Oct. 27, 1959 D. W. LAVIANA 2,910,551

SWITCH ASSEMBLY

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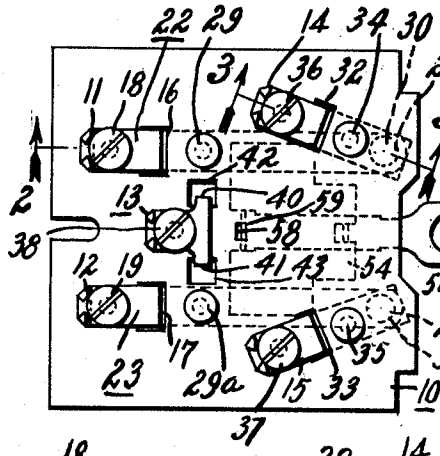


Fig. 1

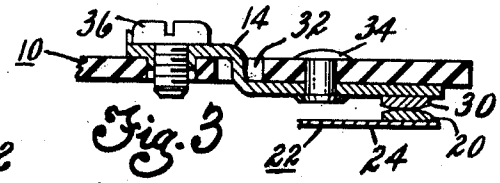


Fig. 3

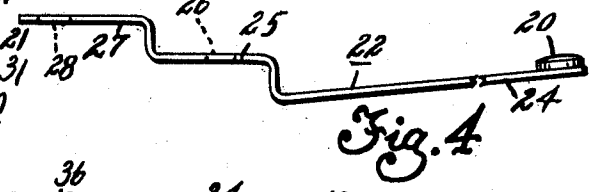


Fig. 4

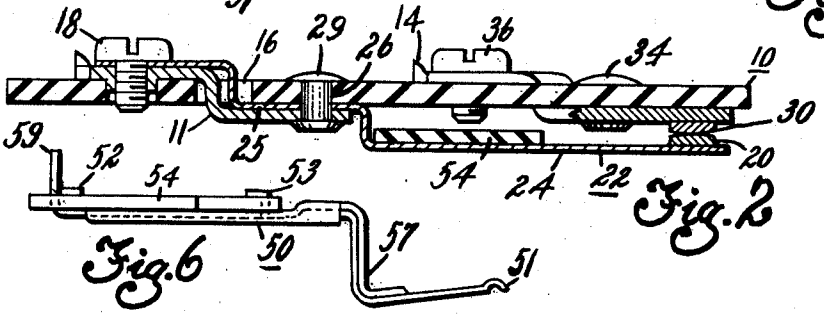


Fig. 2

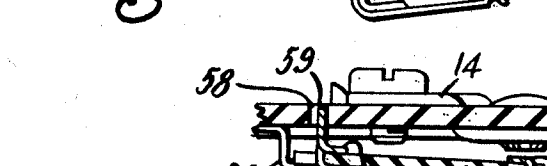


Fig. 6

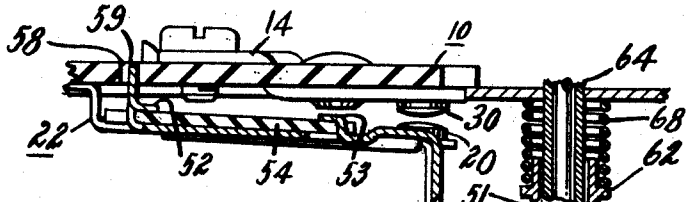


Fig. 7

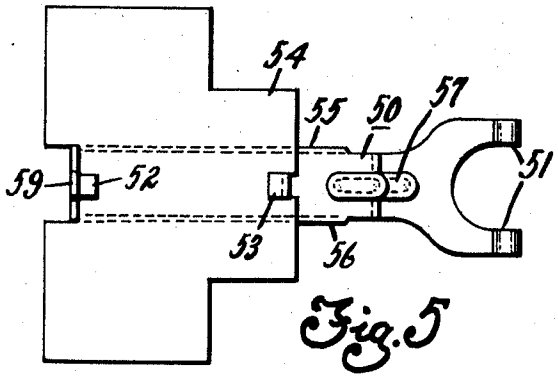
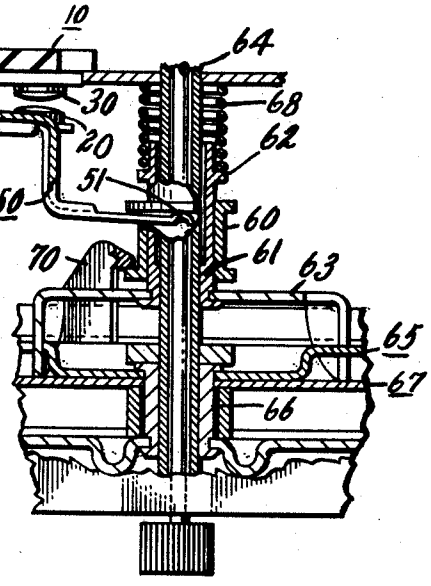


Fig. 5



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SWITCH ASSEMBLY

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4 Claims. (Cl. 200—1)

This invention pertains to switches, and particularly to an improved switch assembly for timers.

Timer switches are usually designed to carry high current, and thus it is essential to have low resistance electrical connections between the current carrying members. Heretofore, it has been common to rivet current carrying members in a switch assembly in contact with each other and to a switch mounting plate composed of insulating material. However, it has been noted that since the current conducting members become heated, expansion and contraction of the riveted members gradually loosens the connections thereby creating a high resistance electrical connection. Moreover, some timer switches are designed for operation in conjunction with latch means so that at a preset time, the switch can be automatically closed by releasing the latch means. In this type of switch operation, it is desirable to minimize contact bounce which causes arcing between the contacts and materially reduces switch life. The present invention relates to an improved switch assembly designed particularly for timers having low resistance electrical connections, and means for minimizing contact bounce upon releasing of the latch means. Accordingly, among my objects are the provision of a switch assembly including a continuous current conducting member of low electrical resistance; the further provision of a switch assembly wherein the movable current conducting switch member is maintained in pressure engagement with terminal means; the further provision of a switch assembly including a plurality of spring contacts and actuating means therefor which minimize contact bounce during switch closure by absorbing the stored spring energy; and the still further provision of a timer switch including leaf spring carried movable contacts of low mass and an actuator of relatively high mass operatively associated therewith.

