Feb. 13, 1951 M. L. NELSON 2,541,376

SWITCH

Original Filed Oct. 16, 1945 2 Sheets-Sheet 1

Fig. 1

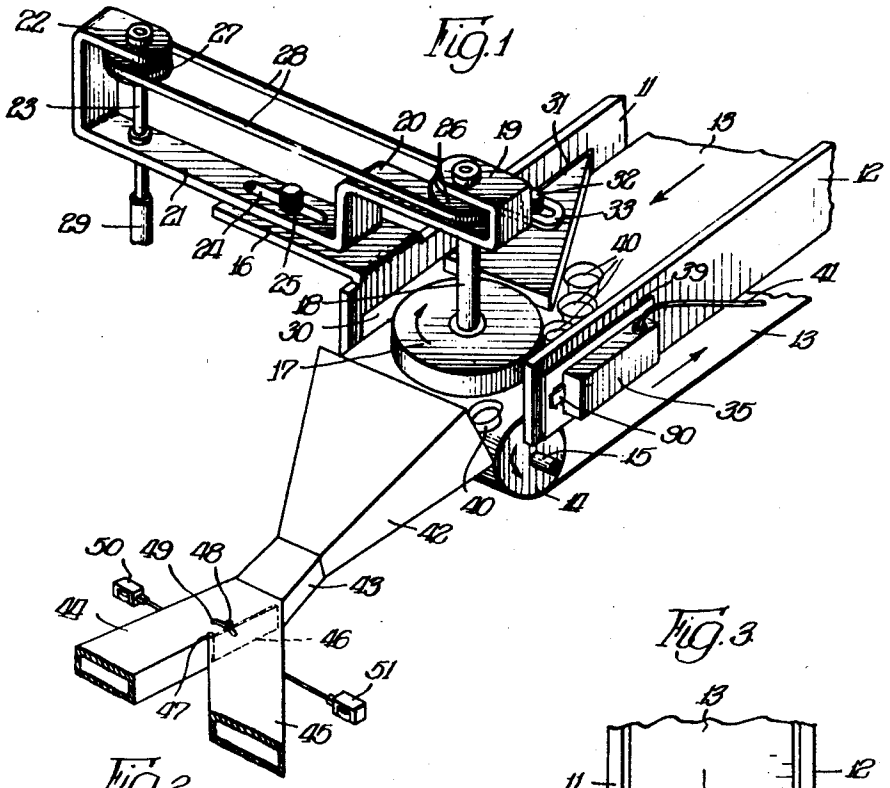



Fig. 2

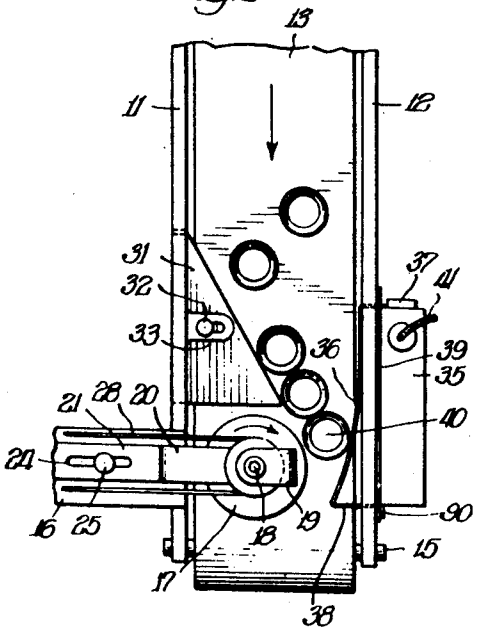
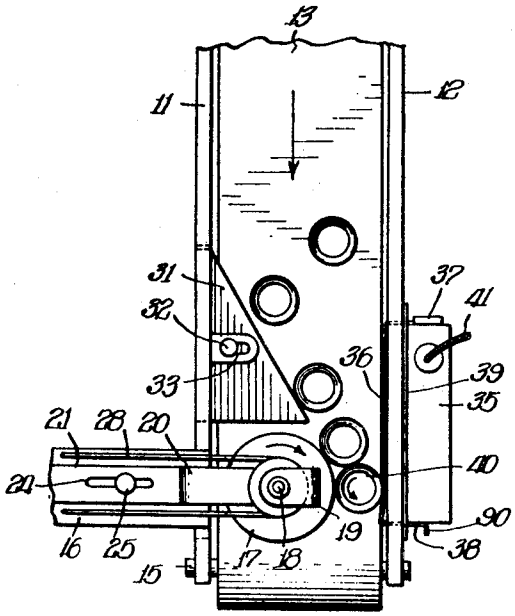



