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2,755,346

SENSITIVE RELAY

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2 Sheets-Sheet 1

Fig. 1

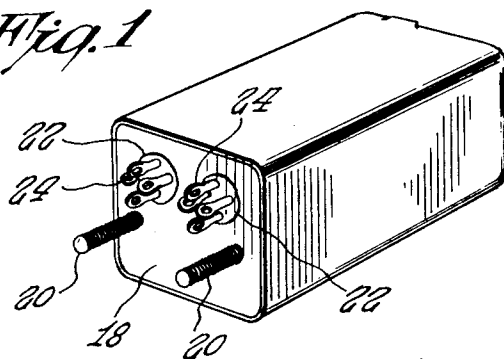


Fig. 2

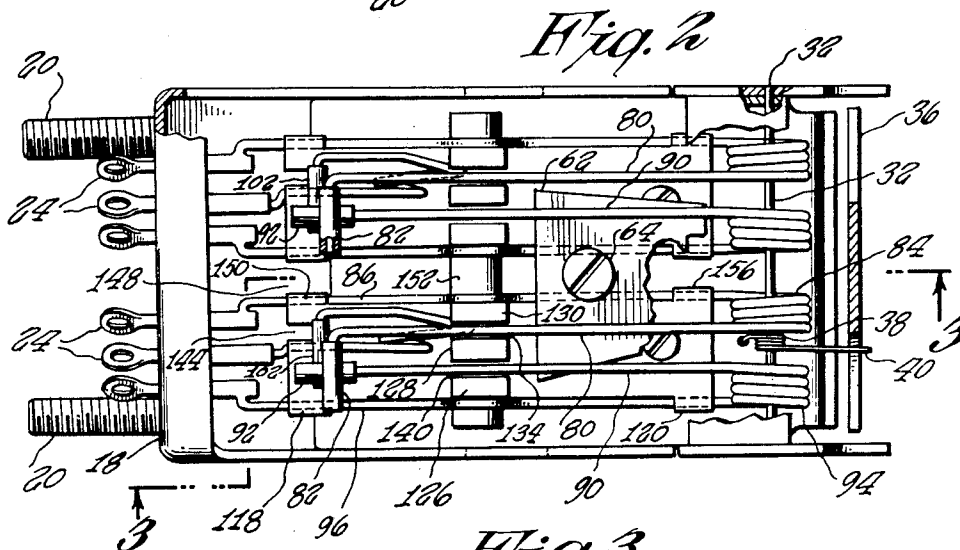
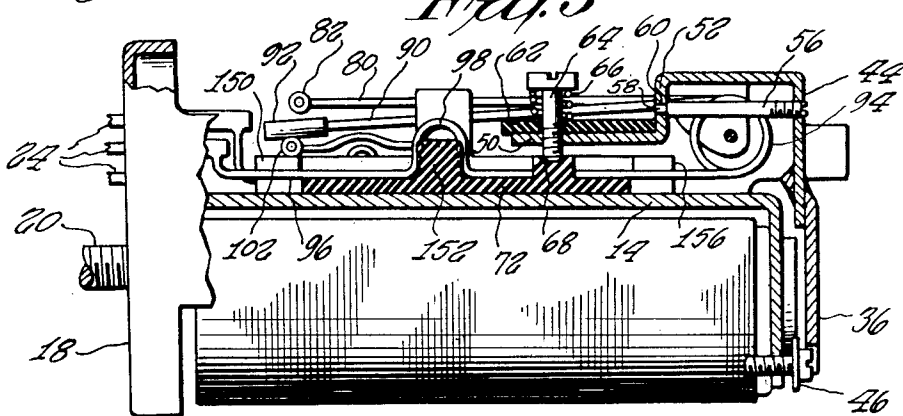


