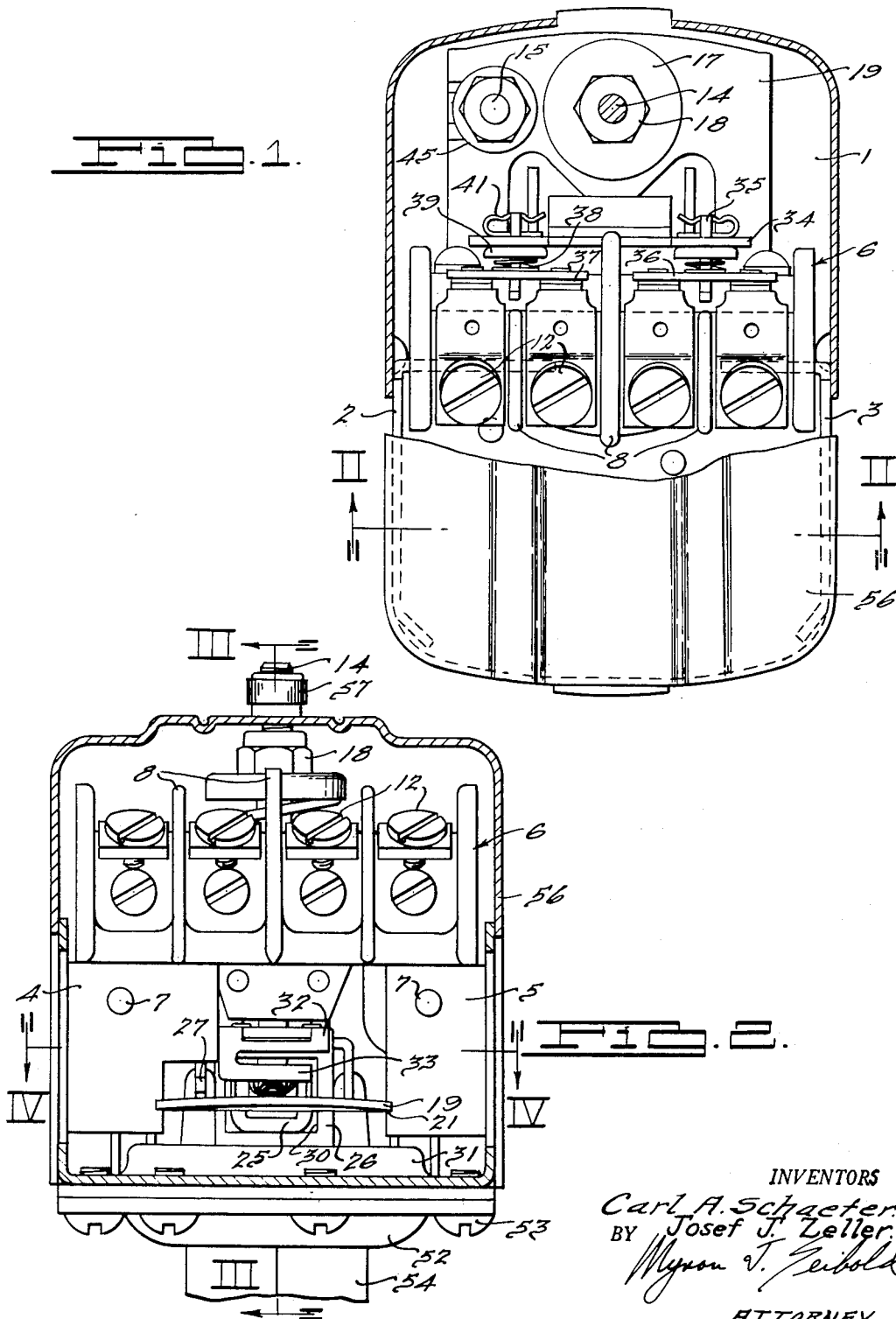


2,741,678

PRESSURE SWITCH

Filed April 9, 1952

3 Sheets--Sheet 1



INVENTORS

Carl A. Schaeter

BY *Josef J. Zeller.*

Myron V. Seibold

ATTORNEY.