The aforementioned and other objects are accomplished in the present invention by incorporating continuous leaf spring contact assemblies which are directly electrically connected to terminal means, and an actuator having a lost motion connection with the leaf spring contact assemblies. Specifically, the switch assembly of this invention includes a mounting plate of insulating material having a plurality of apertures therein. A pair of stationary contact assemblies are riveted to the mounting plate, the stationary contact assemblies being composed of good electrically conducting material, such as brass, and having portions disposed on opposite sides of the mounting plate. Thus, the stationary contact assemblies are of stepped configuration and include an intermediate portion which extends through an aperture in the mounting plate. The movable contact assemblies are carried by brass leaf springs of stepped configuration. The leaf springs have opposite ends disposed on opposite sides of the mounting plate, and an intermediate portion extending through an aperture in the plate. Each leaf spring assembly is

riveted to the base and to a terminal lug composed of steel. In addition, the leaf spring is secured to the terminal lug by a screw and also is adapted to be electrically connected to a terminal wire. Accordingly, the current conducting path to the movable switch contacts from the terminal wire is continuous thereby assuring a low resistance electrical connection for the life of the switch assembly.

The switch assembly of this invention is designed particularly for use with a range timer of the type disclosed in copending application Serial No. 647,377, filed March 20, 1957, in the name of Barton et al. and assigned to the assignee of this invention. Thus, the switch assembly includes an actuator which is controlled by a latch means. The actuator comprises an arm pivotally attached to the vertically arranged mounting plate. The actuator arm carries a bar of insulating material having a substantial mass as compared to the mass of the leaf spring contact assemblies.

