

July 12, 1966

H. E. SCHLEICHER

3,260,824

LOW ENERGY NON-ARCING ELECTRIC RELAY CONSTRUCTION

Filed July 29, 1963

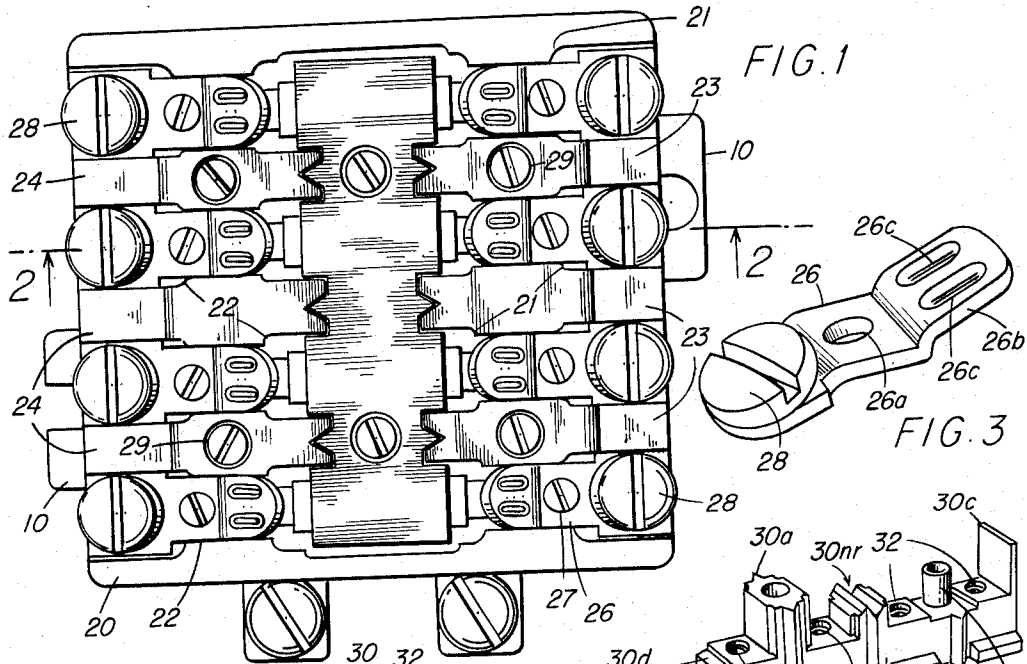
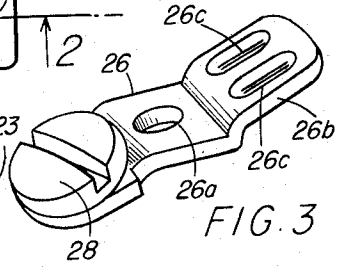
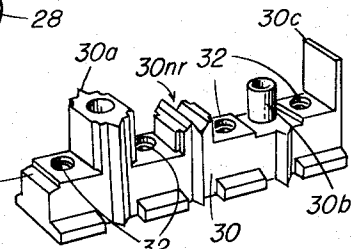
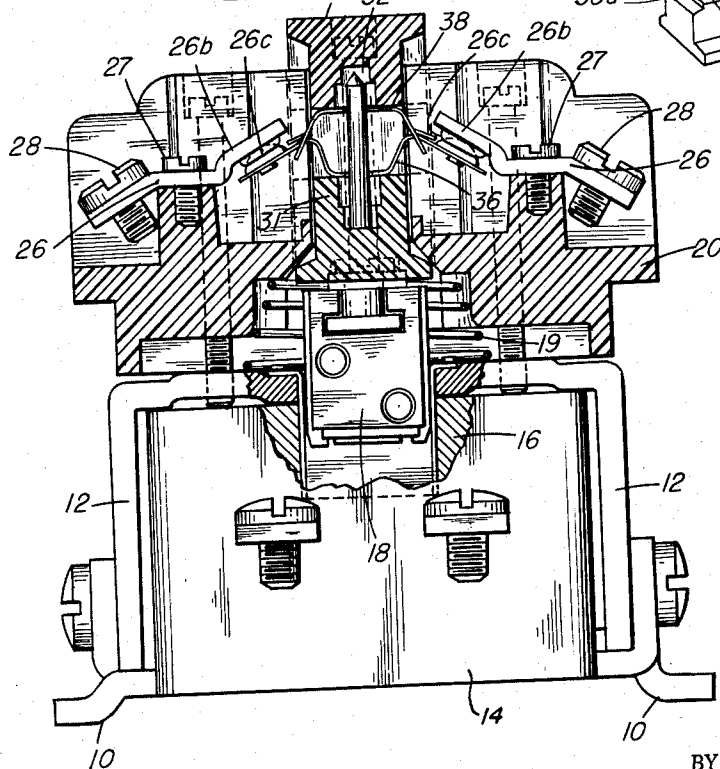
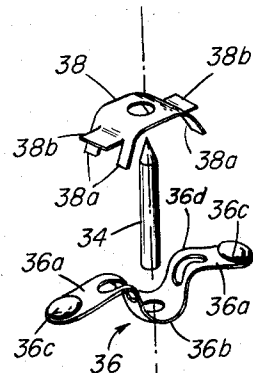


