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W. C. KARCH

3,200,227

CARRIER FRAME FOR MOVABLE CONTACT AND COMBINATION

THEREOF WITH SNAP ACTING SWITCH

Original Filed Sept. 29, 1960

2 Sheets-Sheet 1

Fig. 1.

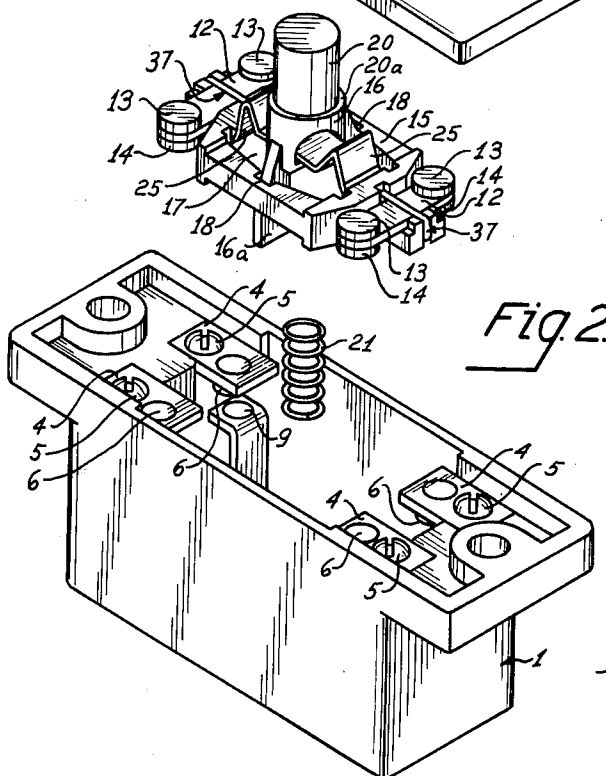
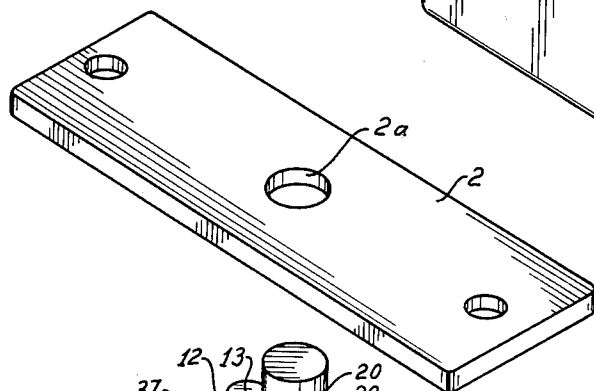
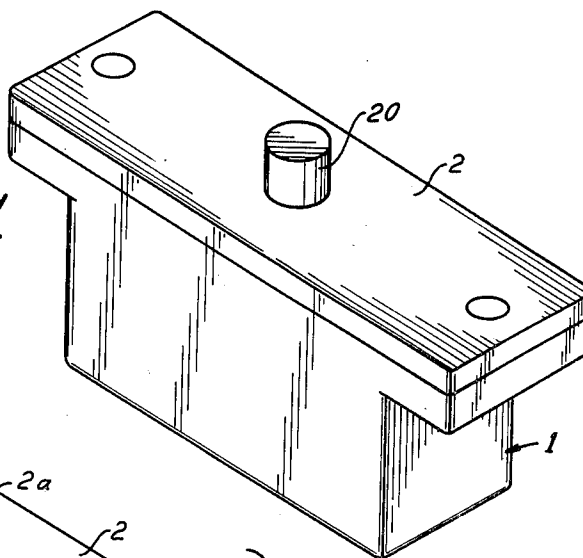


Fig. 2.

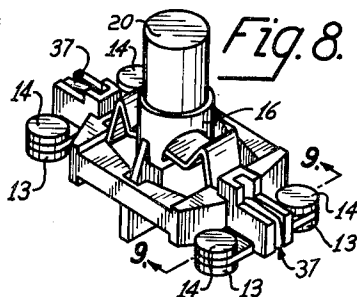


Fig. 8.

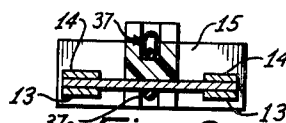


Fig. 9.

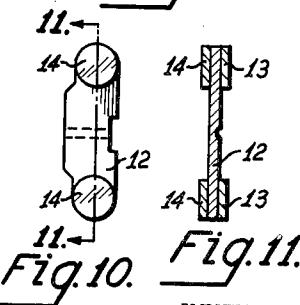


Fig. 10.

