June 3, 1969 J. E. MADING ET AL 3,448,226

COMPACT ELECTRICAL CONTACT BLOCK WITH ELECTRICALLY ISOLATED BRIDGING CONTACTS

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Fig. 1

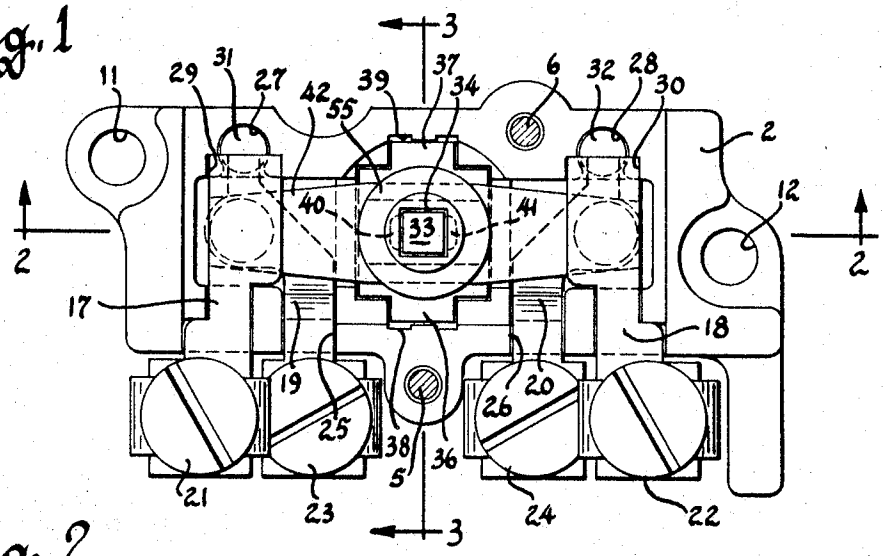
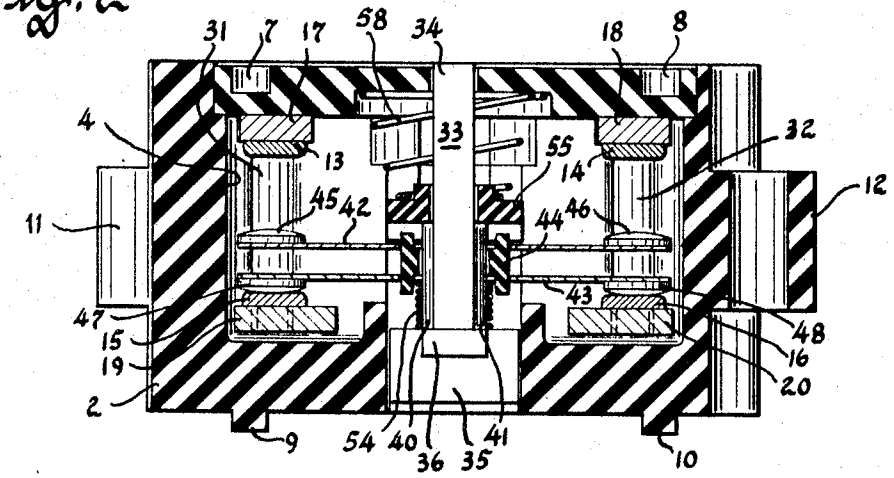