FIG. 2

INVENTOR.

Harold E. Schleicher
BY his attorneys

Hawson and Hawson.

1

3,260,824

LOW ENERGY NON-ARCING ELECTRIC RELAY CONSTRUCTION

Harold E. Schleicher, West Hartford, Conn., assignor to The Arrow-Hart & Hegeman Electric Company, Hartford, Conn., a corporation of Connecticut
Filed July 29, 1963, Ser. No. 298,209
7 Claims. (Cl. 200-104)

This invention relates to electric relays and, more particularly, to low-energy non-arcng electric relays, the contact structure thereof and its mounting.

Conventional relays and the contact mountings and structure thereof for carrying power of 10 amperes at 110 volts and upwardly in both amperage and voltage have undergone considerable development as improvements have been made in the past. But, such relays are not well suited to low energy circuit work such as in milli-ampere and micro-volt work.

Relay contact arrangements for 110 volt and 15 ampere circuits, for example, are not recommended for voltages under 10 volts. Generally stated where the product of the voltage and amperage shows that the relay will be used under conditions of low energy consumption, relays designed for high energy conditions are not suitable not only because they are unduly expensive on account of great over-capacity designing, but also because they do not perform the task of handling low energy as well as relays whose structure has been perfected with the particular job in mind of handling particular low-energy ranges.

Thus, the general object of this invention is to provide fixed and movable contact structure particularly suited for low energy electric relays.

A particular object of the invention is to multiply the likelihood of carrying current over a clean, smooth contact surface by providing for flexure of the movable contact to enable it to accommodate itself to multiple contact engaging formations on the fixed contact member.

Another particular object is to provide sliding and wiping action over a great distance along with good vertical deflection of the movable contacts as they engage the fixed contacts.

Another particular object is to provide a vibration damping action as the movable contact separates from the fixed contact member.

Another object is to provide for irregularities in manufacture in order to maintain the functioning of the structure embodying and accomplishing the foregoing objectives.

Other objects and advantages of the invention will appear as it is described in connection with the accompanying drawing.

In the drawing:

FIG. 1 is a top plan view of an electric relay embodying the invention.

FIG. 2 is a vertical transverse section view, partly broken away, through the switch of FIG. 1 with the section taken along line 2-2 of FIG. 1.

FIG. 3 is an enlarged perspective view of the stationary contact member.

FIG. 4 is a perspective view of one of the movable contact mounting blocks.

FIG. 5 is an exploded perspective view of the movable contact parts.

Referring to the drawing, the relay in which the invention is embodied is adapted to be supported by a bottom sheet metal frame plate 10 on which is fixedly mounted a top U-shaped stamped sheet metal frame plate 12. Between the two is secured an electromagnetic solenoid coil 14 within which is a field piece 16 which, when mag-

2

netized, attracts a core armature 18 whose movement operates the movable switch contacts. A spirally coiled compression spring 19 rests on the top of the frame plate 12 and presses against the bottom of the lower (31) of two movable contact supporting blocks or bars 30, 31 and urges it upwardly, in FIG. 2.