Fig. 11.

INVENTOR.

Walter C. Karch,

BY

John H. Leonard, Jr.
ATTORNEY.

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CARRIER FRAME FOR MOVABLE CONTACT AND COMBINATION THEREOF WITH SNAP ACTING SWITCH

Walter C. Karch, Milwaukee, Wis., assignor to Square D Company, Park Ridge, Ill., a corporation of Michigan
Original application Sept. 29, 1960, Ser. No. 59,363, now Patent No. 3,017,471, dated Jan. 16, 1962. Divided and this application Sept. 22, 1961, Ser. No. 139,971
6 Claims. (Cl. 200-168)

This is a division of application Serial No. 59,363, filed September 29, 1960, now U.S. Patent No. 3,017,471, issued January 16, 1962.

This invention relates to electrical switches of the snap-acting type in which a contact carrier is movable from on to off positions with a snap action by a dead-center spring consequent upon initial movement of the carrier toward the selected position, either by a suitable actuating means or by a return spring.

As pointed out more fully in my copending application switches of this character are sold in a highly competitive market and it is necessary, therefore, that the working parts thereof be capable of being manufactured and assembled with a minimum of manual labor. Further, it is equally important that the switch be small and compact in relation to its rated maximum voltage and current, yet strong enough to operate several million times with a snap action without breakage or damage to the parts.

In the identified copending application, the claims are directed to the manner of fastening the movable bridging conductor element to its carrier.

An additional important feature of the invention resides in the manner in which the grooves for connecting the dead-center snap-acting springs to the carrier are arranged. The claims of the present application are directed to this additional feature.

For the purposes of illustration, the invention herein is disclosed in connection with a double-pole, double-throw snap-acting switch employing a movable carrier and two contact assemblies which can be installed readily on the carrier and removed therefrom and replaced readily for servicing, yet which, when installed, are retained effectively in proper position for operation over long periods of use.

The manner in which the invention can be incorporated in other types of switches will be readily apparent from the illustrative example in which reference is made to the drawings, wherein:

FIG. 1 is an isometric view of a switch embodying the principles of the present invention;

FIG. 2 is an exploded isometric view of the switch illustrated in FIG. 1, showing the parts in the position for assembly;

FIG. 3 is an enlarged top plan view of the switch illustrated in FIG. 1 with the cover removed, and with the upper stationary contacts and movable contact assembly removed in the right-hand portion;

FIG. 4 is a front elevation of the structure illustrated in FIG. 3 with the cover plate in place, part of the structure being shown in section for clearness in illustration, as indicated by the lines 4-4 in FIG. 3;

FIG. 5 is an enlarged top plan view of the carrier frame of the present invention; and

FIGS. 6 and 7 are vertical sectional views taken on the lines 6-6 and 7-7, respectively, of FIG. 5;

FIG. 8 is a fragmentary isometric view of the push-button and carrier, with the contact bridges and mounting springs, illustrated in FIG. 2, but with the carrier inverted;

FIG. 9 is an enlarged cross sectional view of the car-

rier and bridging conductor taken on the line 9-9 in FIG. 8;

FIG. 10 is an enlarged top plan view of a bridging conductor; and

FIG. 11 is a longitudinal sectional view of the bridging conductor and is taken on line 11-11 of FIG. 10.

Referring to the drawings, the switch comprises a hollow body 1 normally closed by a suitable cover plate 2. The body is preferably made of insulating material and embedded in each end is a pair of metal conducting sleeves 3. A metal conductor 4 is fastened fixedly by a suitable screw 5 to each sleeve and on its under face carries a stationary contact 6. The other end of each sleeve 3 carries a screw 7 which is accessible for operation through the bottom of the body for clamping a wire to the sleeve 3 and thereby effecting an electrical connection to the upper stationary contact 6. Two stationary contacts 6 are provided at each end of the body and are spaced laterally of the body from each other. A pair of lower stationary contacts 9 is arranged at each end of the body. Each pair is secured to the body by a suitable conducting sleeve 10 which, in turn, receives a screw 11 for connecting a wire thereto. Each lower stationary contact 9 of each pair is arranged beneath and in alignment with a corresponding upper contact 6 of the pair thereabove.

In operation of the switch, it is desirable to bridge the upper contacts 6 of each pair by a bridging conductor in one position of the switch, and to bridge the lower contacts 9 by the same conductor in another position of the switch. For this purpose, movable contact assemblies are provided, one for each set of aligned upper and lower stationary contacts.