Fig. 2



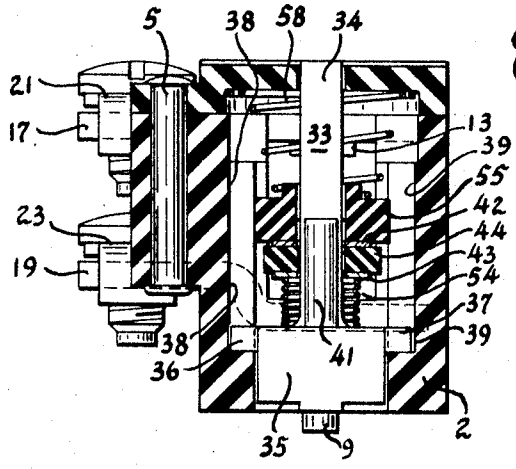


Fig. 3

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Fig. 4

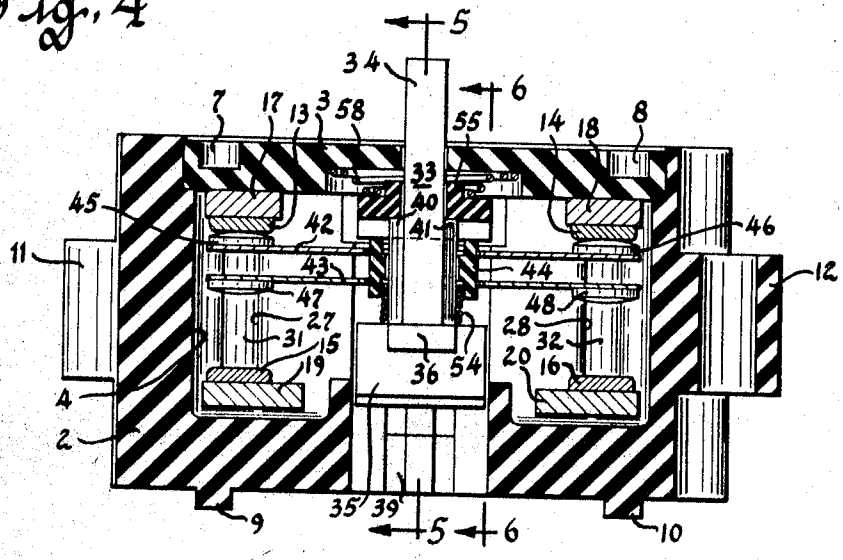


Fig. 5

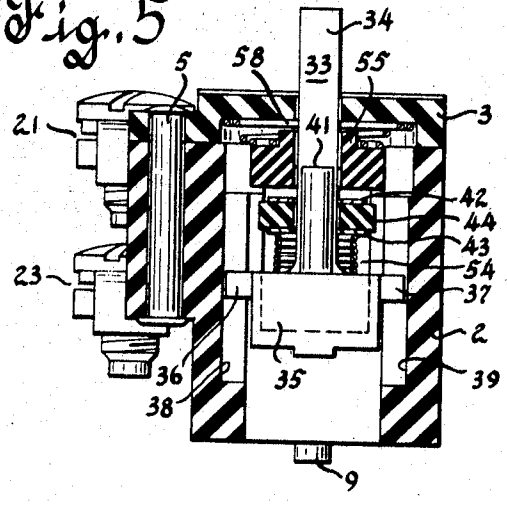
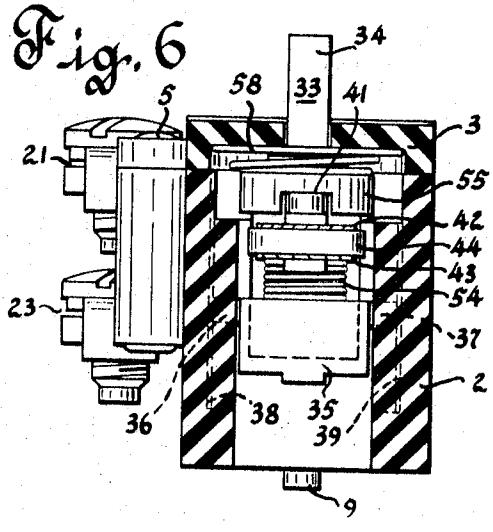


Fig. 6



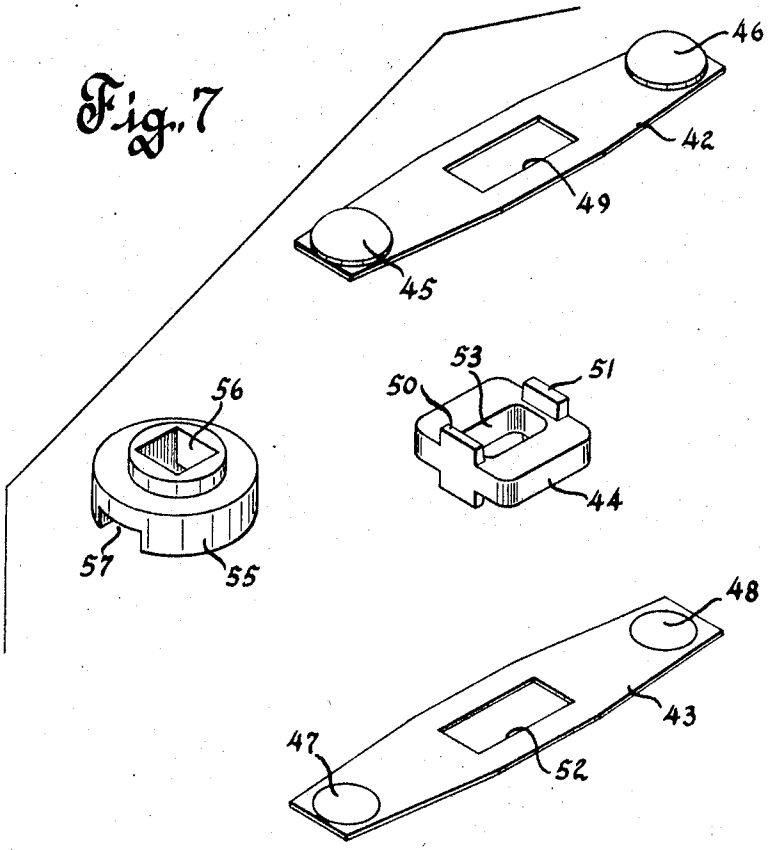
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Fig. 7