Upon the top frame plate 12 is bolted a molded insulation support member 20 for a plurality of fixed contact and terminal members 26. This support has its upper surface divided into a plurality of compartments or parallel recesses 21, 22 extending to the edge of the support 20 from opposite sides of the central zone in which the movable contact carrying block moves. The recesses are separated from each other by parallel ribs or barriers 23, 24.

In each compartment or recess is fixedly mounted a fixed contact and terminal member 26 of the form shown in FIG. 3 having a central mounting portion with a hole 26a through which passes a mounting bolt 27. The outer ends of the members 26 are bent down at an oblique angle to the central portion and carry terminal screws 28. The inner ends 26b of the members 26 are up-turned at an oblique angle to the central portion to provide for increased sliding contact as the movable contact engages the fixed contact as hereinafter will more fully appear.

As will be observed from FIG. 2, the fixed contacts 26 on the opposite sides of the support 20 extend toward each other in upwardly inclined directions. Beneath them and supported on a lower molded insulation block or bar 31 and between it and an identical upper molded insulation bar 30 are a plurality of spaced bridging contact members 35 stamped into the form best shown in FIG. 5 from thin flexible sheet metal having good conductivity, such as Phosphor bronze. As will be observed, the contact members have U-shaped central portions and the ends of their arms are each out-turned in opposite directions and bent downwardly at an oblique angle generally parallel to or approaching the angularity of the contact portions 26b of the fixed contact members.

Contact buttons 36c of silver or other good contact material are affixed on the upper surfaces of the down-turned arms 36a of the movable contact members. To provide added flexibility of the arms 36a, elongated apertures 36b are punched out of these members between the buttons 36c and the midportion 36b of said contact members.

The midportion 36b is curved and is rounded at the corners between the midportion and the upwardly extending portions of the arms 36a. This makes the movable contact less rigid and more flexible and enables the contact to compensate for variability or irregularity in manufacturing.

The movable contact members are loosely positioned in chambers formed by the interengaging portions of the upper and lower movable contact supporting bars 30 and 31. Vertical pins 34 seated in circular pockets 32 in the bars 30 and 31 hold the movable contact member loosely in place.

Above and engaging each movable contact is a positioning member 38 of shape as shown in FIG. 4. The positioning members are stamped from thin flexible sheet metal such as phosphor bronze, preferably but not necessarily into generally inverted U-shape with a central recess through which the pin 34 passes. The positioning member is wider than the movable contact arms 36a and has tongues 38b struck out from the midportion of each end so as to overlie the out-turned arms of the movable contact member when the parts are assembled.

When the movable contact member is pressed into engagement with the fixed contacts 26 by the urge of the spring 19 on the contact supporting bar 31, the flexure of the movable contact arms causes them to have a slight

angle with respect to the tongues 38b. However, when the magnet is energized and the movable contacts separate from the fixed contacts, the tongues 38b act as stops which minimize upward flexure of the movable contact arms 36a and also damp out the vibrations of the movable contact arms on their separation from the fixed contacts.

The striking out of the tongues 38b leaves parallel arms 38a on each side of each tongue in position to embrace the movable contact arm 36a with which it is associated. These parallel arms 38a keep the positioning member from turning with respect to the movable contact member 36. Turning of the positioning members 38 with respect to the upper contact supporting bar 30 is prevented by the interengagement of the side edges of the positioning member with the aforementioned chambers formed by the interengagement of the identical oppositely directed contact supporting bars 30 and 31.

Referring to the formation and configuration of the contact supporting bars as shown in FIG. 4, it will be noted that a post 30a formed near one end has a circular well formed therein. This well is adapted to receive a circular boss 30b formed near the opposite end of the bar of the other (inverted) movable contact supporting member. Likewise, an end wall or flange 30c is adapted to seat against a ledge or shoulder 30d at the opposite end of the other movable contact supporting member; and at the center a notch and ridge formation 30nr on the top of an upward extension is adapted to interfit with a similar notch and ridge formation on the other contact supporting member.

