March 10, 1959 J. W. GREAR, JR 2,877,314

ELECTRIC CONTACT MEANS

Filed Nov. 10, 1954 2 Sheets-Sheet 1

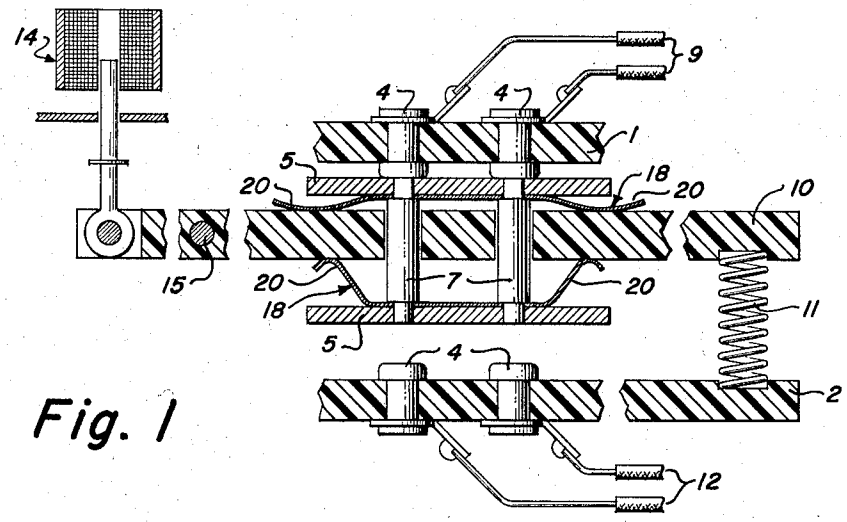


Fig. 1

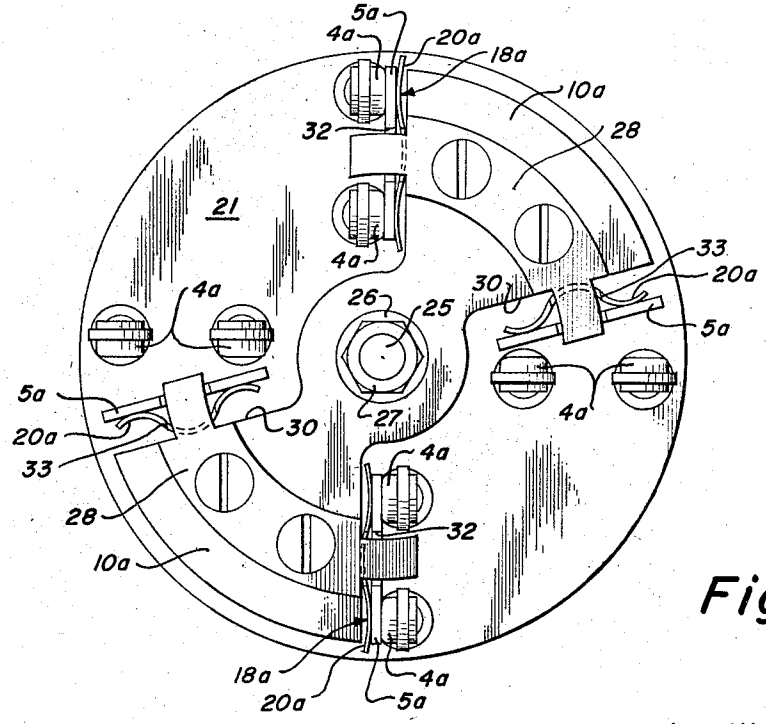


Fig. 2

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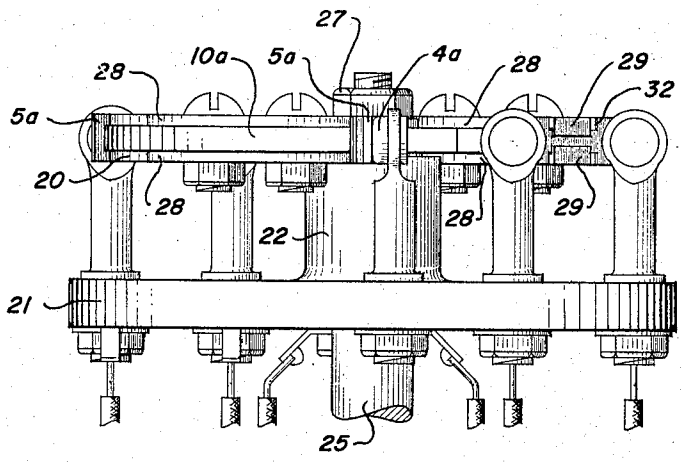