April 10, 1956

C. A. SCHAEFER ET AL

2,741,678

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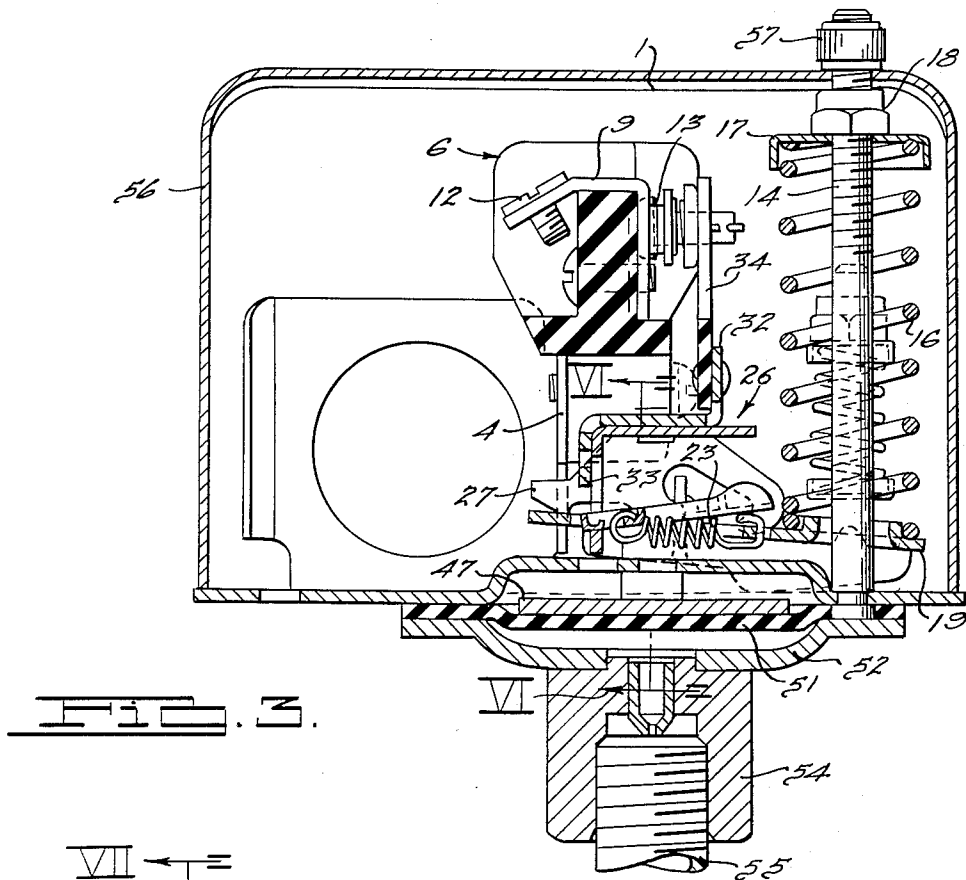


FIG. 3.

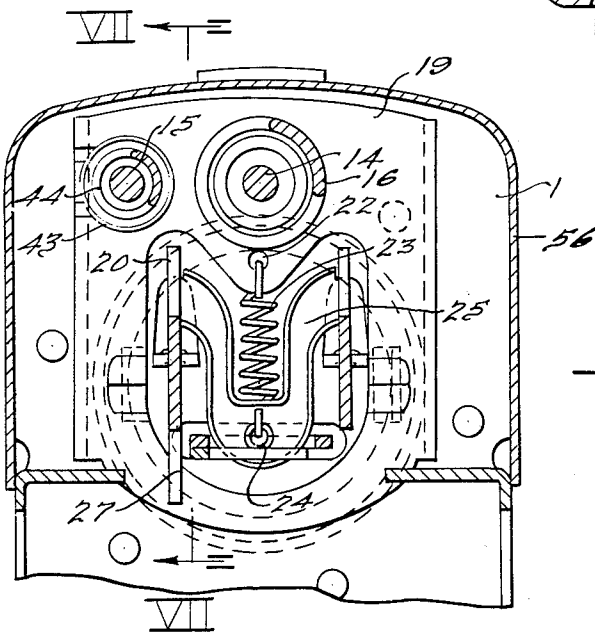


FIG. 4.