The insulating bar has a lost motion connection with the leaf spring contact assemblies and upon movement of the arm in one direction, the leaf spring contact assemblies will be moved away from the mounting plate so as to open the switch contacts. When the leaf spring contact assemblies are moved away from the mounting plate, energy is stored in the leaf springs. The actuator arm is formed with a yoke, or bifurcated end, adapted to engage a spool which is controlled by clock driven mechanism as disclosed in the aforementioned copending application. When the spool is biased away from the switch assembly, the actuator arm is carried thereby and opens the switch contacts. The spool can be retained in the switch opening position by a latch. When the latch is released, the inherently resilient leaf spring contacts move toward a contact closed position due to the stored energy therein, thereby moving the actuator arm towards the mounting plate. By reason of the actuator bar having a lost motion connection with the leaf spring contacts, and being of substantial mass, upon releasing of the latch, the leaf spring contacts move into engagement with the stationary contacts and the actuator operates as an inertia weight to absorb the energy stored in the leaf springs thereby preventing contact bounce.

Further objects and advantages will be apparent from the following description, reference being had to the accompanying drawings wherein the preferred embodiment is shown.

In the drawings:

Figure 1 is a plan view of a switch constructed according to this invention.

Figure 2 is a sectional view taken along line **2—2** of Figure 1.

Figure 3 is a sectional view taken along line **3—3** of Figure 1.

Figure 4 is a view in elevation of one of the leaf spring contact assemblies.

Figure 5 is a plan view of the actuator arm assembly.

Figure 6 is a side view of the actuator arm assembly.

Figure 7 is a fragmentary view, partly in section and partly in elevation, illustrating the manner in which the switch assembly is operated in a timer assembly.

With particular reference to Figure 1, a switch assembly is shown including a mounting plate **10** of insulating material having a plurality of terminal lugs **11** through **15** attached thereto. The terminal lugs **11**, **12** and **13** can be made of steel since they are not current conducting members. However, the terminal lugs **14** and **15** must be composed of a copper bearing alloy since they are current conducting members. The construction of terminals **11** and **12** is identical and hence only one will be described in detail. As seen in Figure 2, the ter-

minal lug 11 is of stepped configuration and includes an intermediate portion which extends through an aperture 16 in the mounting plate 10. One end of the terminal lug 11 is disposed on one side of the mounting plate and the other end of the terminal lug is disposed on the other side of the mounting plate. The terminal lug 12 likewise includes a portion which extends through an aperture 17 in the mounting plate 10, so as to have its opposite ends disposed on opposite sides of the mounting plate. The terminal lugs 11 and 12 have terminal screws 18 and 19 threaded therein.

The switch assembly includes a pair of movable contacts 20 and 21 which are carried by leaf spring assemblies 22 and 23 respectively. As seen in Figure 4, the leaf spring contact assemblies, which are composed of a copper bearing alloy, such as brass, are of stepped configuration. The leaf spring contact assemblies are inherently resilient, and the contacts 20 and 21 are carried by portions 24 thereof which are biased towards the mounting plate 10. The leaf spring contact assemblies include an intermediate portion 25 having an aperture 26 therein and an end portion 27 having an aperture 28 therein. Portion 25 of each leaf spring assembly 22 and 23 is riveted to the terminal lugs 11 and 12, respectively, and the insulating plate 10 by means of rivets 29 and 29*a*. The end portions 24 of the leaf springs 22 and 23 are biased to a position where the movable contacts 20 and 21 carried thereby engage a pair of stationary contacts 30 and 31 carried by terminal lugs 14 and 15. The terminal lugs 14 and 15 are composed of a copper bearing alloy and as shown in Figure 3, the lugs 14 and 15 are of stepped configuration with an intermediate portion extending through apertures 32 and 33 in the mounting plate. The terminal lugs 14 and 15 are secured to the mounting plate 10 by rivets 34 and 35. In addition, the terminal lugs 14 and 15 have terminal screws 36 and 37, respectively, threaded therein.

