invention.

## SUMMARY OF THE INVENTION

This invention relates to an improved hesitation mechanism.

An object of the invention is to provide a double-throw device with improved means for blocking continuous movement of its operating member from either operating position through its center position to the other operating position whereby hesitation at the center position is required before movement to the other operating position can be completed.

A more specific object of the invention is to provide a three-position toggle switch with an improved latch mechanism that prevents continuous movement of the operating lever from one operating position through its center off position to the other operating position but requires a jogging hesitation at the center off position to permit the latch mechanism to release before movement to the other operating position can be resumed.

Another specific object of the invention is to provide a toggle switch with an improved latch mechanism that prevents continuous unidirectional movement of the operating lever from one position through the center position to the other position but requires momentary hesitation or slight reverse movement to release the latch mechanism before such movement can be continued to completion thereby to prevent instantaneous reverse energy from being applied to a load such as a motor before the arc at the opened contacts has extinguished.

Another specific object of the invention is to provide a latch mechanism of the aforementioned type that is simple and compact in construction and efficient in operation and fits into a thin flat space beneath the cover plate of a toggle switch.

Another specific object of the invention is to provide a latch mechanism of the aforementioned type that can be applied to a conventional toggle lever operated switch with modification of the toggle lever or to other types of actuators.

A further specific object of the invention is to provide a latch mechanism of the aforementioned type that will fit into a space substantially equal to that sometimes used for a momentary-action lever return spring at the top of the switch housing, such as that shown in H. W. Hults U.S. Pat. No. 2,759,075, dated Aug. 14, 1956.



Another object of the invention is to provide a toggle switch of the aforementioned type with an improved operating lever having lost motion to afford freedom of movement for latch mechanism release without the contact actuator interfering therewith.

Another object of the invention is to provide an improved hesitation switch of the aforementioned type with improved snap-in plates for assembling the cover to the base.

Other objects and advantages of the invention will hereinafter appear.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a toggle switch incorporating the hesitation latch mechanism according to the invention;

FIG. 2 is an enlarged vertical cross-sectional view taken along line 2–2 of FIG. 1;

FIG. 3 is an enlarged vertical cross-sectional view taken along line 3–3 of FIG. 1 that is perpendicular to the view in FIG. 2;

FIG. 4 is a horizontal cross-sectional view taken along line 4–4 of FIG. 2 showing the toggle lever in its center off position and the hesitation latch mechanism released;

FIG. 5 is an enlarged exploded isometric view of the cover and hesitation latch mechanism including its retaining plate of the switch of FIG. 1;

FIG. 6 is a bottom view, with the retaining plate removed, of the hesitation latch mechanism of the switch of FIG. 1 showing the toggle lever in one operating position and the hesitation latch mechanism reset; and

FIG. 7 is a view like FIG. 6 showing the toggle lever blocked in its center off position when movement was attempted from the position shown in FIG. 6 toward the other operating position.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, there is shown a four-pole double-throw hesitation switch of the toggle lever type adapted for one-hole mounting in a panel. This switch is provided with a housing having an insulating base 2 and a cover 4 having an integral bushing 4*a* thereon, a toggle lever 6, terminals 8 at the bottom of the base for connection to an external circuit, and two spring plates 10 and 12 of the snap-in type for securing the combined bushing and cover to the base. While four poles are shown, other members of poles may be used.

Base 2 is provided with means for mounting switch contacts. This means comprises a cavity in the base divided by three partition walls 2*a* into four compartments for the four poles, respectively, of the switch as shown in FIG. 3. Each of these partition walls is provided with an upper edge 2*b* arcing down from its ends toward the middle as shown in FIG. 2 to provide clearance for the arcuate swing of actuator block 14.

Each compartment is provided with three stationary contacts 16, 18 and 20 and a movable rocking contact 22. As shown in FIG. 2, stationary contact 18 is in the middle and is in the form of a cradle for rockably supporting movable contact 22 in the center off or open position shown or in either of two operating or closed positions against contact 16 or contact 20, respectively. Each stationary contact is riveted through the bottom of the base to an external terminal 8 having a screw therein for connection to an external circuit. Other contact arrangements could be used.

