June 2, 1964 N. MILLER 3,135,841

SNAP ACTING SWITCH

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Fig 1

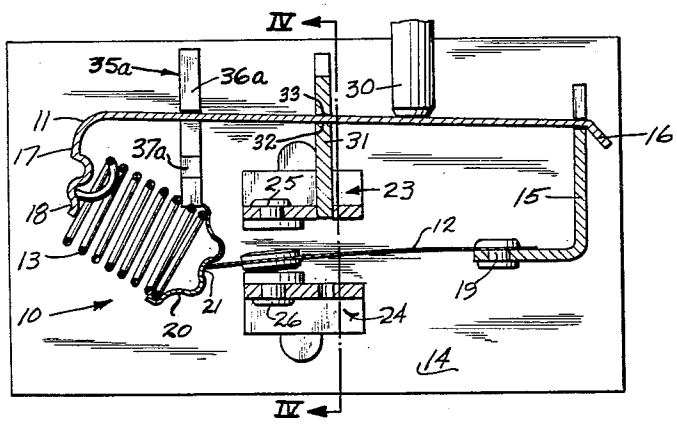

Fig 2

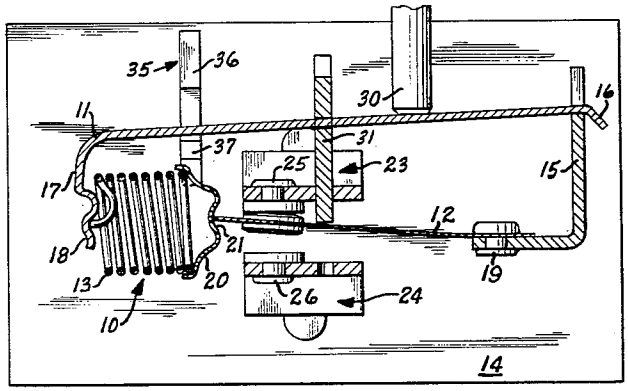

Fig 3

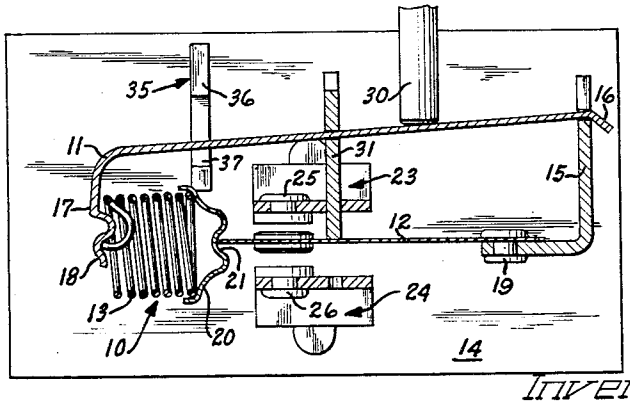

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Fig 4

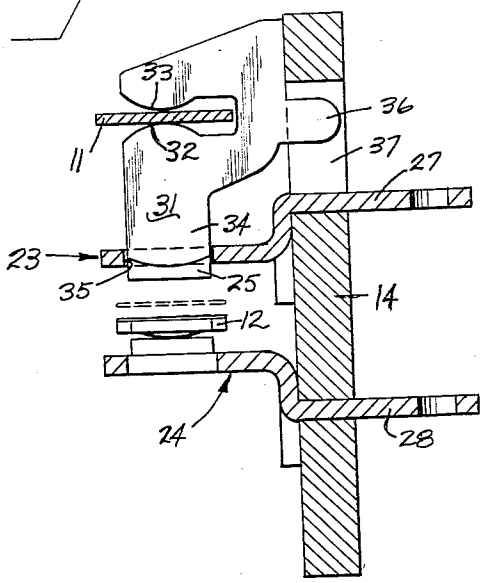

Fig 8

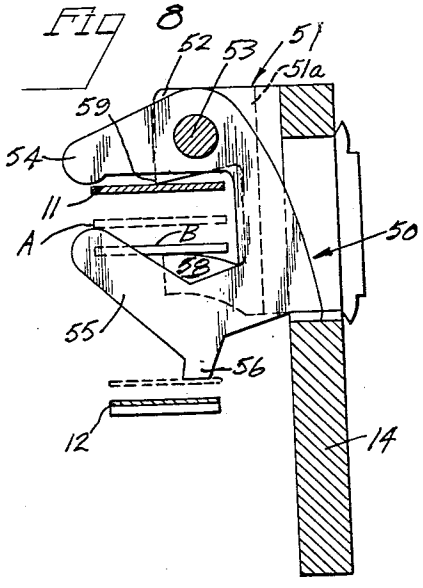

Fig 9

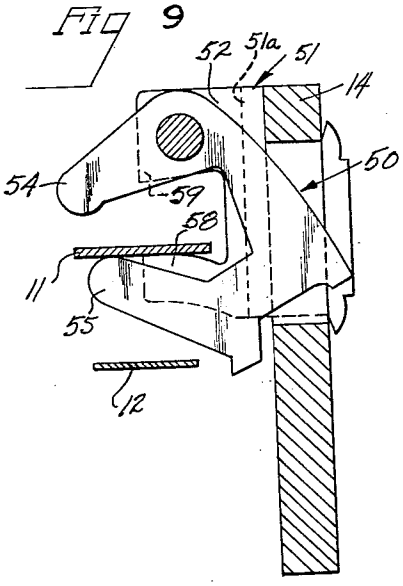

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Fig 5