Fig. 3



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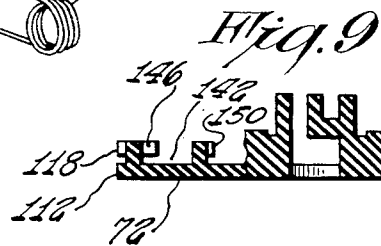
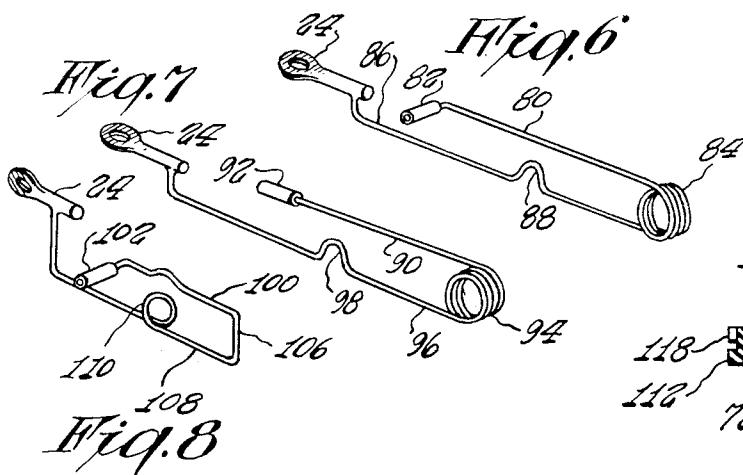
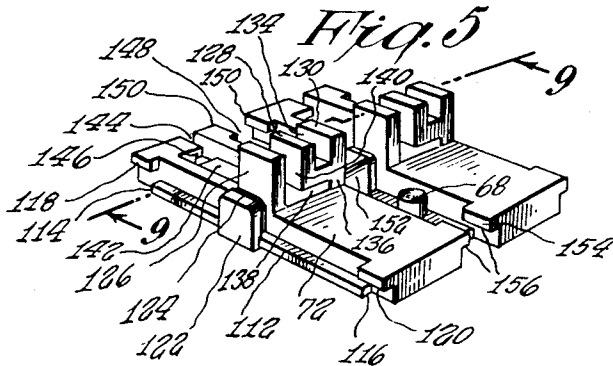
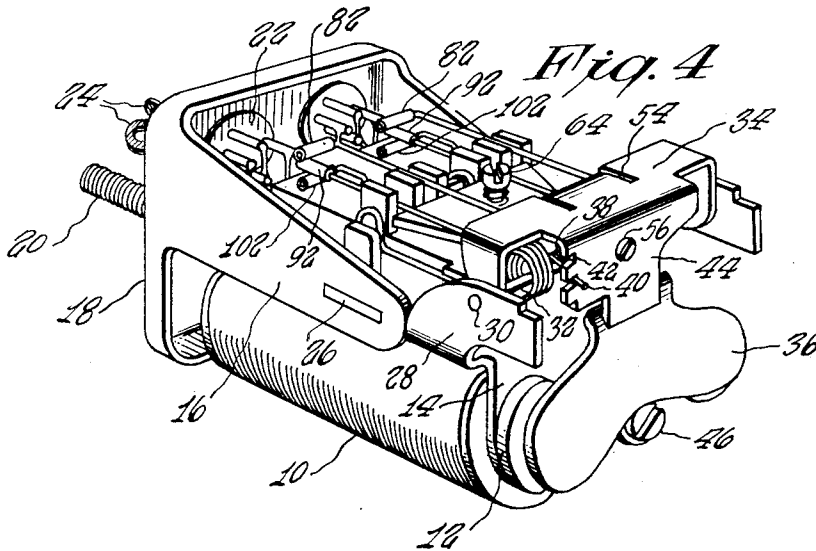
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2,755,346

SENSITIVE RELAY

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Application September 19, 1950, Serial No. 185,582

6 Claims. (Cl. 200—1)

This invention relates to relays, and particularly to relays and switch elements therefor, capable of being built in very small sizes for light currents.

An important feature of the present invention comprises a switch or relay construction of the character described in which the contact elements comprise properly bent or formed pieces of spring wire which are assembled with a preformed base of insulating material, preferably molded plastic, which enables the contact elements to be assembled in position without the use of auxiliary fastening means but solely by interlocking engagement between the contact elements and the plastic base. The construction is such that the contact elements retain themselves in position by their own resiliency. The plastic base is also formed with portions to guide the movable parts of the elements in their movements and to limit such movements within the desired range to insure satisfactory operation. Basic adjustments of the parts are largely built in during formation and assembly so that extensive readjustment is not required after assembly.