Heretofore, the leaf springs which carry the movable contacts have been electrically connected to a terminal lug by means of a rivet, the terminal lug in turn being connected to a terminal screw. In prior switches the riveted connection between the leaf springs and the terminal lugs extended through the insulating mounting plate. Since the mounting plate is usually composed of a hygroscopic material, during use of the switch the mounting plate dries out due to heat and shrinks so that the rivets tend to loosen. This produces an objectional high resistance electrical connection between the leaf springs and the terminal lugs which is obviated by this invention.

Thus, as seen in Figure 2 the leaf spring constitutes a continuous current conducting member from the terminal screw 18 to the movable contact 20. In this manner, the terminal lug 11 can be made of steel since it does not constitute a current carrying member. The only function of the rivets 29 and 29*a* is to maintain the leaf springs 22 and 23 in position on the mounting plate since the rivets 29 and 29*a* do not form electrical connections between the leaf springs and the terminal lugs 11 and 12. The portion 27 of each leaf spring having the aperture 28 is superimposed upon the terminal lug 11, or 12, so that upon a wire or other terminal connection being interposed between the head of the screws 18 or 19 and the portions 27 of the leaf springs, the leaf springs will be electrically connected to the terminal members and thus constitutes a continuous current conducting member from the terminal screw to the movable contacts.

The terminal lug 13 has a pair of tangs 40 and 41 which extend through apertures 42 and 43 in the mounting plate 10 and are bent thereover to securely retain the terminal in position. The terminal 13 may conveniently constitute a ground terminal for the timer to which the switch of this invention can be assembled. Thus, the terminal 13 carries a terminal screw 38.

With particual reference to Figures 5 and 6, the actuator assembly for controlling the operation of the switch will next be described. The actuator assembly includes an arm 50 of stepped configuration having a bifurcated end as indicated by 51 which constitutes a yoke. The arm 50 has a pair of upstruct tangs 52 and 53 which are bent over an arm 54 of insulating material. The arm 50 is also formed with flanged edges 55 and 56 for strengthening the arm and is formed with a corrugated section 57 to strengthen the joint between the curved portions thereof. The tang 52 is projected from upstruct end 59 of the actuator arm which extends through aperture 58 in the mounting plate and constitutes a loose pivotal connection for the actuator arm in the mounting plate 10. The arms of the bar 54 rest upon portions 24 of the leaf springs 22 and 23. It is pointed out that the mass of the actuator assembly is considerably greater than the mass of the leaf springs 22 and 23, and the actuator assembly has a lost motion connection with the leaf springs 22 and 23. Thus, as seen in Figure 2, the actuator assembly is interposed between the leaf springs and the mounting plate, and only imparts movement to the leaf springs when it is moved in a clockwise direction about its pivotal connection with the mounting plate.

In a range timer assembly, the switch assembly is mounted with the plate 10 vertical. The yoke end 51 of the actuator assembly is arranged to engage a spool 60 of a range timer of the type disclosed in the aforementioned application, as shown in Figure 7. The spool 60 is slidably mounted on a sleeve 61 and movable between predetermined limits as determined by a shoulder 62 on the sleeve 61 and a reciprocable bridge 63 attached to the other end of the sleeve 61. The sleeve 61 is reciprocably mounted on a hollow shaft 64. The spool 60 is engageable by a latch arm 70 so as to prevent movement of the actuator assembly towards the switch under the urge of the leaf springs during certain conditions. The latch arm is pivotally mounted on a pulley assembly 65, the pulley assembly 65 being journalled on a hub 66 on which a second pulley assembly 67 is also journalled. When the latch 70 is released with the spool in the position shown, the leaf springs 22 and 23 move the actuator assembly towards the mounting plate with a snap action to close the switch. At this time since the actuator assembly has a lost motion connection with the leaf springs and is of greater mass, the actuator assembly acts as a vibration dampener or inertia weight, to prevent contact vibration, or bounce, due to the stored energy in leaf springs 22 and 23. Thus, when the latch is released, the actuator assembly is free to vibrate between the mounting plate and the leaf springs and engages the mounting plate so as to prevent separation of the contacts while the stored energy in the leaf springs is being dissipated. This constitutes an important feature in switches designed for carrying large currents since vibration of the contacts would result in arcing and reduced life of the switch assembly. The sleeve 61 is biased towards the pulley assemblies by a spring 68, so that when the bridge 63 is aligned with the apertures, not shown, in the pulley 67, the spring 68 will move the sleeve 61 and spool 60 downwardly as viewed in Figure 7 to open the switch.