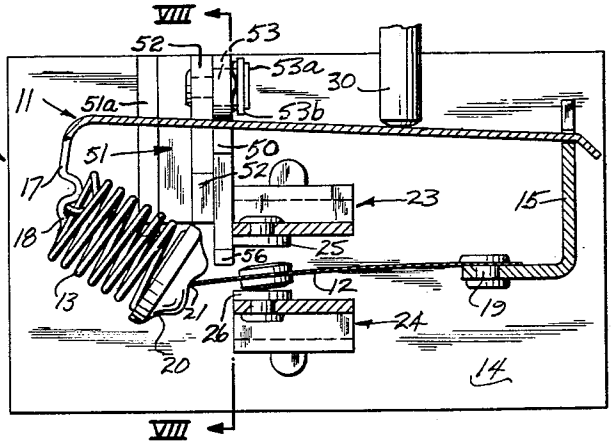


Fig 6

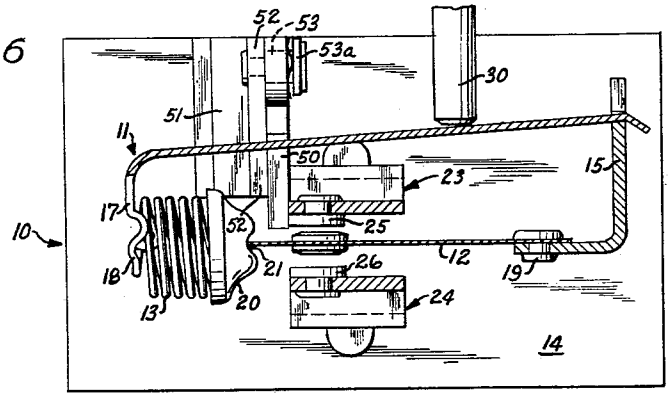
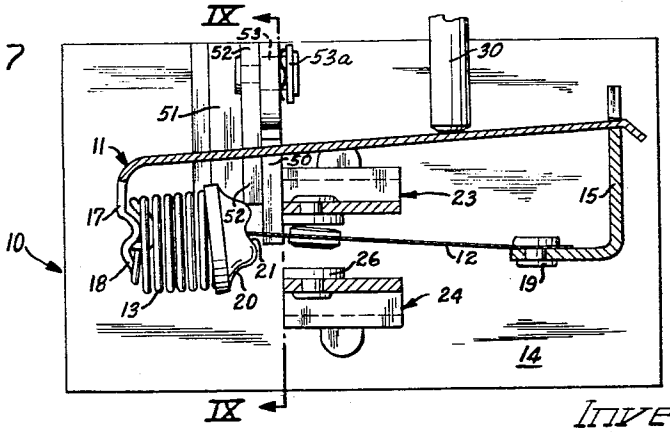


Fig 7



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3,135,841

SNAP ACTING SWITCH

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Filed Aug. 18, 1959, Ser. No. 834,451
2 Claims. (Cl. 200—67)

This invention relates to snap action mechanisms and more particularly relates to a double throw snap action mechanism having a neutral or "off" position.