INVENTORS
Carl A. Schaefer
BY Josef J. Zeller
Myron J. Sibold
ATTORNEY.

April 10, 1956

C. A. SCHAEFER ET AL

2,741,678

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FIG. 5.

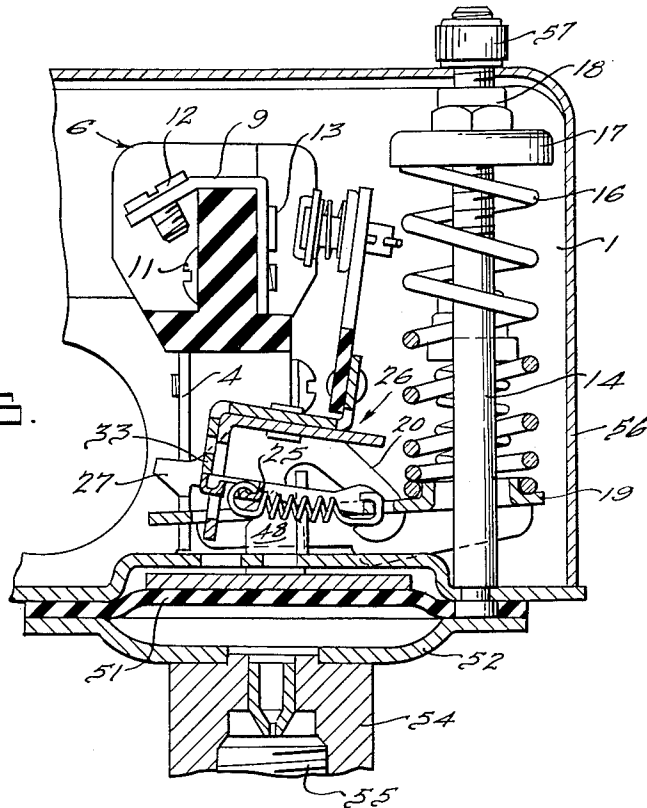
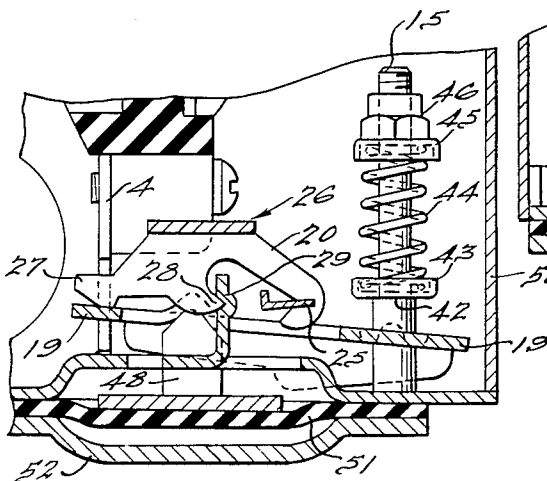


FIG. 7.

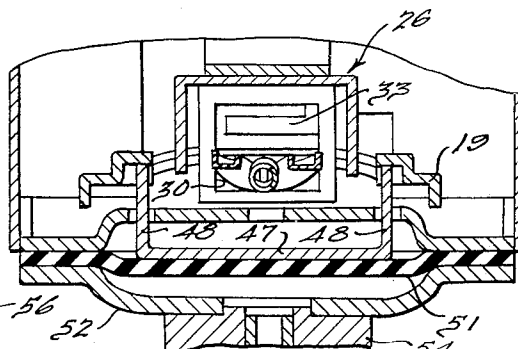


FIG. 6.

INVENTORS

Carl A. Schaefer

BY Josef J. Zeller

Myron J. Seibold

ATTORNEY.

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PRESSURE SWITCH

Carl A. Schaefer, Milwaukee, and Josef J. Zeller, Wauwatosa, Wis., assignors to Square D Company, Detroit, Mich., a corporation of Michigan

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10 Claims. (Cl. 200—83)

This invention relates in general to pressure switches, and more particularly to an electric switch having improved mechanism for causing the automatic opening and closing of the switch in response to predetermined pressure changes.

One object of the present invention is the provision of a pressure switch having improved adjustment means permitting close operating differentials for the switch.