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COMPACT ELECTRICAL CONTACT BLOCK WITH ELECTRICALLY ISOLATED BRIDGING CONTACTS

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Int. Cl. H01k 15/04
U.S. Cl. 200—16 2 Claims

ABSTRACT OF THE DISCLOSURE

An electrical contact block of the type used in manually operable pushbutton assemblies. The block includes an insulating housing and a reciprocally actuable plunger which supports two electrically isolated bridging contacts. Spring means and a sliding contact support provide for wear allowance and contact pressure.

Background of the invention

This invention relates to electrical switching devices and more particularly to electrical contact blocks suitable for use in a pushbutton switch assembly of the type shown in the copending application Ser. No. 520,444, filed Jan. 13, 1966 by Roy A. Mukai, Allan P. Charbonneau, Joseph F. Waldorf and Robert Pearson and assigned to the present assignee.

Contact blocks used for such purposes commonly have two sets of stationary contacts which are alternately closed by a movable bridging contact, one set being normally open and the other normally closed. It is frequently desirable to connect the normally open and normally closed contacts in separate electrically isolated circuits. This gives rise to the possibility of large electrical potential difference between the opposite normally open and normally closed stationary contacts. Consequently, in compact blocks of this type there is a problem with interconnection or arcing between electrically independent circuits. The small size of such contact blocks complicates the economical solution to such problems.

Summary of the invention

It is therefore an object of the invention to provide a contact block of small size suitable for use in pushbutton switching assemblies and which is further suitable for safely alternately switching electrically independent circuits.

It is another object of the invention to provide a device of the aforedescribed type which is of minimum size and complexity, which operates reliably and which incorporates certain desirable operating characteristics.

These objects are accomplished by providing a contact block with an insulating housing and a reciprocally actuable plunger passing therethrough. Two sets of stationary contacts are mounted oppositely within the housing. Bridging contact means are provided comprising a corresponding pair of bridging contacts mounted in parallel spaced apart relationship on an insulating support member which is carried by the plunger. A second insulating member is slidingly carried by the plunger and bears against one side of the bridging contact means. A first spring between the housing and the second insulating member biases the mechanism to a normal position in which one of the bridging contacts is in contact with one set of stationary contacts. A weaker second spring between an abutment on the plunger and the bridging contact means provides the contact pressure for the other set of contacts. The mechanism is actuated by movement of the plunger which then engages the second insulating

member to compress the first spring and allow the normally closed contacts to open and the other contacts to close under the influence of the second spring.

Brief description of the drawing

FIGURE 1 is a top view of a contact block with its cover removed which contact block embodies the invention;

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1 but with the cover in place;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 1 with the cover in place;

FIG. 4 is a sectional view similar to FIG. 2 but with the operating mechanism in its opposite position;

FIG. 5 is a sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is a sectional view taken on line 6—6 of FIG. 4; and

FIG. 7 is an exploded isometric view of certain members of the operating mechanism.

Description of the preferred embodiment

Referring to the drawings, there is shown a contact block having a housing comprising a hollow insulating molded base 2 which is closed by a cover 3 to enclose central contact chamber 4. Cover 3 is fastened to base 2 by a pair of rivets 5 and 6. The cover 3 has a pair of cylindrical depressions 7 and 8 formed in the outer surface thereof and the base 2 has corresponding complementally formed projections 9 and 10 to facilitate the proper alinement of adjacently stacked similar contact blocks. A pair of mounting lugs 11 and 12 extend from opposite ends of base 2.