Each assembly comprises a bridging conductor element 12 and upper and lower contacts 13 and 14 thereon, the contacts 13 being cooperable with the contacts 6 and the contact 14 being cooperable with the contacts 9, of their associated set.

In order to move the assemblies to different contact making and breaking positions, a carrier frame 15 is provided and is floatingly mounted in the body. For supporting the carrier frame in the body for movement to cause the assemblies to make and break contact with respect to the different stationary contacts, an actuator 16 is mounted in the body 1 for movement upwardly and downwardly. The carrier frame 15 preferably is in the form of a frame and has a central opening 17. The actuator 16 has portions in the form of depending legs 16a which extend through the opening 17 and through a pair of oppositely facing notches 18 in the carrier frame 15 and are received in suitable guideways 19 in the body 1. The clearance is provided between the legs 16a and the walls of the notches 18. The guideways guide the actuator in a lineal path upwardly and downwardly relative to the cover 2. The actuator 16 also has a portion in the form of a push-button 20 having a reduced diameter portion and a shoulder 20a. The reduced diameter portion extends through a suitable opening 2a in the top cover 2 and is accessible for operation by hand or for connection to a suitable operating mechanism for operating the switch. The shoulder 20a is engaged by the underside of the cover 2 and the button is held partially depressed thereby.

It is desirable that the carrier frame 15 be moved, with a snap action, downwardly upon depression of the button 20 and upwardly upon upward or return movement of the button 20. The actuator 16 is moved upwardly by a return spring 21 when the button 20 is released. In order to provide a snap action for causing the frame to snap upwardly when the button is depressed and snap downwardly when the button is returned, dead-center springs are provided and interconnect the actuator and carrier.

For this mounting, the carrier frame 15 is provided at each of its opposite ends with a pair of internal shoulders 23 and an internal cooperating shoulder 23a. Correspondingly, the actuator 16 is provided at opposite sides with notches 24. Each notch 24 is adapted to receive one end of a snap-action, dead-center spring 25, of which the other end is bent, as indicated at 26, to be accommodated between the shoulder 23a and shoulders 23 on the carrier frame.

Thus, each spring is stressed resiliently in position between one set of the shoulders 23 and 23a and the base of the adjacent notch 24 and is held so engaged by the forces imposed by its own stressed condition. Each spring 25 preferably has a loop portion 27 intermediate its ends to assist in the snap action by permitting the length of the springs 25 to be reduced as they approach and pass dead center.

The normal location of the shoulders 23 and 23a and the notches 24, when the button 20 is held in partially depressed position by the engagement of the cover with the shoulder 20a, is such that the springs 25 bear downwardly on the carrier frame 15, the ends of the springs 25 in the notches 24 being upwardly above the level of the shoulders 23 and 23a. This holds the carrier so that the lower contacts 14 of the bridge are pressed into firm contact with the lower contacts 9. When the button 20 is fully depressed, the bases of the notches 24 are below the level of the shoulders 23 and 23a. Thus, when the button 20 is depresser, the ends of the springs received in the notches 24 are moved to a position below the level of the shoulders 23 and 23a and the springs exert their snap action force so as to lift the carrier frame 15 upwardly. When again the button 20 is released and returned by the spring 21, the base of the notches 24 move to a position above the level of the shoulders, whereupon the springs exert their snap action force to move the carrier frame 15 downwardly.

It is to be noted, as illustrated in FIGS. 6 and 7, that the shoulder 23a slopes downwardly outwardly endwise of the frame from the mid-portion of the frame and the shoulders 23 slope upwardly outwardly endwise of the frame from the mid-portion. The upper edges of the shoulders 23 and the lower edge of the shoulder 23a preferably intersect a first reference plane parallel to the plane of the frame 15 so that the intersections define a single straight line. The shoulders 23 terminate at their inner ends, in a direction which is parallel to said first referenced plane and transversely of the length of the frame, in spaced relation to each other at opposite sides of a reference plane which extends lengthwise of the frame along the longitudinal medium line of the frame and which is at substantially a right angle to the first reference plane. The shoulder 23a is aligned, in a direction normal to the plane of the frame, with the space between the adjacent inner ends of the shoulders 23, and preferably terminates at the adjacent ends of the shoulders 23, or at least does not exceed in length the length of the space between them.