Fig. 3




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Fig. 4

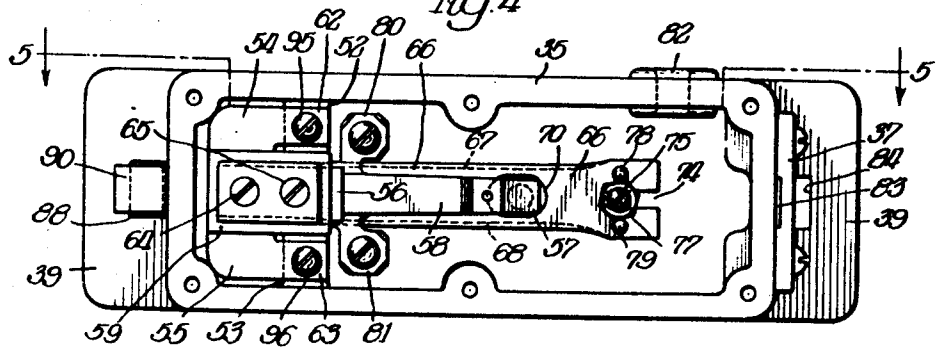



Fig. 5.

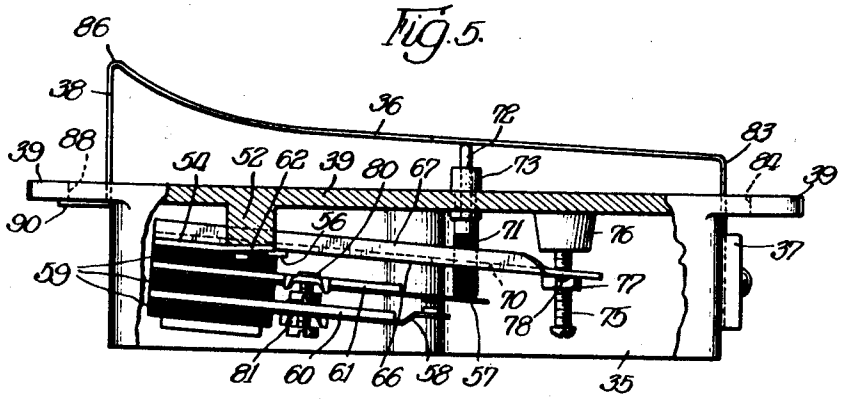



Fig. 6.

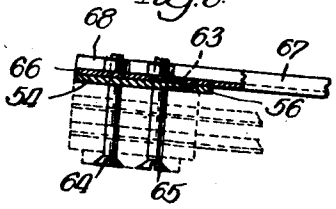
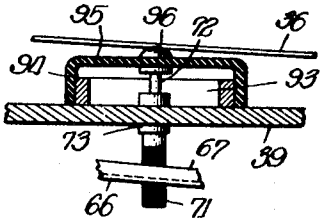



Fig. 7.



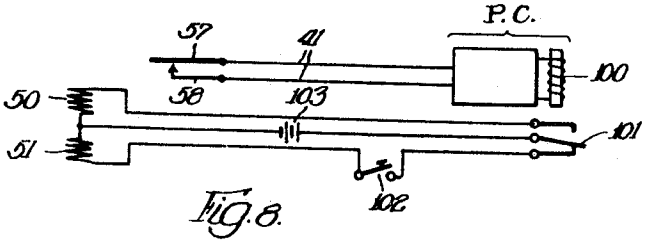




Fig. 8.

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# UNITED STATES PATENT OFFICE

2,541,376

## SWITCH

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Original application October 16, 1945, Serial No. 622,561. Divided and this application November 1, 1946, Serial No. 707,198

6 Claims. (Cl. 200—159)

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This invention is concerned with a novel switch which may be used, for example, in control apparatus such as shown in Patent No. 2,493,464, dated January 3, 1950, of which the present application is a division.