Fig. 3

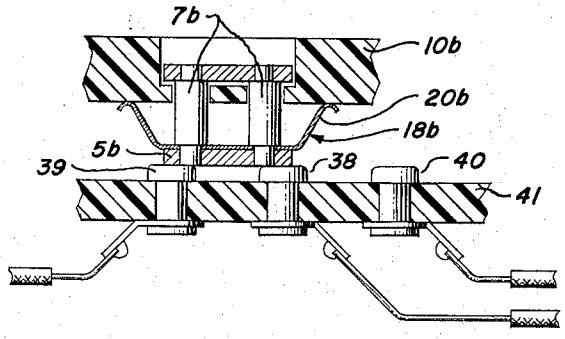


Fig. 4

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ELECTRIC CONTACT MEANS

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1 Claim. (Cl. 200—87)

The present invention relates to means adapted to maintain electric connections under conditions of vibration or acceleration, and to electric switches embodying such means.

A major difficulty or disadvantage experienced with electric switches that are used in mechanisms subject to vibration, acceleration or shock is a tendency to open and so remain or "chatter," i. e., to open and close rapidly. The difficulty is particularly acute with switch mechanisms or relatively high current rating as the larger terminals and contacting masses required are more susceptible to vibration, acceleration and shock forces.

The present invention aims to overcome the above and other difficulties or disadvantages by providing new and improved means for holding electric conducting or contact members in firm interengagement at all times and for simultaneously and rapidly absorbing or damping out applied vibration, acceleration or shock forces.

An object of the present invention is to provide new and improved means for maintaining electric switches in closed relationship.

Another object of the invention is to provide improved electric switch means of relatively simple, rugged, lightweight, and inexpensive construction.

Another object of the invention is to provide improved chatter minimizing means which may be readily incorporated into electric switches of small or large sizes and capacities.

Still another object of the invention is to provide yieldable means for maintaining contact elements of a switch in firm interengagement at all times.

A still further object of the invention is to provide improved means for damping out effects of externally applied forces.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention and various modifications thereof have been chosen for purposes of illustration and description. The preferred embodiment and the modifications are not intended to be exhaustive nor to limit the invention to the precise form disclosed. They are chosen and described in order to best explain the principles of the invention and their application in practical use to thereby enable others skilled in the art to best utilize the invention in various embodiments and modifications as are best adapted to the particular use contemplated.

In the accompanying drawings,

Fig. 1 is a fragmentary sectional view showing one form of the invention;

Fig. 2 is an end view of a slightly different form of the invention;

Fig. 3 is a side view of the device shown in Fig. 2; and

Fig. 4 is a fragmentary sectional view of a modified form of the invention as it may be employed in a sliding contact mechanism.

As shown in Fig. 1, the invention comprises a pair of spaced apart members 1 and 2 carrying terminals 4 adapted to be contacted by electrically conducting bar members 5 which are secured to guide pins 7. The guide pins 7 extend through apertures in an intermediate or support member 10. The spaced members 1 and 2 and the support member 10 may be composed entirely of any suitable insulating material or include such insulating material only adjacent the terminals 4 and guide pins 7. The intermediate or support member 10 may be normally urged toward one terminal engaging position by a spring 11 and may be moved toward an opposite contact engaging position by solenoid means 14 which effects rotation of the support member 10 about an axis or support rod 15. The combination of spring 11 and solenoid means 14 with rod 15 for obtaining movement of the support member 10 is merely illustrative as any other suitable means may be employed. If desired, the support member 10 may be stationarily mounted and the spaced members 1 and 2 actuated so as to selectively close or open their contacts 4 with respect to one or the other of the conducting members 5 on the support member 10.