Another object is the provision of an improved pressure switch having opening and closing "hammer" forces transmitted to the movable contacts thereof when the controlled pressure reaches predetermined limits.

Another object of the present invention is the provision of a pressure switch having an improved operating mechanism therefor of sturdy and reliable construction.

Another object is the provision of a toggle operated pressure switch in which the toggle strikes the movable contact carrier upon both opening and closing of the electrical circuit through the switch in response to pressure changes.

Other objects and features of the invention will be readily apparent to those skilled in the art from the specification and appended drawing illustrating certain preferred embodiments in which:

Figure 1 is a plan view of the device of the present invention with part of the cover broken away to show internal parts.

Figure 2 is a sectional view along the lines II—II of Figure 1.

Figure 3 is a sectional view along the lines III—III of Figure 2.

Figure 4 is a sectional view along the lines IV—IV of Figure 2.

Figure 5 is a partial sectional view similar to Figure 3 with the parts in changed position.

Figure 6 is a detailed sectional view along the lines VI—VI of Figure 3.

Figure 7 is a partial sectional view along the line VII—VII of Figure 4.

The device of the present invention comprises a frame 1 having integral, inwardly extending brackets 2 and 3, which in turn have inwardly extending arms 4 and 5. To arms 4 and 5 there is mounted an insulating terminal block 6 by means of screws 7. Barrier walls 8 formed integrally with the terminal block 6 divide it into two main compartments, each of which is also divided into two sub-compartments and in each sub-compartment there is mounted a terminal-contact member 9 by means of a screw 11. As shown in Figure 5, the member 9 is generally L-shaped and carries at one end a terminal screw 12, which extends through a suitable threaded hole in the member 9, and near the other end carries an electrical contact 13.

The frame 1 also carries a pair of inwardly extending posts 14 and 15, the upper ends of which are threaded. About the post 14 is disposed a range spring 16, the upper end of which bears against a cup washer 17 positioned by a nut 18 which cooperates with the threaded

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portion of the post 14. The lower end of the range spring 16 abuts against, and applies a force to, one extremity of an operating lever 19 which is provided with relatively large openings through which the posts 14 and 15 extend. The amount of force applied by spring 16 to lever 19 is determined by the setting of nut 18. The opposite extremity of the operating lever 19 is pivotally mounted in suitable slots 21 in the arms 4 and 5, as illustrated in Figure 2.

One hooked end of a toggle spring 23 is connected to the operating lever 19 through a small aperture 22. The opposite end of toggle spring 23 is connected to a generally U-shaped toggle link 25 through a suitable aperture 24. The arms of the U-shaped toggle link 25 have knife edge pivotal mountings in relatively sharp V notches in spaced depending arms 20 on a contact lever 26, as illustrated in Figure 7. To pivotally mount the contact lever 26, the arms 20 have integral fingers 28 pivoted in suitable depressions in a pair of spaced ears 29 which project inwardly from an embossed portion 31 of the frame 1. One of the depending arms 20 has an extension 27 which extends beyond the arm 4 of bracket 2, and in closed circuit position rests upon a rear portion of the operating lever 19. As indicated in Figure 2, the rear central portion of the contact lever 26 is shaped to provide a substantially square opening 30 through which one portion of the toggle link 25 projects.

As illustrated in Figure 3, there is riveted to the upper surface of contact lever 26 a generally Z-shaped bracket 32, the rear portion of which is provided with an adjustable, depending arm 33 which is adjacent the aforementioned substantially square opening 30 formed in the contact lever 26, and which overhangs the end of the toggle link 25 extending through this square opening so as to limit the amount of upward movement of link 25, as will be subsequently explained.

To the front, upstanding portion of bracket 32 is riveted an insulating, movable contact carrier 34 which is substantially a V in shape, each arm thereof having an opening therein through which extends a contact pin 35 of a generally T shape; each pin carries a bridging conducting member 36 having an electrical contact 37 disposed at each end thereof so as to cooperate with adjacent fixed contacts 13 in the manner illustrated in Figure 1. Springs 38 are provided between bridging members 36 and cup washers 39, carried by the pins 35, to bias the bridging members away from carrier 34. Suitable pins 41 are provided to maintain the assembly of the movable contacts upon the carrier 34.