Four stationary contacts 13, 14, 15 and 16 are arranged within contact chamber 4. Stationary contacts 13, 14, 15 and 16 are welded to and supported by contact plates 17, 18, 19 and 20, respectively. Each of plates 17, 18, 19 and 20 extends to the exterior of base 2 where they are provided with screw type terminal clamps 21, 22, 23 and 24, respectively. Each one of plates 17, 18, 19 and 20 is clamped between cover 3 and base 2 at the point where it passed to the exterior of base 2. The lower plates 19 and 20 pass through base 2 at the lower end of slots 25 and 26 which extend from the top edge of the front wall of base 2 nearly to the bottom of chamber 4. A pair of extensions (not shown) are integrally molded on cover 2 and depend from the cover to fit snugly within slots 25 and 26 and clamp plates 19 and 20 at the lower end thereof. When assembled, the extensions fill slots 25 and 26 to form a relatively smooth continuous wall with the adjacent sides of base 2.

The inner ends of plates 19 and 20 are retained within the low ends of cylindrically shaped grooves 27 and 28. Grooves 27 and 28 are formed on the inner side of the rear wall of base 2 and extend from near the bottom of chamber 4 to the upper edge of the rear wall of base 2. The open upper ends of grooves 27 and 28 are closed by cover 3 when the housing is assembled. At the upper edge of the rear wall of base 2 a pair of rectangular depressions 29 and 30 are formed contiguously with the upper ends of grooves 27 and 28 to receive the inner ends of contact plates 17 and 18. When in assembled position, the inner ends of plates 17 and 18 extend partially across the upper ends of grooves 27 and 28. Cover 3 when fastened in place holds the inner plates 17 and 18 securely within depressions 29 and 30.

The inner ends of the lower pair of contact plates 19 and 20 are held in place within grooves 27 and 28 by cylindrical insulating rods 31 and 32, respectively, which fit slidingly within cylindrical grooves 27 and 28. The lower ends of rods 31 and 32 rest on the inner ends of plates 19 and 20 within grooves 27 and 28 to hold plates 19 and 20 in place near the bottom of chamber 4. Rods

31 and 32 are held in place by the engagement of their upper ends with the inner ends of plates 17 and 18 which are in turn held in place by cover 3.

A reciprocatory plunger 33 is located centrally within the housing and extends through the cover 3 and the bottom of base 2. The smaller upper end 34 of plunger 33 is of square cross section and fits slidingly within a square aperture in cover 3. The larger lower portion 35 is also of substantially square cross section and fits slidingly within a substantially square aperture in base 2. A pair of lugs 36 and 37 extend oppositely from portion 35 to slidingly engage a corresponding pair of guiding grooves 38 and 39 formed oppositely in the walls of chamber 4. The smaller portion 34 of plunger 33 is enlarged on opposite sides near its lower end to form a pair of shoulders 40 and 41.

Two contact bridges 42 and 43 are supported by an insulating contact support 44. Bridges 42 and 43 carry movable contacts 45, 46, 47 and 48 which are riveted thereto. Contact bridge 42 has a central rectangular aperture 49 which when in place stradles a pair of upstanding lugs 50 and 51 formed on the edges of contact support 44. Similarly, a central aperture 52 in contact bridge 43 fits over lugs 53 and 54 on the other side of contact support 44. The apertures 49 and 52 aline with a rectangular central aperture 53 in contact support 44. Aperture 53 is of such size as to loosely and slidingly fit on portion 34 and shoulders 40 of the plunger 33. A compression spring 54 is assembled between portion 36 of plunger 33 and the lower surface of bridge 43 to provide contact pressure for the normally open contacts 45 and 46.

A second insulating spacer 55 is assembled above bridge 42 and contact support 44. Spacer 55 has a central square aperture 56 which fits slidingly over the smaller upper end portion 34 of plunger 33 but is not of sufficient size to pass over shoulders 40 and 41. The lower surface of spacer 55 is provided with a diametric groove 57 to provide clearance around lugs 50 and 51 on contact support 44. The lower surface of spacer 55 therefore bears against the upper surface of bridging contact 42.

A conical compression spring 58 is placed between the upper surface of spacer 55 and cover 3. Spring 58 is of considerably greater strength than spring 54 and therefor provides contact pressure to normally closed contacts 47 and 48 in addition to providing the return force to plunger 33 by way of spacer 55 and shoulders 40 and 41.

The operation of the device will now be explained.