The various objects and features of the invention will appear from the detailed description of the accompanying drawings which show the new switch in connection with control apparatus for counting and packaging articles such as bottle caps. In the drawings,

Fig. 1 is a diagrammatic perspective view of the apparatus for counting and packaging bottle caps, including the new switch;

Fig. 2 illustrates a diagrammatic partial top plan view of the apparatus with a bottle cap and actuating parts shown in position just prior to the operation of the novel switch;

Fig. 3 represents a view similar to the one shown in Fig. 2, but shows a bottle cap and actuating parts of the apparatus in counting position;

Fig. 4 is an enlarged diagrammatic elevational top plan view of the novel switch with the cover removed to expose its operating parts;

Fig. 5 shows the operating parts of the novel switch as seen along sectional lines 5—5 in Fig. 4;

Fig. 6 illustrates a mounting detail;

Fig. 7 represents an embodiment of a moisture-proof closure for use in connection with the contact-actuating member of the switch shown in Figs. 4 and 5; and

Fig. 8 is a simplified circuit diagram showing the interconnection of the apparatus with a counting device.

Known details and elements will be described only to the extent required for conveying an understanding of what is believed to be new. Like parts are indicated by like reference numerals throughout the drawings.

Referring now to the drawings, and particularly to Figs. 1, 2 and 3, the control apparatus shown in these figures comprises side walls 11 and 12 defining a trough-like channel which encloses a conveyor belt 13. The belt 13 is mounted at each end on a rotatable drum such as the drum 14, the shaft of which is indicated at 15. The drum 14 rotates in the direction of the arrow shown in Fig. 1. Accordingly, the belt 13 moves in the direction indicated by the arrows. The objects or articles to be counted, for example, bottle caps, are deposited more or less haphazardly on the moving belt 13, at an intermediate point, and move with the belt to the forward or discharge end at the left. The side walls 11 and 12 of the feed channel are shown separate from

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the rotatable drum 14 and shaft 15 only for the sake of convenience. It will be understood that these side walls may be extended in longitudinal and in downward directions at either end of the structure, and that they may include the bearings for journalling the shaft of the drum 14 as well as the shaft of the drum at the rear end.

The side wall 11 of the feed channel is provided with an extension 16 which projects laterally therefrom for adjustably attaching the mounting strip 21 carrying the feed member or wheel 17 and the drive therefor. The wheel 17 is carried by a shaft 18 which is rotatably journalled in the arms 19 and 20 extending from the mounting strip 21, the rear end of which is bent upwardly and inwardly to form the extension 22 for journalling the drive shaft 23. The mounting strip 21 is provided with a slot 24, and its attachment on the lateral extension 16 is obtained by suitable means, for example, a screw 25. The mounting strip 21, and therewith the disk-like feed wheel 17, can thus be moved laterally and angularly with respect to the forward end of the feed channel and with respect to the conveyor belt 13. The feed wheel 17 constitutes an element of a discharge gate or passageway for controlling the discharge of articles from the feed channel. The shaft 18 of the wheel 17 is provided with a pulley 26, and the shaft 23 is provided with a similar pulley 27. These pulleys are interconnected by a drive belt 28. A different drive, for example, a chain and sprocket drive, may be substituted. The shaft 23 may be operated in any desirable and suitable manner, for example, by a flexible shaft drive 29. The side wall 11 of the feed channel is also provided with a cutout 30 for accommodating the wheel 17 in any of its retracted angularly and laterally adjusted positions. The wheel 17 may be in the position shown in Figs. 1, 2 and 3 for the handling of relatively small articles, such as small bottle caps. Its position relative to the feed channel may be changed by releasing the screw 25 and adjusting the mounting strip 21 angularly and laterally as desired, and again tightening the screw 25.

A generally triangular deflector plate 31 is provided which is adjustably secured by means of a screw 32. The screw engages a slot in an ear 33 projecting from the side wall 11 laterally inwardly of the feed channel. The deflector plate 31 is thus likewise adjustable angularly and laterally with respect to the moving belt within the feed channel, and may be moved into its forward position in which it is shown, or may be

angularly tilted and laterally retracted as desired. The slot 30 in the side wall 11 accommodates the deflector plate 31 in laterally retracted position. The deflector plate constitutes means for guiding the articles on the moving belt tangentially in the direction of the discharge gate formed by the wheel 17.