Snap action mechanisms have found great utility in recent years since they are relatively simply and economically manufactured and since they are operable to actuate the mechanism with which they are associated with a positive stroke of the snap blade even though the force which acts to actuate the mechanism is applied very slowly. More particularly such snap action mechanisms have found particular utility in the electrical field in the form of double throw snap action switches since the quick snapping action of the snap blade associated with the mechanism is effective to substantially eliminate arcing between two adjacent contacts.

Heretofore, however, such snap action mechanisms have been simply of the single or double throw type having no provision for maintaining the snap blade associated with the mechanism in an intermediate position. Those skilled in the art of designing and using snap action mechanisms and particularly those acquainted with the adaptability of same to the electrical field will recognize the desirability of providing a snap action mechanism having a neutral or off position so that, in essence, a triple throw rather than the usual double throw switch is provided.

The invention relates to a switch mechanism wherein the snap blade associated with the mechanism is movable to any one of three selected positions as desired. Two embodiments of such a mechanism are hereafter set forth and described with particulartiy and illustrated in the appended drawings.

In the first embodiment of the invention, the snap action mechanism is shown as comprising generally a mounting plate upon which are affixed two transversely spaced electrical contacts which have a movable contact disposed therebetween. The movable contact is snapped into engagement with one or the other of the two stationary contacts by the usual actuator lever and overcenter spring but has an abutment member associated therewith which is connected to the actuator lever and which is effective to hold the movable contact out of engagement with one of the stationary contacts in one position of the actuator lever. Upon depressional movement of the actuator lever the movable contact, which is initially disposed in engagement with the lower of the two stationary contacts is snapped upwardly into engagement with the upper of the two stationary contacts. Upon further depressional movement of the actuator lever, however, the abutment member which is connected to the actuator lever and which is engageable with the movable contact moves into engagement with the movable contact to move the same out of engagement with the upper of the two stationary contacts. Since, however, the movable contact is not moved by the abutment member to a position past the overcenter position of the overcenter spring the movable contact is not thereby snapped into engagement with the lower of the two stationary contacts but is, rather, held in an intermediate or neutral position between the two stationary contacts.

The second embodiment of the invention functions on substantially the same principles but in this embodiment

depressional movement of the actuator lever acts to first move the movable contact which is initially in engagement with the lower of the two stationary contacts into an intermediate position and, thereafter, further depressional movement acts to permit spring urged movement of the movable contact into engageemnt with the upper of the two stationary contacts. Thus, in the first embodiment of the invention, the intermediate or neutral position of the movable contact or snap blade is effected after the actuator lever has been depressionally moved to its fullest extent. On the contrary, in the second embodiment of the invention the neutral or intermediate position of the movable contact or snap blade is effected in an intermediate pivoted position of the actuator lever.

It is, of course, to be understood that such snap action switch mechanisms as are hereinafter disclosed in detail may find utility in other instances than in the electrical field since triple throw switches may, for instance, be used in controlling the movement of a spool valve or the like.

It is therefore a principal object of the present invention to provide a snap action mechanism in which the snap blade associated therewith may be controllably moved to any of three separate positions.

A further object of the invention is to provide a snap action mechanism of the type above described which may be readily and economically manufactured.

Another important object of the invention is the provision of a snap action mechanism wherein the snap blade associated therewith may be moved to any of three separate positions as desired and wherein movement of the snap blade to these respective positions is effected as a function of the degree of movement of the usual actuator lever associated therewith.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings, wherein:

FIGURE 1 is a partially sectional partially elevational view of a snap action mechanism constructed in accordance with the principles of the present invention and showing the snap blade or movable contact in a first position;

FIGURE 2 is a partially sectioned partially elevational view which is similar in nature to FIGURE 1 but which shows the snap blade in engagement with the other of two opposed electrical contacts;

FIGURE 3 is a partially sectional partially elevational view which is similar in nature to FIGURES 1 and 2 but which shows the snap blade in an intermediate position;

FIGURE 4 is a fragmental partially sectioned partially elevational view of the snap action mechanism illustrated in FIGURES 1–3 which is taken along lines IV—IV of FIGURE 1;

FIGURE 5 is a partially sectioned partially elevational view of a second embodiment of the snap action mechanism of my invention showing the movable contact in a first position;

FIGURE 6 is a view similar in nature to FIGURE 5 but which shows the movable contact in an intermediate position;

FIGURE 7 is a view similar to FIGURES 5 and 6 which shows the movable contact in engagement with the other of the two opposed stationary contacts;

FIGURE 8 is a partially sectioned partially elevational view of the snap action mechanism illustrated in FIGURES 5–7 which shows the mechanical transducer in side elevation and which is taken along lines VIII—VIII of FIGURE 5; and

FIGURE 9 is a view which is similar in nature to FIGURE 8 but which shows the mechanical transducer in a different position from that illustrated in FIGURE 8 and which is taken along lines IX—IX of FIGURE 7.