An appropriate conducting member 5 (the upper one as shown in Fig. 1) is urged into firm engagement with terminals 4 and applied vibratory, acceleration or other forces are damped out by yieldable means or springs 18 shown intermediate the conducting members 5 and an adjacent surface of the support member 10. In Fig. 1 the upper spring 18 is deflected and presses the conducting bar 5 firmly against the two upper terminals 4 to interconnect them so that a circuit path is established through the bar 5 from one upper conductor 9 to the other. Leg portions 20 of the upper spring are simultaneously urged into firm frictional or sliding engagement with adjacent surfaces of the intermediate support member 10. If relative movement, together or apart, between the upper insulator member 1 and the intermediate support member 10 occurs, the upper spring 18 continues to urge the conducting bar 5 into engagement with the upper terminals 4 and the projecting leg portions 20 of the spring slide along adjacent surfaces of the support member 10 during the movement. As a result of the sliding or frictional engagement between spring legs 20 and support member 10, kinetic energy of the members is quickly absorbed or damped out. In addition to the damping effect provided by leg portions 20 of the upper spring 18, the damping action is enhanced by simultaneous frictional or sliding engagement of the lower spring leg portions 20 along the underside of the support member 10. The configuration of both springs 20 approximates that shown for the lower spring prior to movement of the support member 10 and consequent deflection or deformation of the upper spring.

Sliding and frictional engagement of the springs 18 with the support member 10 is enhanced by disposing the spring leg portions 20 at any appropriate angle to the adjacent engaging surface so as to minimize the possibility of digging thereinto, and also by forming reverse bends on the legs 20 to provide what may be termed enlarged "shoes" for engaging and sliding along the support member 10. The enlarged engaging surfaces thus provided between the spring legs 20 and support member 10 more quickly and effectively absorb or damp out relative movement of parts caused by vibratory or acceleration forces as the spring strengths may be increased without causing objectionable "digging in" of the spring ends.

When the solenoid means **14** is energized the support member **10** rotates about the axis **15**, in opposition to the spring **11**, and the lower conducting member **5** engages with terminals **4** of the lower insulator member **2** so as to interconnect the lower conductors **12** and disconnect the upper conductors **9**. When so disposed, the lower spring **18** will be deflected similarly to the illustrated relationship of the upper spring **20** and the upper spring will then be of configuration similar to that shown in Fig. 1 for the lower spring.

While the invention as illustrated in Fig. 1 is adapted to establish a circuit through one set of terminals substantially simultaneously with interruption of a second circuit through another set of terminals, it will be clear that one set of terminals and their supporting means may be omitted and any desired circuit established only in response to movement of a conducting member **5** in one direction. For example, the upper insulating member **1** with its terminals **4** and the spring **11** may be omitted, so that energization of the solenoid means **14** serves only to connect the lower conducting member **5** across the terminals **4** of the lower insulating member **2**. In such instances the upper spring **18** may, of course, be dispensed with.

The legs **20** of the yieldable means or springs **18** have been disclosed in Fig. 1 frictionally engaging and slidable along the support member **10** and with central portions resting against the conducting members **5**. The springs may, however, be positioned so that their central portions rest against a support member and their ends or leg portions slidingly and frictionally engage conducting bar members, similar to the embodiment shown in Figs. 2 and 3.

In Figs. 2 and 3 the invention is shown embodied in a switch mechanism which includes a rotor or support member **10***a* secured to a rotatable shaft **25** for movement with the shaft in clockwise or counterclockwise directions, as the case may be, to electrically interconnect one plurality of sets of terminals **4***a* and disconnect another plurality of sets of similar terminals. While the support member **10***a*, which may be composed of some insulating synthetic resin or plastic material, is shown with a pair of oppositely disposed wings to facilitate making and breaking of circuits via the illustrated sets of terminals, only a single wing may be employed if desired.

The terminals **4***a* and associated conducting wires are carried by and project above a plate member **21** having a hollow hub **22** penetrated by the rotatable shaft **25**. The shaft **25** and hub **22** may be electrically isolated from each other by an intermediate annular bearing or bushing (not shown) and the rotor or support member **10***a* may rest adjacent the end of the hub **22** and be secured to the shaft **25** by a washer **26** and nut **27**.