On the side wall 12, near the forward end of the structure, is mounted the new contact switch, the housing of which is indicated in Figs. 1, 2 and 3 by numeral 35. This switch is particularly shown in Figs. 4–7, inclusive, and will presently be described in detail. It will be sufficient to state at this point that the switch is provided with a spring 36 which is adjustably anchored at one end of the switch housing by a plate 37 and the forward end 38 of which is hooked on the mounting plate 39 of the switch housing by an angular extension 90 and is laterally movable with respect to the housing. The spring 36 extends inwardly of the feed channel through a slot in the side wall 12. In Fig. 2, the spring is shown in normal position, and in Fig. 3, it is shown in its actuated position. The spring 36 forms with the feed wheel 17 the previously mentioned gate or restricted passageway within the feed channel near or at the forward or discharge end thereof. This passageway normally prevents or inhibits the passage of the articles for discharge from the feed channel.

Assuming now that the belt 13 moves in the direction indicated by the arrows in Figs. 1, 2 and 3, the bottle caps deposited thereon will be carried forwardly toward the discharge end of the structure, and will be deflected by the plate 31 to flow along the gradually narrowing feed channel formed by the deflector plate, and thence in the direction of the restricted passageway or gate formed by the wheel 17 and the spring 36. Further motion of the bottle caps through the restricted passageway is normally impeded. Assuming, however, that the wheel 17 is rotated, it will take hold of the bottle cap, for example, the one indicated in Fig. 2 by numeral 40, which has reached the restricted passageway, and will spin the bottle cap 40 around its own axis and force it at the same time forwardly against the elastic pressure of the spring 36, thereby depressing the spring. The parts are shown in Fig. 3 in this actuated position. The bottle cap 40 is then discharged and the spring 36 moves into its normal position shown in Fig. 2, in which the next cap is spun axially and driven forwardly for discharge as described. The operation is repeated with each bottle cap. The depression of the spring 36, caused by the passage of each bottle cap through the restricted passageway, produces an electrical impulse which is transmitted over conductors in a suitable cable 41 to the counting device. The latter may be a predetermined counter, indicated in Fig. 8 by the letters PC.

The bottle caps are in the above described manner individually discharged, one by one, into the chute 42 which is provided with the neck 43 and chute branches 44—45 for delivery of the bottle caps into separate containers, the delivery being governed by a vane 46 rotatably mounted at 47 and controlled by solenoids 50—51.

The structural details of the new contact switch will now be described with reference to Figs. 4–7, inclusive.

The switch comprises the housing 35 which is mounted on the side wall 12 of the feed channel (Figs. 1, 2, 3) by means of extensions projecting from the bottom plate 39 referred to previously as the mounting plate of the switch. The housing 35 is provided with a suitable cover which has been omitted in Figs. 4 and 5 to show the interior operating parts. From the mounting or bottom plate 39 extend the posts 52—53. Mounted on these two posts are the legs 54—55 of a resilient generally W-shaped plate. The central leg underlies the contact pile including the contact springs 57—58, insulating washers 59, and the terminal strips 60—61, the first of which is in engagement with the spring 58 and the second of which is in engagement with the spring 57. The strip 60 carries the laterally projecting terminal 81, and the strip 61 carries a similar terminal 80. The forward mounting end 62 of the outside leg 54 of the resilient W-shaped plate is bent with respect to the forwardly projecting central leg 56, and the forward end 63 of the outside leg 55 is bent likewise. These outside legs are attached to the posts 52, 53 e. g., by means of the screws 95, 96, respectively, and it will therefore be clear that the entire contact assembly is disposed at an angle to the plane of the bottom of the housing, as shown in Figs. 5 and 6. The contact pile, including the contact springs 57—58, the insulating washers 59 and the terminal strips 60—61, is secured by means of the screws 64—65 which project through the straight central leg 56 of the resilient W-shaped mounting member and through the top wall 66 of a shallow, generally U-shaped strong control or adjusting member having the side walls 67—68. This adjusting member 66/67/68 thus extends forwardly in parallel with the contact springs 57—58 at an angle with respect to the plane of the bottom wall 39 of the switch housing. The top wall 66 of the adjusting member is provided with a cutout 70 through which projects the insulating portion 71 at the inward end of a plungerlike actuating pin, the rear end 72 of which projects to the outside through a bushing 73. This actuating pin projects into the housing perpendicular to the bottom 39 thereof. The contact springs 57—58 are tilted as described and are therefore disposed at an angle to the axis of the actuating pin 71—72.