From the foregoing it is apparent that the present invention provides a switch assembly designed particularly for carrying heavy currents wherein a continuous current conducting path is provided between the terminal means and the movable contacts of the switch assembly. In addition, the switch assembly is designed so that the contacts will remain closed and vibration due to stored energy in the leaf springs will be absorbed by the actuator assembly since the actuator assembly has a lost motion connection with the leaf springs.

While the embodiment of the present invention as dis-

closed herein constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a switch, a mounting plate of insulating material, a plurality of stationary contacts attached to said mounting plate, a plurality of movable contacts, a plurality of leaf springs secured to said mounting plate and carrying said movable contacts, said leaf springs being biased to a position of engagement between the movable and stationary contacts, an actuator assembly having one end loosely pivotally supported on said mounting plate and having a lost motion connection with said leaf springs for moving said leaf springs to a contact disengaged position, said actuator assembly having a mass substantially greater than the mass of said leaf springs, and latch means operatively engageable and disengageable with the other end of said actuator assembly whereby upon release of said actuator assembly from said latch means the movable contacts will firmly engage said stationary contacts and will not be disengaged therefrom by vibration of said actuator assembly.

2. In a switch, a mounting plate of insulating material, a plurality of stationary contacts attached to said mounting plate, a plurality of movable contacts, a plurality of leaf springs secured to said mounting plate and carrying said movable contacts, said leaf springs being biased to a position of engagement between the movable and stationary contacts, an actuator assembly pivotally supported on said mounting plate comprising an actuater arm and an insulating bar engageable with said leaf springs, the pivotal support for the actuator assembly comprising an upstruct tang adjacent one end of said actuator arm which extends into and is loosely received by an opening in said mounting plate, and latch means operatively engageable and disengageable with the other end of said actuator arm, the mass of said actuator assembly being substantially greater than the mass of said leaf springs, said bar having a lost motion connection with said leaf springs whereby upon release of actuator assembly from said latch means the movable contacts will engage the stationary contacts without vibration.

3. In a switch assembly, a mounting plate of insulating material, a pair of stationary contacts attached to said mounting plate in spaced relation, a pair of movable contacts engageable with said stationary contacts, a pair of leaf springs secured to said mounting plate in spaced

apart relation and carrying said movable contacts, said leaf springs being of stepped configuration and being biased so as to engage the movable and stationary contacts, an actuator assembly having one end loosely pivotally supported on said mounting plate and disposed between said mounting plate and said leaf springs, and latch means operatively engageable and disengageable with the other end of said actuator assembly, said actuator assembly having a mass substantially greater than the leaf springs, whereby upon release of said actuator assembly from said latch means said leaf springs will move to a position wherein said movable contacts engage said stationary contacts and said actuator assembly will absorb vibrations without separating said contacts.

4. In a timer switch, a vertical mounting plate of insulating material, a pair of stationary contacts attached to said mounting plate at spaced apart points, a pair of movable contacts engageable with said stationary contacts, a pair of leaf springs secured to said mounting plate in spaced relationship and carrying said movable contacts, said leaf springs including portions spaced from said mounting plate and being biased to a position wherein said movable contacts engage said stationary contacts, an actuator assembly loosely pivotally supported on said mounting plate including an arm and an actuating bar disposed between said mounting plate and said leaf springs, said actuator assembly having a mass substantially greater than the mass of said leaf springs and having a one way lost motion connection with said leaf springs whereby upon release of said actuator assembly said actuator assembly will absorb the vibration without separating said contacts, and latch means operatively engageable and disengageable with said actuator arm for controlling the engagement of the switch contacts.

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