As may be more particularly seen in Figure 7, post 15 is provided with a shoulder 42 against which a cup washer 43 is normally biased by a spring 44. This spring 44 is compressed by a second cup washer 45 against which the upper end of spring 44 abuts, a nut 46 positioning the cup washer 45 and providing for adjustment of the bias of spring 44.

Means are provided for effecting movement of the operating lever 19 in a manner to be subsequently more fully described, these means comprising a pressure plate 47 having spaced upstanding arms 48 which extend through suitable apertures in the embossed section 31 of the frame 1 to engage the opposite sides of operating lever 19. The pressure plate 47 rests upon a diaphragm 51 which is sealably secured to the undersurface of frame 1 by means of a flanged cup 52 and suitable screws 53 which pass through the cup 52, and the diaphragm 51, to cooperate with threaded holes in the frame 1. The cup 52 has sealably attached thereto an internally threaded coupling member 54 with which suitable conduits 55, connected to the controlled pressure, may cooperate.

As may be best seen from Figure 3, a cover 56 is provided to protect the operating mechanism, the cover 56 hav-

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ing an aperture therein which is fitted over the post 14, a cover nut 57 being provided on post 14 to maintain the cover 56 in position.

The operation of the device of the present invention will now be described. Referring to Figure 1, with one power line connected to each of the outside terminals illustrated in that figure, and with the inside terminals connected to the load, which may be electric motor, it will be seen that when the movable contacts engage the fixed contacts an electrical circuit from the source through the load is completed through the switch of the present invention. As the controlled pressure builds up, the conduit 55 and the coupling member 54 introduce this pressure to the underside of the diaphragm 51. As the central portion of this diaphragm is forced upwardly by this increased pressure, the pressure plate 47 presses against operating lever 19 and rotates it about its pivotal mounting in slots 21, carrying the end of spring 23 attached thereto upwardly. As this movement continues, operating lever 19 engages the undersurface of cup washer 42, lifting it from its seat against the bias of spring 44, so that the bias of springs 44 and 16 both operate to oppose the upward movement of the operating lever 19. After the operating lever 19 has been raised sufficiently, the spring 23 passes over-center and toggle link 25 moves with a snap action to the position illustrated in Figure 5, whereby contact lever 26 is rotated in a clockwise direction about its pivot in the ears 29. As will also be seen from Figure 5, as toggle link 25 snaps upwardly, it strikes the undersurface of the arm 33 to thereby impart a hammer blow to the contact lever 26, whereby the movable contacts 37 and the insulating carrier 34 are rapidly moved to open circuit position to break the electrical circuit through the switch. As will be seen from Figure 5, the open position of the contact lever 26 is limited by the interengagement between the extension 27 and the arm 4. It should be noted that the distance through which toggle link 25 travels on this "switch opening" movement is limited by arm 33. If arm 33 is bent downwardly, this movement of link 25 is decreased.

With the parts in the position illustrated in Figure 5, upon a decrease in pressure, the pressure plate 47 no longer exerts so strong a force upon the operating lever 19. Operating lever 19 will move downwardly under the influence of springs 16 and 44 until such a time as the cup washer 42 is once again seated in the position illustrated in Figure 7, at which time only the bias of spring 16 operates upon the operating lever 19. Inasmuch as the bias of both springs 16 and 44 operate against the operating lever 19 at the time the contacts are separated, and only the bias of spring 16 normally operates against the operating lever 19 at the time the contacts reclose, it will be seen that changes in the operating differential of the switch may be accomplished by varying the bias of spring 44. This is effected, as previously indicated, by adjusting the position of nut 46.

As lever 19 continues toward the position of Figure 3, the end of operating spring 23 attached to the operating lever 19 is moved downwardly until toggle links 25 snaps over-center. The force of toggle link 25, exerted at the point of its pivot in contact lever 26, causes the contact lever 26 to move to closed circuit position illustrated in Figure 3. The end of toggle link 25 aids this closing movement by striking against the bottom portion of the rectangular opening 30 described above. This hammer blow effected by the toggle link gives a distinct, positive contact pressure at the moment of the closing of the movable contact upon the fixed contacts to complete the electrical circuit through the switch. As illustrated in Figure 7, the closed position of the contact lever 26 is determined by the interengagement between the extension 27 and a rear portion of the operating lever 19.