Cover 4 comprises a bushing 4*a* upstanding from its center and a skirted portion 4*b* depending from its edge and extending all the way around. The lower edge of the skirt on the cover abuts the upper edge of the base and the two are clamped rigidly together by a pair of spring plates 10 and 12. For this purpose, the opposite sides of the base as shown in FIG. 2 are provided with undercut portions 2*c* that are engaged by hooks 10*a* and 12*a* on the spring plates whereafter

the upper portions are pressed toward one another over the cover until they snap into place. For snap-in purposes, the upper surface of the cover is provided with two pairs of catches 4*d* each having an inclined surface ending in a vertical detent surface. Also, each spring plate is provided with a pair of lateral projections 10*b* and 12*b* that slide up the inclined surfaces and snap therebehind to be retained by the vertical detents. These spring plates can be removed by inserting a sharp pointed tool under projections 10*b* and 12*b* and prying them out from behind the catches.

Bushing portion 4*a* is provided with means for pivoting toggle lever 6 therein for rocking movement. This means comprises a central bore and lateral grooves 4*c* therein shown in FIG. 3 extending up from below through which the ends of a pivot pin 6*a* may be inserted to be wedged in the upper tapered ends of these grooves whereby the toggle lever is pivotally supported on the pin. Upward bias force resiliently applied on the pivot pin by the contact actuator mechanism hereinafter described maintains the pivot pin in its seat but leaves the toggle lever freely movable without any binding force thereon throughout its lost motion.

The hesitation latch mechanism is mounted below the cover within the skirt. As shown in FIGS. 4 and 5 the hesitation latch mechanism comprises a pawl L and a spring LS for the pawl. There is also a retaining plate 24 for retaining the pawl and spring in place. Pawl L is also provided with two pivot points, L1 and L2, with the two pivot points being on opposite sides of the line of action of the associated spring enabling pivoting of the pawl in opposite directions. The lower surface of the cover is provided with suitable pivot points, pivot shoulders, abutments, projections and notches for accommodating the pawl and spring in their operation as hereinafter described.

As shown in FIG. 5, spring LS is in the form of a narrow strip formed into a generally U-shaped with its ends bent outwardly to project at upward-outward angles. One end of the spring bears in a notch LN1 in the pawl and the other end bears in a notch LN2 in the cover of the switch housing. A straight line passing through the ends of the spring passes between pivot points L1 and L2. Consequently, when pivot point L1 of the pawl bears on wall LW of the cover, the pawl will rotate counterclockwise. And when pivot point L2 bears on shoulder LX of the cover, the pawl will rotate in the clockwise direction. This provides latching and unlatching action.

The operation of the hesitation latch mechanism when the lower end of the toggle lever is moved from the right toward the left is shown in FIGS. 6, 7 and 4 in that sequence. As shown in FIG. 6, the lower end of toggle lever 6 initially has been moved to the extreme right position to close contact 22 to 20. The toggle lever is provided with a tooth LT at its lower end as shown in FIGS. 3 and 4 for hooking into a complementary catch in the pawl. Tooth LT is rounded in a vertical plane to maintain uniform contact with the pawl when the lever is pivoted. When the toggle lever was moved to the extreme right, it cammed pawl L off shoulder LX (pivot L2) to pivot L1 on wall LW. Since pivot L1 is above the line of action of spring LS, the spring puts a counterclockwise torque on pawl L to rotate it against the toggle lever as shown in FIG. 6. Consequently, when the toggle lever is moved left, its tooth LT engages catch LC in pawl L and carries the pawl with it against the force of the spring until the pawl stops against abutment LA. This stops the toggle lever in the switch-open position and blocks further movement as shown in FIG. 7. At the same time as pawl L was moved against abutment LA at the left or blocking end its right or pivot end was moved from wall LW (pivot point L1) onto shoulder LX (pivot point L2) as shown in FIG. 7 under the force of spring LS.

This blocking of toggle lever motion imposes a "hesitation" on the operator to keep the switch momentarily open thereby to allow any arc at the just opened contacts to extinguish before reverse torque is applied by closing contact 22 to contact 16 as the existence of an unextinguished arc from one direction of operation would cause a short circuit on the line when reversing contacts close.