In order to double the possibility and likelihood of the current being carried over a clear smooth contact surface as the movable contact button 36c engages the fixed contact portion 26b, a pair of parallel elongated contact ribs or ridges 26c are pressed out of the lower or contacting surface of the fixed contacts 26. Thus, as the movable contact buttons 36c engage the fixed contact ribs or ridges 26c as the switch contacts close, the buttons will rub over the ridges for substantially their entire length, from the beginning to the end of the switch closing movement, keeping the contacting surfaces clean and bright not only in one path, but in two paths. This materially increases the clear contact surface for the current to pass from one contact to another, as is important in low energy relay circuits. Dimensionally, the button diameter is approximately equal to the spacing of the center lines of the parallel ribs 26c so that the button enters to some degree in between the ribs.

The loose mounting of the movable contacts and the flexibility of the contact itself provides for twisting and flexing of the contact so that the button will engage both ribs on the fixed contact, in contrast to engagement of only one which would occur if the bridging contact were rigid. This mounting and flexibility together with the curved midportion of the movable contact makes up for irregularities normal in mass production.

From the foregoing, it will be observed that by the combination of unique features described, a novel and reliable relay switch contact structure has been provided which is particularly useful in relays in low-energy circuits. The invention embodies the high degree of flexibility necessary for the movable contact while at the same time providing for stopping of vibration and damping out vibration incident to the separation of the fixed and movable contacts. At the same time, provision is increased twofold for having the clear and clean contact surfaces of the fixed and movable contacts in engagement and for increased flexure of the movable contacts.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the in-

vention is not limited to the specific form and configuration of the parts as shown and described.

What is claimed is:

1. In a low energy relay switch, electromagnetic operating means, an insulation support moved by said operating means, a pair of fixed contacts positioned adjacent opposite sides of said support having their contact surfaces directed at an acute angle with respect to the direction of movement of said support by said operating means, flexible bridging contact means on said insulating support, said bridging contact means being U-shaped and symmetrical with the end portions of its arms being out-turned at an acute angle, said end portions having contact surfaces directed at a substantially supplementary angle with respect to the angle of said fixed contact surfaces and engaging obliquely with said fixed contact surfaces and slidable over said fixed contact surfaces as said bridging contact flexes after said engagement, and a positioning member engaged with said bridging contact means at spaced points, said positioning member having means to damp the vibrations of said flexible contact member as said fixed and bridging contact members separate.

2. A low energy relay as claimed in claim 1 wherein one of said contact surfaces comprises a plurality of parallel ridge-like protrusions both slidably engageable with an arcuately surfaced contact button as the switch closes.

3. A low energy relay as claimed in claim 2 wherein said flexible bridging contact means has elongated holes punched therein between said buttons and the central portion thereof to increase the flexibility of the bridging contact.

4. A low energy relay as claimed in claim 3 wherein said damping means comprises tongues oppositely directed from said positioning member, and arms on opposite sides thereof embracing said bridging contact intermediate its ends.

5. A low energy relay as claimed in claim 1 wherein said flexible bridging contact means has holes punched therein intermediate its ends and its central portion to increase flexibility.

6. A low energy relay as claimed in claim 1, wherein said damping means comprises tongues oppositely directed from said positioning member, and arms on opposite sides thereof embracing said bridging contact intermediate its ends.

7. A low energy relay as claimed in claim 1 wherein the insulating support comprises upper and lower parts between which said bridging contact means is mounted, a pin seated at its opposite ends in said upper and lower parts and passing through a hole in said bridging contact means to hold the latter loosely in position.

References Cited by the Examiner

UNITED STATES PATENTS

2,389,429	11/1945	Griffith.	
2,541,398	2/1951	Wood	200—166
2,756,291	7/1956	Peter	200—166 X
2,885,516	5/1959	Goudy et al.	200—104 X
2,897,311	7/1959	Schleicher	200—104 X
2,919,324	12/1959	Schuessler	200—104 X
2,924,685	2/1960	Burch	200—104
3,004,127	10/1961	Carding et al.	200—166
3,184,574	5/1965	Dennison	200—166 X

FOREIGN PATENTS

221,742	2/1959	Australia.
204,628	8/1959	Germany.

BERNARD A. GILHEANY, *Primary Examiner*.
T. D. MACBLAIN, *Assistant Examiner*.