The free end of the top wall 66 of the adjusting member is provided with a slot 74 and through this slot extends, in the mounted position shown in Figs. 4 and 5, a screw 75 which is attached to a post 76 projecting from the bottom wall 39 of the switch housing. The screw 75 is provided with a nut 77 for the purpose of determining and setting the desired angular position of the adjusting member 66/67/68 and therefore of the contact spring 57 with respect to the contact actuating pin 71—72. The nipples or projections 78—79 are punched out from the material of the top wall 66 of the adjusting member at its forward end, where it forms the slot 74, and on a line which intersects the axis of the nut 77, for the purpose of forming peripherally effective frictional stop means which prevents inadvertent angular dislocation of the nut 77 incident, for example, to jarring of the mechanism.

An insulating bushing 82 is provided in the housing wall, as shown in Fig. 4, for carrying to the outside the cable 41 (Figs. 1, 2, 3) which contains the conductors connected to the terminals 86—87 of the contact springs 57—58, respectively.

It will be seen from the foregoing description that the position of the contact spring 57 may be adjusted with respect to the insulating portion 71 of the contact actuating pin, simply by operating the nut 77 along the screw 75, to tilt

the adjusting member 66 and therewith the entire spring assembly i.. desired clockwise or in counter-clockwise direction until the proper and desired co-acting position is obtained between the contact spring 57 and the actuating pin. The gap between the contact points on the springs 57—58, and therewith the contact opening and contact pressure as well as the extent of axial displacement of the contact actuating pin, can likewise be adjusted by operating the nut 77. In other words, once the position of the adjusting member 66, and therewith of the contact assembly, is obtained so that the spring 57 just touches the tip of the insulating part 71 of the contact actuating pin, any further (counter-clockwise) tilting of the spring assembly by the operation of the nut 77 will be against the tip of the insulating part 71 of the contact actuating pin and will tend to narrow the gap between the contact points on the springs 57—58. Pressure is thus put on the contact actuating pin 71—72, and the gap between the contact points on the springs 57—58 is adjusted as desired. The pressure exerted on the actuating pin corresponds to the pressure which will be required to operate the contact spring 57 with respect to spring 58, and the gap between the contact points on these springs corresponds to the minimum displacement of the actuating pin. Upon operative actuation of the contact springs, the pressure of spring 58 is added to the pressure of spring 57 on the tip of the contact actuating pin depending on the gap adjustment.

The switch operating spring 36 is mounted on the switch, as is particularly shown in Figs. 4 and 5. The rear end of the spring 36 is bent at an angle to its body, forming the arm 83 which extends through an aperture 84 in the bottom extension 39 and is clamped on the end wall of the housing by means of the plate 37. Inasmuch as the spring 36 is in engagement with the outwardly protruding portion 72 of the contact actuating pin, it is thus possible to determine the position of this actuating pin and of the tip of its insulating portion 71 with respect to the contact spring 57. The mounting of the spring 36 furnishes in this manner, in conjunction with the adjustment that may be obtained by the nut 77, additional adjustment possibilities. In other words, the outward motion of the contact actuating pin may be resiliently limited by the spring 36, thereby defining the normal position of the tip of its insulating portion 71 with respect to the contact spring 57. The pressure of the contact springs and the gap between the contact points are then adjusted by means of the nut 77, as described before.

The spring 36 is bent at an angle at 86 to form the arm 88 which extends through an aperture 89 in the bottom flange or extension 39 at the left of the switch structure, as shown in Figs. 4 and 5. The free end of the spring arm 88 is bent to form the hook 90 for overlapping engagement with the face of the bottom flange 39. The spring 36 is thus elastically and adjustably mounted for angular motion with respect to the outwardly protruding end 72 of the contact actuating pin.

The switch has been described so far for use in the counting and packaging of bottle caps. It is understood, of course, that it may be used for counting and for packaging other objects such as cans, jars, bottles and the like, either incident to the manufacture thereof, or incident to their use in canneries, breweries, dairies, etc., etc.