Due to the lost motion, a relaxation of the toggle lever or slight jogging or reverse movement thereof releases pawl L from being pinched between the toggle lever and abutment LA transferring the pawl support to LX for pivotal movement. This time spring LS puts a clockwise torque on the pawl about pivot L2 since pivot point L2 is below the line of action of the spring. Consequently, pawl L rotates away from the toggle lever to release it and allow continued movement thereof toward the left as shown in FIG. 4.

While the single pawl structure hereinbefore described provides a complete hesitation latch mechanism for one direction of movement of the toggle lever, bidirectional hesitation latching may be provided by adding a like mechanism symmetrically arranged on the other side of the toggle lever. The elements of this added mechanism are identified in FIGS. 4, 6 and 7 by like reference characters having the prefix R instead of L.

If the toggle lever were now moved left from the position shown in FIG. 4, it would cause closure of contact 22 to contact 16 and would also cam pawl R off from shoulder RX onto wall RW so that it shifts from pivot point R2 to pivot point R1. It will be seen that as long as pawl R was on pivot point R2 it was biased clockwise by spring RS to be clear of the toggle lever. Now at pivot point R1, this pawl will receive counterclockwise torque from the spring and will rotate against the toggle lever into readiness to provide blocking action when the toggle lever is attempted to be moved all the way to the right. This position of pawl R is not shown but is the same as the position of pawl L in FIG. 6.

From the foregoing, it will be apparent that the two hesitation latch means provide blocking action in both directions. If unidirectional blocking action is desired, one pawl and preferably also its spring may be removed.

The walls and abutments in the configurations shown in FIGS. 4—7 may be cast integrally with cover 4. There is also formed integrally with the cover means for positioning the retaining plate comprising a pair of positioning studs LP and RP on the center line of the cover and on opposite sides of pawl L and R, respectively. Each stud has a landing as shown in FIG. 5 to space retaining plate 24 from the cover and a reduced round pin fitting into a hole in retaining plate 24 to locate it in proper position relative to the cover. These studs also serve as back stops for the pawls as shown in FIG. 4, The reduced round pins could serve as rivets for securing 24, if cover removal were not contemplated. To enable removal of the retaining plate, removable securing means such as rivets are used as hereinafter described.

For this purpose, there is provided reworkable means for rigidly securing retaining plate 24 to cover 4. This means comprises a pair of shorter studs 26, each having a rivet hole extending therethrough to the top of the cover. These studs are suitably spaced on opposite sides of the bushing near studs LP and RP, respectively. These studs 26 are shorter to accommodate offset and perforated portions of retaining plate 24, through which rivet holes and perforations the retaining plate is riveted to the cover. This offsetting provides cups for the rivet heads to avoid interference with movement of actuator block 14.

Actuator block 14 is of known type having a round recess for each pole of the switch in which is received a helical compression spring 28 and a plunger 30 that rests on movable contact 22. A rod 32 having an intermediate annular flange has its lower end friction fitted into a center recess in actuator block 14 and has its upper end extend into a hole in the lower end of toggle lever 6 to bear against pivot pin 6*a* as shown in FIGS. 2 and 3. With this construction, the compression springs 28 provide a bias between the movable contacts and pivot pin 6*a* so that toggle lever 6 is relatively free of any spring bias or binding.

Since toggle lever switches of this type have a relatively small amount of movement provided for operating the contacts, means are provided for insuring operation of the hesitation latch mechanism. This means comprises lost motion means in the actuator mechanism to allow free toggle lever

movement at the center position after the contacts have opened to insure release of the blocking pawl from the toggle lever as soon as the operator lets go of the handle. This lost motion is provided by making the hole in the lower end of toggle lever **6** slightly larger than the diameter of the adjacent end of rod **32** received therein as shown in FIG. **2**. This allows the toggle lever to be free through a larger angle at the center position to insure release of the pawl when the toggle lever is no longer being pushed.