In the embodiment of the invention illustrated in FIGURES 1–4, a snap action mechanism **10** is shown by way of example, and not by way of limitation, being adapted for use as a double throw electrical switch mechanism and includes generally a snap or actuator lever **11**, a snap blade or movable contact **12**, and an overcenter spring **13** interconnecting the free end portions of the lever **11** and the blade **12**. A supporting member or plate **14** serves to mount the various parts of the snap action mechanism and has an L-shaped bracket **15** mounted adjacent one end thereof which, in turn, serves as a mounting means for the actuator lever **11** and the snap blade **12**. The bracket **15** is apertured at the upper end thereof to receive one end of the actuator level **11**. The lever **11** has its end which is disposed adjacent the aperture in the bracket **15** turned downwardly as at **16** to prevent movement of the lever out of the aperture by the overcenter spring **13**. The free end of the lever **11** has a downwardly turned arm **17** formed integrally therewith which is bent to form a recess **18** adjacent the lower end thereof.

The snap blade **12** is secured to the base portion of the L-shaped bracket **15** by means of a rivet **19** and has its outer free end connected with the depending arm **17** of the lever **11** by means of the overcenter spring **13**. The overcenter spring **13** has one outturned end portion disposed within the recess **18** in the depending arm **17** and has its opposite end portion received within a spring retaining cup **20**. The spring retaining cup **20** has a recess **21** formed within the outer surface thereof which is adapted to receive the free end of the snap blade **12**.

A pair of transversely spaced electrical connecting tabs **23** and **24** are mounted within suitable apertures on the supporting plate **14** and have contacts **25** and **26**, respectively, mounted therein. Obviously, where the snap action switch mechanism is being used as an electrical switch it would be necessary to form the supporting plate **14** of some insulating material. The connecting tabs **23** and **24** each have protruding legs **27** and **28**, respectively, extending rearwardly from the supporting plate **14** which are adapted to be connected to electrical power transmission lines. Thus, by connecting the bracket **15** to the opposite side of an electrical power line a current may be transmitted through the tab **27** or the tab **28** as desired by merely moving the snap blade **12** into engagement with one or the other of the two contacts **25** and **26**.

As is well known in the art the snap blade **12** is moved into contact with one or the other of the two stationary contacts **25** and **26** as a function of the position of the actuator level **11**. Thus, when the actuator lever **11** is in an extreme clockwise rotated position such as is shown in FIGURE 1, the overcenter spring **13** acts to urge the snap blade **12** into engagement with the lower stationary contact **26**. When the point of contact of spring **13** with the actuator lever **11** is moved to a point below the point of contact of the spring retainer **20** and the blade **12** by depressional movement of the actuator lever **11**, the overcenter spring **13** acts to snap the blade **12** out of engagement with the lower stationary contact **26** and into engagement with the upper stationary contact **25** thus opening the circuit through the tab **28** and closing the electrical circuit through the tab **27**.

It will here be noted that depressional movement of the actuator lever **11** may be effected by means of a plunger **30** such as is illustrated in the drawings or in any other suitable manner. In this regard it will be understood that the plunger **30** may be connected to the actuator lever **11** so that upward movement of the plunger will act to return the actuator lever **11** and its associated parts to the position illustrated in FIGURE 1 or that the plunger **30** and/or the lever **11** may be provided with suitable spring means operable to normally bias the various parts of the snap action mechanism to the position illustrated in FIGURE 1. The means for effecting pivotal movement of the actuator lever **11** do not, however, form a part of the present invention and so will not herein further be described.

As hereinbefore noted, ordinary snap action switch mechanisms are generally so arranged that the snap blade is only movable to one of two opposed positions. The invention, however, relates to a switch mechanism wherein the snap blade may controllably be held in an intermediate position between the two opposed stationary contacts **25** and **26**. To effect this desirable feature, an abutment member **31** is disposed in sliding contact with the supporting member **14** and has a pair of opposed convex lips **32** and **33** which are adapted to snugly engage the actuator lever **11**. A nib **36** extends rearwardly from member **31** and slides within a slot **37** formed in the member **14** to guide the member **31** through its path of movement in a vertical plane. An integral depending leg **34** of the abutment member **31** extends through a guide slot **35** in the connecting tab **27** to act as a further guide for the member **31** and is engageable with the snap blade **12** to hold the same out of contact with the stationary contact **25**. A rearwardly extending tab **36** is also formed integrally with the abutment member **31** and is slidable within a longitudinal guide slot **37** formed in the supporting member **14**.