As may be seen from Figure 5, if the ear 33 is bent downwardly from the position of that figure, the toggle link 25 moves through a lesser distance as toggle link 25

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moves toward open circuit position. It is, therefore, readily apparent that by bending this ear 35 downwardly the differential between the pressure values required to open and close the circuit through the switch may be finely adjusted. It will also be seen that toggle link 25 imparts a hammer blow to the assembly which carries the movable contacts upon both opening and closing movement thereof, whereby positive contact pressure is achieved upon the closing operation, and any tendency of the contacts to "freeze" on opening is minimized.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In a pressure switch, fixed contacts, movable contacts for cooperation with said fixed contacts, means for moving said movable contacts to open and closed circuit positions, means pivotally mounting said moving means, a toggle link pivoted in said means for moving said movable contacts, an operating lever, a toggle spring connecting said toggle link and said operating lever, means biasing said operating lever toward one position, pressure responsive means for moving said operating lever against said bias, the line of action of said toggle spring being moved across the pivot point of said toggle link by said operating lever to effect a rapid overcenter snapping movement of said toggle link, means on said means for moving said movable contact for determining the limit of travel of said toggle link in both directions of movement thereof, said toggle link imparting a hammer blow to said last mentioned means as said toggle link is snapped over-center whereby a sudden and substantial force is imparted to said moving means in moving both to open and closed circuit positions.

2. The device as claimed in claim 1 in which said means for determining the limit of travel of said toggle link includes an adjustable stop for the open circuit position of said toggle link.

3. In a pressure switch, a frame, an insulating block mounted thereon, fixed contacts on said block, movable contacts cooperating with said fixed contacts, means pivotally mounted on said frame for moving said movable contacts to open and closed circuit positions, a toggle link pivoted in said means for moving said movable contacts, an operating lever pivoted in said frame, a toggle spring connecting said toggle link and said operating lever, means biasing said operating lever toward one position, pressure responsive means for moving said operating lever against said bias, the line of action of said toggle spring being moved across the pivot point of said toggle link by said operating lever to effect a rapid overcenter snapping movement of said toggle link, means on said means for moving said movable contacts for determining the limit of travel of said toggle link in both directions of movement thereof, said toggle link imparting a hammer blow to said last mentioned means in each direction as said toggle link is snapped over-center whereby a sudden and substantial force is imparted to said moving means in moving both to open and closed circuit positions.

4. In a pressure switch, a frame, an insulating block mounted thereon, fixed contacts on said block, movable contacts cooperating with said fixed contacts, means pivotally mounted on said frame for moving said movable contacts to open and closed circuit position, a toggle link pivoted in said means for moving said movable contacts, an operating lever pivoted in said frame, a toggle spring connecting said toggle link and said operating lever, means biasing said operating lever toward one position, pressure responsive means for pivoting said operating lever against said bias, the line of action of said toggle spring being moved across the pivot point of said toggle

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link by said operating lever to effect a rapid overcenter movement of said toggle link, means on said means for moving said movable contacts for determining the limit of travel of said toggle link including a first portion determining the closed circuit position of said link and a second and adjustable portion determining the open circuit position of said link, said second portion being movable to vary the open circuit position of said toggle link whereby the amount of movement required of said operating lever to move said toggle link back to closed circuit position is variable, said toggle link imparting a hammer blow to said first or second portions as said toggle link is snapped overcenter whereby a sudden and substantial force is imparted to said moving means in moving both to open and closed circuit positions.