This device is intended for use in two electrically isolated circuits in which one circuit is connected to stationary contacts 13 and 14 and the other circuit is connected to stationary contacts 15 and 16. Bridge 42 therefore carries current in the upper normally open circuit and bridge 43 carries current in the normally closed lower circuit. Obviously a single bridge could be used to perform this switching function as was done in prior devices. A single bridge however leads to the possibility of drawing an arc from one circuit to the other or otherwise increasing the possibilities of interconnection between the circuits.

The normal position of the switching mechanism is shown in FIG. 2 in which the lower normally closed movable contacts 47 and 48 are in contact with stationary contacts 15 and 16 respectively. In this position the force of spring 58 is transmitted through spacer 55 to bridge 42 thence to contact support 44 and bridge 43 to hold contacts 47 and 48 closed against contacts 15 and 16, respectively. The contact pressure is determined by the difference between the force of spring 58 and the opposing force of weaker spring 54 bearing against the lower surface of bridge 43. The opposite end of spring 54 bears against portion 35 to hold plunger 33 in its normal position with lugs 36 and 37 bottomed on the lower ends of slots 38 and 39. In this position shoulders 40 and 41 do not bear against the lower surface of spacer 55 and the small distance therebetween provides for wear allowance for the normally closed contacts 15, 16, 47 and 48.

When the switching device is actuated pressure on the lower surface of portion 35 moves plunger 33 upwardly. After a short movement shoulders 40 and 41 engage the lower surface of spacer 55. Further movement compresses spring 58 and moves spacer 55 upwardly allowing the pressure of spring 54 to move bridge 43, contact support 44 and bridge 42 upwardly. If the normally closed movable contacts 47 and 48 should happen to stick, the coils of spring 54 would soon compress "solid" and a positive opening force would be applied to the contacts. Continued movement of plunger 33 causes the normally open movable contacts 45 and 46 to close on stationary contacts 13 and 14 as shown in FIGS. 4, 5 and 6. After normally open contacts touch the contact pressure is applied by spring 54. Plunger 33 may continue to move to the upper end of its stroke.

Release of the actuating pressure to plunger 33 permits spring 58 to return the mechanism to its original position.

It can be seen that bridges 42 and 43 are electrically insulated from each other during the entire operating cycle. If an arc were drawn between the normally closed contacts 15, 47, 16 and 48 when the device was operated, the arc would not be drawn over to the opposite set of stationary contacts 13 and 14.

It can also be seen that the construction of the parts is of extreme simplicity and their assembly would be very easy. For instance, the movable members are simply assembled by placing in sequence spring 54, bridge 43, contact support 44, bridge 42, spacer 55 and spring 58 over the smaller upper end 34 of plunger 33.

What is claimed is:

1. An electrical switching device comprising:

a housing;

a plunger made of electrically insulating material and reciprocally movable within said housing;

first and second pairs of stationary contacts positioned oppositely within said housing;

first and second movable bridging contact means for respectively electrically bridging said first and second pairs of stationary contacts;

insulating movable bridging contact supporting member for supporting said first and second bridging contact means in fixed spaced apart and electrically insulated relation to form a bridging contact assembly, said bridging contact supporting member being slidably supported on said plunger;

first spring means positioned between said plunger and said bridging contact assembly for providing a yielding force between said plunger and said bridging contact assembly to bias said bridging contact assembly in a first direction;

insulating spacer means slidingly mounted on said plunger and positioned in said first direction from said bridging contact assembly;

second spring means of greater strength than said first spring means positioned between said spacer means and said housing for providing a yielding force between said spacer means for yieldingly biasing said spacer means in a spaced direction which is opposite to said first direction, said secnnd spring means and spacer means also being effective by engagement of said spacer means with said bridging contact assembly for yieldingly pressing said first bridging contact means into contact with said first pair of stationary contacts when said plunger is in its unoperated position; and

means on said plunger for engaging said spacer when said plunger is operated in said first direction from its unoperated position to move said spacer away from said bridging contact assembly and to thereby permit the force of said first spring means to move said bridging contact assembly in said first direction

away from said first pair of stationary contacts and toward said second pair of stationary contacts whereby said first bridging contact means breaks contact with said first pair of stationary contacts and said second bridging contact is moved into contact with said second pair of stationary contacts.

2. The invention as defined in claim 1, in which

said bridging contact supporting member includes projections on opposite sides for engaging apertures in said first and second bridging contact means;

said first spring means bears against said first bridging contact means to hold said first bridging contact means in assembled relation with said bridging contact supporting means; and

said spacer means bears against said second bridging

contact means to hold said second bridging contact means in assembled relation with said bridging contact supporting means.

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