As a result of the configuration of the abutment member **31** and its cooperation with the actuator lever **11** depressional movement of the lever from the position illustrated in FIGURE 2 to the position illustrated in FIGURE 3 will be effective to move the abutment member **31** into engagement with the snap lever **12** and to subsequently move the snap lever out of engagement with the stationary contact **25**.

In operation the snap action mechanism which is illustrated in FIGURES 1–4 functions substantially as follows: Assuming that the actuator lever **11** is initially in the position illustrated in FIGURE 1, the snap blade **12** will be maintained in contact with the stationary contact **26** by the biasing force of the overcenter spring **13** so that the electrical circuit through contact **26** will be closed. Depressional movement of plunger **30** will act to pivotally move the actuator lever **11** with respect to the bracket **15** to effect compression of the overcenter spring **13**. When the point of contact of the overcenter spring **13** with the actuator lever **11** has moved to a point below the point of contact of the spring retainer **20** with the snap blade **12**, the overcenter spring will act to snap the outer free end of the blade **12** upwardly out of engagement with the contact **26** and into engagement with contact **25**. Further depressional movement of plunger **30** will act to further pivotally move the actuator lever **11** in a counterclockwise direction about the bracket **15** thereby moving the abutment member **31** into engagement with the snap blade **12** and subsequently moving the free end of the snap blade **12** out of engagement with stationary contact **25**. Accordingly, the free end of the snap blade **12** will simply be held by the abutment member **31** in an intermediate position between the stationary contacts **25** and **26** so that an electrical energizing circuit through each of the contacts will at the same time be opened.

In order to maintain the various interconnected parts in an operative relation with respect to one another, I provide a stop **35***a* on the supporting member **14** for limiting pivotal movement of the actuator lever **11**. The stop **35***a* has upper and lower outwardly extending arms **36***a* and **37***a* formed integrally therewith and embracing the actuator lever **11** which are adapted to limit the degree of pivotal movement of the lever.

Referring now more particularly to the embodiment of the invention illustrated in FIGURES 5–9, a snap action switch mechanism is shown which is somewhat similar to the embodiment of the invention illustrated in FIGURES 1–4 (like parts having like numerals) but in which the means for holding the snap blade **12** in a neutral position differ somewhat. In this embodiment of the invention the switch mechanism is so constructed that depressional movement of the plunger **30** acts initially to move the

snap blade to an intermediate position while further depressional movement of the plunger acts to move the free end of the snap blade 12 into engagement with the upper stationary contact 25. Thus, the cycle of movement of the snap blade is different from that which is effected by means of the mechanism illustrated in FIGURES 1–4.

As shown especially in FIGUES 8 and 9, a mechanical transducer 50 is substituted in place of the abutment member 31 for holding the snap blade 12 in a neutral position and functions on a different principle. A mounting bracket 51 is rigidly secured to the supporting member 14 and has an apertured outwardly extending flange 52 formed integrally therewith. A pivot pin 53 extends through the aperture in outturned flange 52 and is adapted to rotatably receive the apertured upper arm 54 of the mechanical transducer 50. A friction spring 53*a* is disposed intermediate the head 53*b* of the pin 53 and the transducer 50 which frictionally engages the transducer 50 to retard pivotal movement thereof. The mechanical transducer 50 also has a lower arm 55 formed integrally therewith which, in turn, has a depending abutment leg 56 extending therefrom which is adapted to engage the outer free end portion of the snap blade 12.

It will be understood that the mechanical transducer 50 is so formed that, when the transducer is in the position illustrated in FIGURE 8, the inner edge of the upper arm 54 extends substantially horizontally while the inner edge of the lower arm 55 extends angularly upwardly toward the outer end of the arm forming a cam face for reasons which will hereinafter become apparent. The actuator lever 11 is adapted to be disposed in the space intermediate the upper and lower arms 54 and 55, respectively, of the mechanical transducer 50 and the end portions of the arms are so spaced from one another that the lever has limited relative freedom of movement between the arms. That is, the distance intermediate the outer end portions of the respective arms of the mechanical transducer is so fixed that the lever 11 can move from the position illustrated in full lines in FIGURE 8 to position A illustrated in broken lines therein without causing pivotal movement of the transducer 50. It will be understood that the position of the actuator lever 11 which is shown in full lines in FIGURE 8 is the same position of the lever as is shown in FIGURE 5 and that position A of the lever is the same as the position of the lever shown in FIGURE 6.