5. In a pressure switch, fixed contacts, movable contacts cooperating with said fixed contacts, a frame, a movable contact lever, means mounting said movable contacts to said movable contact lever so as to be movable thereby to open and closed circuit positions, means pivotally mounting said contact lever to said frame, a toggle link, means pivotally mounting said toggle link in said contact lever, an operating lever pivoted in said frame, means biasing said operating lever toward one position, a toggle spring connecting said operating lever and said toggle link, said spring causing said link to apply a substantial force to said contact lever, pressure responsive means for effecting movement of said operating lever against its biasing means whereby the line of action of said spring is moved across the pivot of said link in said contact lever to effect a rapid overcenter snapping movement of said link and consequent rapid movement of said contact lever about its pivot, and means on said contact lever for determining the limit of travel of said toggle link in both directions of movement thereof, said toggle link imparting a hammer blow to said last mentioned means as said toggle link is snapped overcenter whereby a sudden and substantial force is imparted to said movable contact lever in moving both to open and closed circuit positions.

6. The device as claimed in claim 5 in which said means for determining the limit of travel of said toggle link includes an adjustably positioned arm for determining the open circuit position of said toggle link.

7. In a pressure switch, fixed contacts, movable contacts cooperating with said fixed contacts, a frame, a movable contact lever, means mounting said movable contacts to said movable contact lever so as to be movable thereby to open and closed circuit positions, means pivotally mounting said contact lever to said frame, a toggle link, means pivotally mounting said toggle link in said contact lever, an operating lever pivoted on said frame, means biasing said operating lever toward one position, a toggle spring connecting said operating lever and said toggle link, said spring causing said link to apply a substantial force to said contact lever, pressure responsive means for effecting movement of said operating lever against its biasing means whereby the line of action of said spring is moved across the pivot of said link in said contact lever to effect a rapid overcenter snapping movement of said link and consequent rapid movement of said contact lever about its pivot, and means on said contact lever for determining the limit of travel of said toggle link including a first portion for determining the closed circuit position thereof and a second and adjustable portion for determining the open circuit position of said link, said second portion being movable to vary the open circuit position of said link whereby the amount of movement required of said operating lever to move said link back to closed circuit position is variable.

8. In a pressure switch, fixed contacts, movable contacts cooperating with said fixed contacts, pivotally mounted means for moving said movable contacts to open and closed circuit positions, a toggle link pivoted in said pivotally mounted means, an operating lever, a toggle spring connecting said toggle link and said operating lever, means biasing said operating lever toward one position, pressure responsive means for moving said operating lever against said biasing means, the line of action of said toggle spring being moved across the pivot point of said toggle link by said operating lever to effect an overcenter snapping movement of said toggle link, and an arm on said pivotally mounted means engaging said operating lever in closed circuit position to determine the position of said pivotally mounted means in said position.

9. In a pressure switch, fixed contacts, movable contacts cooperating with said fixed contacts, pivotally mounted means for moving said movable contacts to open and closed circuit positions, means resiliently mounting said movable contacts on said pivotally mounted means to supply contact pressure, a toggle link pivoted in said pivotally mounted means, a pivoted operating lever, a toggle spring connecting said toggle link and said operating lever, means biasing said operating lever toward one position, pressure responsive means for moving said operating lever against said biasing means, the line of action of said toggle spring being moved across the pivot point of said toggle link by said operating lever to effect an overcenter snapping movement of said toggle link, and an arm on said pivotally mounted means engaging said operating lever in closed circuit position near the point of pivotal mounting of said operating lever to determine the position of said pivotally mounted means, whereby contact pressure is provided only from the resilient contact mounting.

10. In a pressure switch, fixed contacts, movable contacts cooperating with said fixed contacts, pivotally mounted means for moving said movable contacts to open and closed circuit positions, means resiliently mounting said movable contacts on said pivotally mounted means to supply contact pressure, a toggle link pivoted in said pivotally mounted means, an operating lever, a toggle spring connecting said toggle link and said operating lever, means biasing said operating lever toward one position, pressure responsive means for moving said operating lever against said biasing means, the line of action of said toggle spring being moved across the pivot point of said toggle link by said operating lever to effect an overcenter snapping movement of said toggle link, means on said pivotally mounted means for determining the limit of travel of said toggle link in both directions of movement thereof, said toggle link imparting a hammer blow to said last mentioned means as said toggle link is snapped overcenter whereby a sudden and substantial force is imparted to said pivotally mounted means in moving both to open and closed circuit positions, and an arm on said pivotally mounted means engaging said operating lever in closed circuit position to determine the position of said pivotally mounted means, whereby contact pressure is provided only from the resilient contact mounting.

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