This arrangement of the shoulders 23 and 23a provides, in operating effect, an effective notch for the carrier frame engaging end of the spring 25. It has a distinct advantage in that the shoulders can be molded integrally with the carrier frame. For example, the carrier frame can be formed by a pair of complementary dies movable to and from closed position along a path normal to the plane of the carrier frame. The shoulders 23 and 23a are formed by relatively simple die portions in fixed position on the dies and are removed from shoulder forming position simply by movement of the dies away from each other along the path. Any other arrangement would require quite complicated die and expensive die parts which would have to be movable relative to the frame forming dies on which they were carried.

The manner of mounting the bridging element 12 on the carrier frame 15, will be described. The carrier

frame preferably is elongated endwise of the body and comprises side frame members 30 and end frame members 31 and is supported by the springs 25 with one face of the frame upwardly and the end frame members 31 facing towards the ends of the body 1. The bridging conductors 12 are connected to the end frame members 31 and since the manner of attachment of each thereto is the same, the attachment of only one will be described in detail.

Referring to FIGS. 5 through 7, on each end frame member 31 is a ledge 32 which has an upwardly open trough 33, the trough being defined by a supporting surface 34 on which one of the conductor elements 12 rests flatwise and which extends transversely of the length of the frame, as illustrated. The element 12 is constrained from displacement laterally of the trough, endwise of the frame, by the side walls of the trough which provides suitable shoulders 35 and 36.

In order to hold the conductor element 12 in the trough, a suitable snap-acting spring C-clamp 37, having an upper arm 37a, a lower arm 37b, and a base 37c, is provided. This C-clamp is adapted to be received on the frame, and to be moved endwise of the frame and transversely of the trough, open end foremost, into operating position after the conductor 12 is disposed in the trough. In its operating position, it spans the upper open side of the trough and thus prevents displacement of the conductor 12 therefrom through the open side. A suitable socket 38 is provided in the end frame member 31. This socket may be in the form of a small upright groove which has its open side facing endwise of the frame toward the trough and which is open at its upper end, indicated at 39, at the top face of the frame. The ledge portion of the frame is provided at the outer end of the frame with an upright trough 40 which has its open side facing outwardly endwise of the frame. The trough 40 is open at the top end, indicated at 41, and is open at the bottom end, indicated at 42 for engagement at the bottom end with the open end of an inverted trough 43. The trough 43 is formed in the end frame member in spaced relation below the supporting surface 34 of the trough 33. The inverted trough 43 extends in a direction transversely of the trough 33 and is adapted to receive endwise, and accommodate, the lower arm 37b of the C-clamp 37. Near the inner end of the trough 43 is a recess 44 which provides a shoulder over which a detent 45, formed on the free end of the lower arm 37b of the C-clamp, snaps when the clamp is installed and behind which the detent 45 seats to prevent accidental withdrawal of the C-clamp closed end foremost.

The upper surface of the outer portion of the frame which defines the shoulder 36 is preferably flush with the top of the conductor element 12 when the conductor element 12 is seated in the trough 33. Thus, as the clamp 37 is pressed into operating position, open end foremost, the upper arm 37a slides across the top face of the frame member 31 and across the top of the conductor element 12 until its free end seats in the socket or trough 38. At the same time, the lower end 37b slides along the trough 43 until the detent 45 on its free end interengages with the recess 44.

Thus, the clamp holds itself in operating position and prevents its own accidental withdrawal closed end foremost. Also, it holds the element 12 in the trough 33. It is to be noted that the lower arm 37b and the base 37c of the C-clamp 37 are deep seated in their notches and protected by the notched side walls against accidental displacement. The C-clamp can be readily removed for removal and replacement of the movable contact assembly, when desired.

Referring to FIGS. 8 through 11, the switch is shown with the carrier frame 15 and bridging conductor inverted relative to their positions as shown in FIG. 2. In this inverted position of the carrier, the bridging conductor is in-

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verted so that its contacts 13 become the lower contacts. The conductor can rock freely about the spring arm 37a for assuring good engagement of its contacts with the stationary contacts. The pressure holding the bridging conductors with their contacts 13 against the stationary contacts 9 when the switch parts are at rest is applied by the ledges 32 instead of by the spring arm 37a. In all other respects, the operation is the same.