The inclined inner edge of the lower arm 55 acts as a cam surface so that when the lever 11 is depressionally moved from position A in FIGURE 8 to position B therein, the mechanical transducer 50 will be pivotally moved about the pin 53 to the position illustrated in FIGURE 9. Depressional movement of lever 11 is limited by means of a stop arm 58 formed integrally with the bracket 51 and upward movement of the lever is similarly limited by a projecting portion 59 of the bracket 51.

When the actuator lever 11 is in the position illustrated in FIGURE 5 and in full lines in FIGURE 8, the snap blade 12 will be positioned with its outer free end portion in engagement with the lower stationary contact 26 and will be positioned relative to the depending leg 56 of the transducer 50 as indicated in full lines in FIGURE 8. Depressional movement of the plunger 30 will act to pivotally move the actuator lever 11 in a counterclockwise direction about the bracket 15 to an overcenter position with respect to the point of engagement of the spring retainer 20 with the snap blade 12 so that the blade 12 will be snapped upwardly out of engagement with the stationary contact 25. The snap blade will not, however, move into engagement with the upper stationary contact 25 but will be held in an intermediate position between the two opposed stationary contacts by means of the depending abutment member 56 since it will at that point

be disposed in the path of movement of the blade 12. Further depressional movement of the plunger 30 will act to still further move the actuator lever 11 in a counterclockwise direction about the bracket 15 until it moves into engagement with the stop arm 58. Such movement of the lever 11 from position A to position B as shown in FIGURE 8 will act against the inclined cam surface of the mechanical transducer 50 to pivotally move the transducer in a counterclockwise direction about the pin 53 thereby moving the abutment member 56 out of engagement with the snap blade 12 and permitting upward movement of the outer free end of the snap blade 12 into engagement with the upper of the two opposed stationary contacts 25 as is clearly shown in FIGURES 7 and 9.

As hereinbefore mentioned, it is important to note that such a snap action mechanism may find great utility in other fields than the electrical field such as, for instance, where a snap action mechanism is to be associated with a fluid control valve to control the movement of a spool valve or the like.

Also, as a matter of interest, movement of the plunger 30 may be effected by means of a thermally sensitive power element and in such case the plunger 30 might comprise the power member or piston of the thermally sensitive element which is extensible from the body of the power element upon fusion or expansion of the thermally sensitive material therein. This, of course, constitutes no part of the present invention but is noted as of interest.

It will herein be understood that these embodiments of the invention have been used for illustrative purposes only and that various modifications and variations of the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

What is claimed as the invention:

1. A snap action switch mechanism comprising a mounting member, a pair of transversely spaced brackets affixed to said mounting member, contacts on each of said spaced brackets, a resilient contact blade disposed intermediate said spaced contacts, an actuator lever pivotally mounted on said member, biasing means interconnecting said lever and said blade for selectively snapping said resilient contact blade toward one of said spaced contacts, and means comprising an extension from said lever engageable with said resilient contact and guided within at least one of said brackets operable to prevent engagement of said resilient contact with one of said spaced contacts even though said resilient contact is biased toward said one of said spaced contacts and away from the other of said spaced contacts.

2. A snap action mechanism comprising a mounting member, a resilient blade mounted on said member, an actuator lever pivotally mounted on said member, resilient means interconnecting said lever and said blade for biasing said blade selectively toward one of two opposed extreme positions as a function of the pivoted position of said lever, and means comprising an extension from said lever engageable with said resilient blade to hold said resilient blade in an intermediate position between the two opposed extreme positions of said blade.

References Cited in the file of this patent

UNITED STATES PATENTS

2,586,075	Miller	Feb. 19, 1952
2,783,323	Jeffrey	Feb. 26, 1957
2,792,466	Raney	May 14, 1957
2,798,127	Roeser	July 2, 1957
2,846,538	Hager	Aug. 5, 1958
2,872,540	Hager	Feb. 3, 1959

FOREIGN PATENTS

490,372	Germany	Jan. 30, 1930