The conducting members **5***a*, as well as the springs **18***a* of the Figs. 2 and 3 embodiment, are retained in position on the support member **10***a* by cooperating upper and lower retaining and guiding members **28**, which may be bolted or otherwise secured to the support member **10***a*. Inwardly projecting end portions **29** of the retaining members **28** extend over adjacent surfaces of the conducting bar members **5***a* to hold them in opposition to pressure exerted by the energy absorbing springs **18***a*, which are confined between inner surfaces of the conducting members **5***a* and oppositely disposed surfaces **30** of the support member **10**. The conducting bars **5***a* and springs **18***a* are held against excessive endwise movement and separation from the retaining members **28** by cut-outs which form shoulder portions **32** and **33**, respectively, that project beyond adjacent edges of the retaining members **28**.

When the actuating shaft **25** is rotated in one direction the top and bottom conducting bars **5***a* (Fig. 2) are pressed against their respective terminals **4***a* and the corresponding top and bottom spring members **18***a* are compressed from the relationships shown at the right and left sides of Fig. 2 to the deflected positions shown at the top and bottom of Fig. 2. It will be noted that in the embodiment of Figs. 2 and 3 the central portion of the springs rest against portions of the support rotor member **10***a* and the leg portions **20***a* frictionally engage and are slidable along the conducting members **5***a*, wherein in the embodiment of Fig. 1 frictional engagement and sliding took place along the insulating member. In either instance the frictional or sliding engagement quickly absorbs or damps out vibratory or acceleration forces and the conducting bars or members **5***a* are maintained in firm engagement with the terminals **4***a*.

For clarity of illustration the conducting members **5***a* and springs **18***a* of Figs. 1 and 2 are shown disposed at a considerable angle to the contacting faces of their respective terminals. It will be understood that any suitable angles may be utilized; for example, a conducting member **5***a* may be positioned so as to engage the faces of a pair of terminals substantially simultaneously, with the spring exerting substantially equal pressure at each of its spaced legs **20***a*.

Only a single "unit" is shown on the shaft **25**, but any suitable number of them may be mounted along the shaft for actuation in response to operation of a rotary solenoid or other mechanism (not shown).

In some instances it may be desired to utilize the invention in switch mechanisms that are adapted to establish or interrupt circuits by rotary movement and sliding engagement of a conducting bar. Fig. 4 discloses a mechanism of this type. As there shown, a support member **10***b* carries a conducting member **5***b* for selectively establishing contact between a central terminal **38** and either one of outer terminals **39** or **40** carried by a support member **41**. When the support member **10***b* is moved to the right, contact is established between central terminal **38** and outer terminal **40** through the contact bar **5***b*.

The conducting member **5***b* is carried by guide pins **7***b* and is urged firmly into contact with ends of the terminals by a spring **18***b*. The action of the spring **18***a* when the device is subjected to vibratory shocks, jars or accelerations is similar to that hereinabove described in connection with Figs. 1 through 3.

The support members **10***b* and **41** may be in the form of discs with one of them rotatable step by step in response to operation of a rotary solenoid (not shown).

It will be seen that the present invention provides new and improved circuit controlling or switch means adapted to maintain contacts in firmly closed position, even under conditions of extreme vibration, shock or acceleration, and to quickly absorb or dampen kinetic energy forces incident thereto. The device is of relatively simple, lightweight, inexpensive and rugged construction requiring a minimum amount of maintenance or upkeep.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

A support member comprising a base portion and support arms extending from said base in spaced apart relation to provide a guide channel, the ends of said support arms being turned towards each other to substantially close off the guide channel, a conducting bridging member slidably mounted between said support arms and extending transverse on either side of said guide channel, yieldable means intermediate the rear face of the conducting bridging member and the face of the support base normally urging them apart, the yieldable means having a central portion bearing against the support base and a plu-

rality of generally radially spaced portions each projecting toward and frictionally engaging and slidable along an adjacent surface of the bridging member, support means carrying a plurality of spaced electrical terminals, said support means and support member being relatively movable to selectively place the bridging member in and out of abutting engagement with said terminals.

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