To provide long lasting efficient and reliable operation, the cooperating parts of the hesitation mechanism are made of stainless steel or the like to avoid wear and corrosion. These parts include the toggle lever, rod **32**, pawls L and R and springs LS and RS. Base **2** and actuator block **14** are molded of insulating material. Cover **4** is preferably cast of zinc or the like. Also, this mechanism cannot become inoperative due to shock because a pawl dislodged from its pivot can be reset by manipulation of the toggle lever.

While the apparatus hereinbefore described is effectively adapted to fulfill the objects stated, it is to be understood that the invention is not intended to be confined to the particular preferred embodiment of hesitation switch disclosed, inasmuch as it is susceptible of various modifications without unduly departing from the scope of the appended claims. For example, the hesitation latch mechanism could be used with a movable member other than a switch actuator.

I claim:

**1.** A hesitation latch mechanism for preventing continuous movement of an operating member from a first position through an intermediate position to a second position and for causing momentary stopping thereof in the intermediate position whereafter its movement can be resumed comprising:

means providing a thin flat enclosure for the hesitation latch mechanism;

a pawl and means providing first and second alternate pivot points therefor spaced from one another;

a bias spring for said pawl having a line of action extending between said pivot points to cause rotation of said pawl in opposite directions toward and away from the operating member when it is on said first and second pivot points respectively;

a fixed stop member within said enclosure; and

means effective when the operating member is moved from its first position toward its second position for catching said pawl and carrying it therewith until it is stopped by said fixed stop member to prevent movement of the operating member beyond its intermediate position; and such movement of the pawl also causing shifting thereof from its first to its second pivot point to cause said bias spring to rotate said pawl away from the operating member when the actuating force on the operating member is released thereby to free the operating member for resumption of movement to its second position.

**2.** The invention defined in claim **1**, together with:

a second like hesitation latch mechanism within said enclosure symmetrically arranged on the opposite side of the operating member from the first hesitation latch mechanism for providing a like function when the operating member is moved in the opposite direction.

**3.** An electric switch comprising:

stationary contact means adapted for connection to at least two electric circuits;

movable contact means arranged for cooperation with said stationary contact means to close either one of said electric circuits or to open them;

contact actuator means and means mounting the same to be normally capable of continuous movement from a first operating position wherein one of said circuits is closed through an intermediate position wherein both of said circuits are open to a second operating position wherein said other circuit is closed; and a hesitation mechanism operable when said contact actuator means is moved from said first operating position toward said second operating position for stopping it in said intermediate position and being further operable when the operating force on said contact actuator means is slightly relaxed for releasing it to allow continued movement to said second operating position comprising:

means for stopping said contact actuator means in said intermediate position comprising:

a pawl having an operative position and an inoperative position;

a spring biasing said pawl;

means providing two alternate pivot points for said pawl, one on each side of the line of action of said bias spring, to cause said pawl to rotate toward said contact actuator means into its operative position when it is on one pivot point and to cause said pawl to rotate away from said contact actuator means into its inoperative position when it is on the second pivot point;

means operable when said contact actuator means is moved to said first operating position for shifting said pawl from its second to its first pivot point thereby to cause said bias spring to rotate said pawl toward said contact actuator means into its operative position;

means comprising a catch on said pawl operable when said contact actuator means is moved for stopping the latter in said intermediate position and for shifting said pawl to its second pivot point; and

said bias spring being effective when the force on said contact actuator means is relaxed for rotating said pawl clear of the latter to allow continued movement thereof to its second operating position.

**4.** The invention defined in claim **3**, together with:

a second pawl and a second bias spring; and

means mounting said second pawl and second bias spring to provide like hesitation action when said contact actuator means is moved from said second operating position toward said first operating position.