Assuming, for example, that the switch is used for counting milk bottles in a dairy establishment, it is important that it is made water- and moisture-proof. The outwardly protruding portion 72 of the contact actuating pin therefore must be protected. Such an arrangement is shown in Fig. 7, the numerals in this figure indicating identical parts as shown in Fig. 5. Accordingly, 39 is the bottom wall of the switch housing; 66 indicates the control or adjusting member having the side wall 67. Through the adjusting member projects the insulating portion 71 of the contact actuating pin, the portion 72 of which protrudes to the outside through the bushing 73. In order to prevent moisture from entering the interior of the housing, there is provided a ring 93 which is firmly attached to the bottom wall 39 outside thereof. The attachment may be made by soldering, welding, or in any other desirable and suitable manner. An elastic cap 94, which may be made, for example, of rubber, is placed over the ring 93 forming a diaphragm portion 95 which stretches across the ring 93. This diaphragm portion is provided with a nipple 96 for engagement with the operating spring 36. The pressure and displacement of the spring 36 are thus effective on the nipple 96 and are elastically transmitted through the diaphragm 95 to the actuating pin portion 72, and thus to the insulating portion 71 thereof which is in operative engagement with the contact spring.

The far-reaching adjustment provisions of the contact switch furnish an important improvement which will be appreciated when it is considered that the switch, which is a delicate mechanism and requires expert care, may be used in surroundings such as dairies, breweries, etc., which may not have readily available expert facilities. Adjustments, if any are required, do not need expert attention in the present case. All that is necessary to obtain proper contact adjustment is the use of a screw-driver and a wrench or pliers for manipulating the nut 77 and the plate 37. And yet, most delicate adjustment can be obtained by these simple means.

The counter PC of Fig. 8 may be of the general type shown in U. S. Patents Nos. 2,295,968 and 2,346,869; that is, it may be a predetermined counter which may be set to the counting of predetermined numbers or sets of impulses. The counter may include a relay 100 for the operation of a contact spring 101. In normal position of this contact spring, and assuming that the switch 102 is closed, there is a circuit extending from one terminal of the battery 103 over the solenoid 51 which controls the distributor gate 46 shown in Fig. 1 in the receiving chute 43, and back over the switch 102 to the other terminal of the battery 103. This position is maintained for a predetermined number of impulses produced by the passage of a corresponding number of bottle caps, that is, for a predetermined number of caps moving through the restricted passageway by the operation of the feed wheel 17 in coaction with spring 35. When this predetermined number of impulses is reached, in other words, when the predetermined number of bottle caps has been counted and delivered to the chute 44 for deposit to a packaging container at the discharge end of this chute, the relay 100 energizes and moves the contact spring 101 into alternate position. Accordingly, the solenoid 51 deenergizes and the solenoid 50 energizes and moves the gate

46 in the feed chute into its alternate position, blocking the branch chute 44 and opening the chute 45. The next lot of bottle caps will then be delivered into another container disposed at the discharge end of the branch chute 45.

Changes may be made within the scope and spirit of the following claims which define what is believed new and desired to have protected by Letters Patent of the United States.

I claim:

1. A contact switch of the class described comprising a housing, a pair of associated contact springs disposed within said housing, a generally W-shaped mounting member, means for firmly securing the outside legs of said mounting member to an inside wall of said housing, means for firmly securing said contact springs at one end thereof in engagement with the central leg of said mounting member, a plungerlike actuating member extending axially movably through a wall of said housing, the inner end of said plungerlike actuating member being aligned for coaction with said contact springs at the free end thereof, a leaf spring carried by said housing entirely outside thereof, said leaf spring forming an operating portion extending alongside said housing spaced therefrom throughout the length thereof and an angularly disposed portion at each end, one of said angularly disposed portions forming a retaining arm which is movably disposed for inward displacement toward said housing at one end thereof and the other angularly disposed portion forming an adjusting arm which is adjustably disposed for inward and outward displacement relative to said housing at the other end thereof, the operating portion of said leaf spring being arranged for operative coaction with the outer end of said plungerlike actuating member, means for fastening the adjusting arm of said leaf spring in any position of adjustment in engagement with the corresponding end wall of said housing, the adjusted position of said adjusting arm of said leaf spring determining the position of the operating portion thereof relative to the outer end of said plungerlike actuating member to determine the normal position of the inner end thereof relative to the free end of said contact springs, a lever arm connected with and extending from the central leg of said W-shaped mounting member, and means for adjusting the angular position of said lever arm to determine the normal position of the free ends of said contact springs relative to the end of said plungerlike actuating member.