Having thus described my invention, I claim:

1. A carrier for a movable contact and comprising an open frame having a pair of spaced frame members, means on the frame adapted for connecting a conductor thereto for movement therewith in a path generally normal to the plane of the frame, means on the frame for guiding the frame for movement in a direction normal to the plane of the frame, and means on each of said frame members, at the inner faces thereof, for connecting the end of a leaf spring thereto, said means comprising at least three connecting shoulders on each frame member, two of said shoulders being arranged at the same side of a reference plane parallel to the plane of the frame, and the other shoulder being at the opposite side of the reference plane, said shoulders being totally out of alignment with each other in a direction from one face of the frame to the other face, said two shoulders being aligned with each other endwise of their associated frame member and terminating in spaced relation to each other endwise of their associated frame member, and being disposed at opposite sides of the longitudinal mid-portion thereof, whereby a passage is provided between said two shoulders, said other shoulder being aligned with the passage in a direction normal to the plane of the frame and said other shoulder terminating endwise of the associated frame member at locations which are at opposite sides of said longitudinal mid-portion and which are nearer to said longitudinal mid-portion than said two shoulders, respectively, and said shoulders each having an operating face facing generally toward said reference plane.

2. A carrier for a movable contact of a switch and which is to be operated with a snap action by a leaf spring, said carrier comprising a frame having elongated end frame members each with means for connecting the spring thereto, said means on each member comprising at least one pair of shoulders adapted for engaging one face of a leaf spring at its outer end to prevent its displacement of said end of the spring flatwise relative to the frame toward one face of the frame and at least one cooperating shoulder adapted for engaging the other face of the leaf spring at said outer end to prevent displacement of said outer end of the spring flatwise toward the other face of the frame, the shoulders of said pair terminating, endwise of said associated frame member, inwardly and transversely of the frame in spaced relation to the longitudinal mid-portion of the associated frame member, whereby a straight passage between the shoulders of said pair is provided, and said one cooperating shoulder terminating endwise of the associated frame member so that its ends are nearer to the longitudinal mid-portion of the associated frame member than are the lateral limits of the passage.

3. In an electrical switch, a body, a pair of stationary contacts carried thereby, a movable conductor element having a pair of contacts complementary to the stationary contacts, a carrier comprising a frame having a pair of spaced end frame members, said frame supporting said element for movement to contact making and breaking relation upon movement of the frame normal to its plane in opposite directions toward and away from the stationary contacts, an actuating member extending through the

frame, means supporting the actuating member for movement in opposite directions normal to the plane of the frame, dead center leaf spring means interposed between the frame and said member for moving the frame with a snap action in opposite directions, selectively, upon movement of the member in opposite directions, selectively, said dead center leaf spring means comprising a pair of leaf springs normally arranged for flexure flatwise toward and away from the plane of the frame, one spring between each of said frame members and the adjacent side of the actuating member, a plurality of connecting shoulders on each of said frame members connecting each leaf spring at its outer end to its associated frame member, means connecting each leaf spring at its inner end to said adjacent side of the actuating member, for said flexure flatwise, each spring being normally flexed for urging the frame into contact making position, the point of connection of each spring with the actuating member normally being spaced farther from the plane of the stationary contacts than its point of connection with the frame and its point of connection with the member being movable, by movement of the actuating member in said one direction, to a position closer to the plane of the stationary contacts than its point of connection with the frame, whereby the point of connection with the actuating member passes dead center and the frame is moved away from the stationary contacts by the springs, said plurality of connecting shoulders on each frame member comprising at least one pair of shoulders engaging said outer end of the associated leaf spring and preventing displacement of said outer end flatwise in one direction from operating positions and a cooperating shoulder engaging said outer end of the associated leaf spring and preventing displacement of said outer end in the opposite direction from said operating positions, the shoulders of said pair terminating, endwise of their associated frame member, inwardly of the frame in spaced relation to each other and at opposite sides of the longitudinal mid-portion of said associated end frame member, whereby a straight passage intersecting the plane of the frame and extending between the inner ends of said shoulders of said pair is provided, and said cooperating shoulder terminating endwise of said end frame member so that the ends of the cooperating shoulders are positioned endwise of their associated frame member nearer to the mid-portion of their associated frame member than are the lateral limits of said passage.

4. The structure according to claim 1 wherein all of said operating faces slope toward said reference plane in a direction toward the longitudinal mid-portion of the frame.

5. The structure according to claim 1 wherein the frame is composed of electrical insulating material.

6. The structure according to claim 1 wherein the operating faces of said two shoulders are coplanar and the cooperating shoulder is substantially equal in dimension, endwise of the associated frame member, to the distance between said two shoulders.

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BERNARD A. GILHEANY, *Primary Examiner*.

ROBERT K. SCHAEFER, *Examiner*.