**5.** In a double-throw toggle switch having an insulating base provided with an open top cavity therein including stationary contacts in alined spaced apart relation therein, a movable contact, contact actuator means comprising a toggle lever pivotable from center position in opposite directions to first and second operating positions to close first and second contacts, respectively, and a cover closing the top of the base and including a bushing for pivotally supporting the toggle lever; the improvement comprising:

a hesitation mechanism mounted in a thin flat compact space beneath the cover of the switch for blocking continuous movement of the toggle lever through its center position to the other operating position comprising:

a pawl and means providing first and second alternate pivot points therefor spaced from one another;

a bias spring for said pawl having a line of action extending between said pivot points to cause rotation of said pawl in opposite directions in the respective pivot points toward and away from the toggle lever, said pawl being rotated toward the toggle lever when the latter is in one of its operating positions and the pawl is in its first pivot point;

a fixed stop member;

means effective when the toggle lever is moved from said one operating position toward the other operating position for catching said pawl and carrying it therewith until it is stopped by said fixed stop member to prevent movement of the toggle lever beyond its center position where both contacts are open; and

such movement of the pawl also causing shifting thereof to its second pivot point to cause said bias spring to rotate the pawl away from the toggle lever when the actuating force on the toggle lever is reduced thereby to allow resumption of toggle lever movement to the other operating position.

6. The invention defined in claim 5, together with a retaining plate secured in spaced apart relation to the lower surface of the cover to provide said space for said hesitation mechanism.

7. The invention defined in claim 5, wherein the contact actuator means also comprises:

a movable contact actuator; and

a lost motion connection between said toggle lever and said movable contact actuator affording free movement of the toggle lever at its center position to free the pawl for rotation away therefrom and to insure resetting of said pawl to its first pivot point when said toggle lever is moved all the way in the other direction.

8. The invention defined in claim 5, together with:

a pair of spring plates for snap-in securing of the cover to the base;

means on each side of the base for hooking one of said spring plates;

catches on the top of the cover; and

projections on said spring plates that are slid over said catches to clamp the cover to the base.

9. In a double-throw switch having a housing comprising an insulating base with stationary contacts in spaced-apart relation mounted therein and connected to external terminals, a moveable contact, and contact actuator means movable from a center position in opposite directions to first and second operating positions to provide spring pressure actuation of said movable contact to close first and second contacts, respectively, the improvement comprising:

a hesitation mechanism mounted in a thin flat compact space at the upper portion of the housing for imposing on said contact actuator means a momentary time delay at the center position between the opening of one of the contacts and the closing of the other contacts in both directions of movement thereof comprising:

a pair of like pawls each having a pivot portion and a blocking portion and arranged for operation in respectively opposite directions of movement of the contact actuator means;

a pair of like bias springs for the respective pawls;

means in said housing providing first and second alternate pivot points for each of said pawls, one on each side of the line of action of its associated bias spring, to rotate its blocking portion toward and away from the contact actuator means, respectively;

means responsive to movement of the contact actuator means to one of its operating positions for resetting one of said pawls to its first pivot point thereby to cause said bias spring to rotate it toward said contact actuator means into readiness for imposing said momentary time delay;

means responsive to movement of said contact actuator means from said last mentioned operating position toward the other operating position for effecting engagement between it and said reset pawl and to move the latter with it;

means limiting the amount by which each pawl can be moved by said contact actuator means when such pawl has been reset thereby to block movement of said contact actuator means beyond its center position;

said reset pawl being responsive to said movement thereof and to its bias spring for setting the same in its second pivot point; and

the bias spring of said set pawl being responsive to relaxation of the engagement between said contact actuator means and said set pawl for rotating the blocking portion of the latter away to release said contact actuator means for continued movement to said other operating position.

10. The invention defined in claim 9, wherein said contact actuator means comprises:

an actuator block for operating the movable contact;

a toggle lever pivotally mounted in the housing and having an external handle portion and an internal portion within the housing;

means on said internal portion of said toggle lever for effecting said engagement between it and said reset pawl; and

means providing a limited lost motion connection between said toggle lever and said actuator block allowing free movement of said toggle lever at its center position and preventing contact spring reaction from binding said toggle lever and preventing rotation of the pawl away therefrom.

11. The invention defined in claim 10, wherein said means providing a limited lost motion connection comprises:

a member secured to said actuator block and having a rod extending therefrom;

a hole in said toggle lever larger than said rod to provide limited lost motion therebetween; and

a pivot pin for said toggle lever secured in said housing and against which the end of said rod bears.

12. The invention defined in claim 9, wherein said means limiting the amount by which each pawl can be moved comprises:

an abutment for the blocking portion of each pawl in the housing against which the pawl positively stops when the contact actuator means is moved to its center position.