2. A contact switch of the class described comprising a housing, a pair of associated contact springs disposed within said housing, a generally W-shaped mounting member, means for firmly securing the outside legs of said mounting member to an inside wall of said housing, means for firmly securing said contact springs at one end thereof in engagement with the central leg of said mounting member, a plungerlike actuating member extending axially movably through a wall of said housing, the inner end of said plungerlike actuating member being aligned for coaction with said contact springs at the free end thereof, an annular mounting member projecting from said housing and surrounding the portion of said plungerlike actuating member which extends therefrom, an elastic diaphragm carried by said annular mounting member for coaction with the outer end of said plungerlike actuating member, a leaf spring carried by said housing entirely outside thereof, said leaf spring forming an operating portion extending alongside said housing spaced therefrom throughout the length thereof and an angularly disposed portion at each end, one of said angularly disposed portions forming a retaining arm which is movably disposed for inward displacement relative to said housing at one end thereof and the other angularly disposed portion forming an adjusting arm which is adjustably disposed for inward and outward displacement relative to said housing at the other end thereof, the operating portion of said leaf spring being arranged for operative coaction with said diaphragm to act upon the outer end of said plungerlike actuating member, means for fastening the adjusting arm of said leaf spring in any position of adjustment in engagement with the corresponding end wall of said housing, the adjusted position of said adjusting arm of said leaf spring determining the position of the operating portion thereof relative to said diaphragm to determine thereby the normal position of said plungerlike actuating member and of the inner end thereof relative to the free end of said contact springs, a lever arm connected with and extending from the central leg of said W-shaped mounting member, and means for adjusting the angular position of said lever arm to determine the normal position of the free ends of said contact springs relative to the end of said plungerlike actuating member.

3. A switching device comprising a yieldable mounting member having three legs arranged in the general shape of a W, means for fixedly securing the free ends of the outside legs of said mounting member to place the central leg thereof in floating position, contact springs secured at one end to and extending from the floating central leg of said mounting member, an actuating member for operatively actuating said contact springs at the free end thereof, an elongated relatively rigid adjusting member directly connected at one end with and extending from the floating central leg of said mounting member, and means coacting with the free end of said adjusting member for adjustably displacing it to tilt said floating central leg of said W-shaped mounting member for the purpose of angularly adjusting the contact springs extending therefrom to determine the position of the free ends of said springs relative to said actuating member.

4. A switching device comprising a yieldable mounting member having three legs arranged in the general shape of a W, means for fixedly securing the free ends of the outside legs of said mounting member to place the central leg thereof in floating position, contact springs secured at one end to and extending from the floating central leg of said mounting member, an actuating member for operatively actuating said contact springs at the free end thereof, an elongated relatively rigid adjusting member directly connected at one end with and extending from the floating central leg of said mounting member, means coacting with the free end of said adjusting member for adjustably displacing it to tilt said floating central leg of said W-shaped mounting member for the purpose of angularly adjusting the contact springs extending therefrom to determine the position of the free ends of said springs relative to said actuating member, and means for separately adjusting the position of said actuating member relative to the free ends of said contact springs.

5. A switching device comprising a yieldable

mounting member having three legs arranged in the general shape of a W, means for fixedly securing the free ends of the outside legs of said mounting member to place the central leg thereof in floating position, contact springs secured at one end to and extending from the floating central leg of said mounting member, an actuating member for operatively actuating said contact springs at the free end thereof, an elongated relatively rigid adjusting member directly connected at one end with and extending from the floating central leg of said mounting member, means coacting with the free end of said adjusting member for adjustably displacing it to tilt said floating central leg of said W-shaped mounting member for the purpose of angularly adjusting the contact springs extending therefrom to determine the position of the free ends of said springs relative to said actuating member, means for movably mounting said actuating member, and means for adjustably determining the normal position of said actuating member relative to the free ends of said contact springs.

6. A switching device comprising a yieldable mounting member having three legs arranged in the general shape of a W, means for fixedly securing the free ends of the outside legs of said mounting member to place the central leg thereof in floating position, contact springs secured at one end to and extending from the floating central leg of said mounting member, an actuating member for operatively actuating said contact springs at the free end thereof, an elongated relatively rigid adjusting member directly connected at one end with and extending from the floating central leg of said mounting member,



means coacting with the free end of said adjusting member for adjustably displacing it to tilt said floating central leg of said W-shaped mounting member for the purpose of angularly adjusting the contact springs extending therefrom to determine the position of the free ends of said springs relative to said actuating member, means for movably mounting said actuating member, an operating member for direct operative coaction with said actuating member, and means for adjusting the position of said operating member relative to said actuating member to determine the normal position of said actuating member relative to the free ends of said contact springs.

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