Another object of the invention is the provision of simple adjusting means whereby any required adjustments of the relay motor means, and of the linkage between the motor means and the switch element may be accomplished. In particular a coupling adjustment means is provided by which the angular relationship between the armature and the contact moving "lifter" may be adjusted after the relay is assembled.

Other and further objects of the invention will appear in the course of the following description of one preferred embodiment thereof, chosen to illustrate the principles of the invention.

In the accompanying drawings:

Figure 1 is a perspective view showing a relay enclosed in a case or shell.

Figure 2 is a plan view on an enlarged scale showing the mechanism of the relay removed from the case;

Figure 3 is a longitudinal vertical section on line 3—3 of Figure 2;

Figure 4 is a perspective view of the relay removed from the case;

Figure 5 is a perspective view of the plastic insulating base for holding the contact members;

Figures 6, 7 and 8 are perspective views showing the three spring contact members; and

Figure 9 is a transverse section of the base on line 9—9 of Fig. 5.

Referring to the drawings in detail, the relay illustrated comprises a pair of coils 10 mounted on cores having pole pieces 12 mounted in a frame of non-ferrous metal 14. The manner of mounting the coils in the frame is preferably in accordance with the invention of patent No. 2,425,090, although the particular form of the coils and manner of mounting the same is not a feature of the present invention. The frame 14 carrying the coils is shown as mounted between the arms 16 of an end plate 18 which carries mounting screws 20 for

supporting the relay and insulating blocks 22 carrying the groups of terminals 24. The frame 14 is shown as provided with lugs 26 fitting in slots in the arms 16. The frame 14 is also shown as provided with ears 28 having perforations 30 for receiving the ends of a pivot shaft 32 on which the bell-crank-shaped armature carrier or beam 34 is mounted. The armature carrier carries the armature 36 which extends across the pole pieces 12, the armature being biased away from the pole pieces by the action of the spring 38 coiled around the shaft 32, and having an end 40 engaging in one or another of the group of notches 42 formed in the side of the downwardly projecting arm 44 of the armature carrier. By engaging the end of spring 40 with one or another of the notches 42 the tension of the spring may be varied so as to vary the biasing force applied to the armature carrier.

The width of the air gap between the armatures and pole pieces may be adjusted by means of a residual stop 46 in the form of a screw screwing into a lug on the frame 14 and having a flanged head adapted to be engaged by the edge of the armature. This provides what may be termed a "drop-out" adjustment for the relay. The armature carrier or beam 34 has an operating arm 50 projecting forwardly therefrom. This arm 50 is carried at the bottom of a step portion 52 which is bent down from the top of the armature carrier, it being partly separated from such top by slots 54. It is thus rendered somewhat bendable with respect to the rest of the armature carrier or beam. An adjusting screw 56 is provided which screws through a hole in the downwardly turned arm 44 of the beam, the other end of the screw being pointed as indicated at 58 and engaging in a hole 60 in the step portion 52 of the beam. By adjusting this screw 56 it will be seen that the step portion may be spread more or less from the armature carrying arm of the beam, thereby varying the angle between the armature and the operating arm 50. The arm 50 carries a contact engaging member or "lifter" 62 which is shown as a plate of hard insulating material. In the construction shown a back stop adjusting screw 64 is provided which passes through a hole in the lifter and screws through a hole in the arm 50 and which carries a coil spring 66. This spring presses on the lifter 62 and thus holds the same in position, and it also places a tension on the adjusting screw so that the latter will be frictionally held in adjusted position. The lower end of the adjusting screw 64 engages a stop seat 68 formed on an insulating plate or base 72 mounted on the frame 14.

The switch portion of the relay shown embodies features of construction which are believed to be novel and are of such nature as to assure satisfactory operation, ease and correctness of assembly, and simplicity of adjustment. In the embodiment of the invention shown a contact supporting base 72 of insulating material is mounted on the frame 14. This base is so formed as to support and hold the contact springs, all of which are shown as in the form of bent spring wire members. Preferably the base is formed of molded thermosetting plastic, and is provided with all the necessary formations for retaining and guiding the spring contact elements.

In the assembly shown the switch mechanism comprises duplicate sets of three contacts each. Figs. 6, 7 and 8 show the three contact members. Fig. 6 shows the upper contact carrying spring having a spring arm 80 the end of which is bent at right angles and carries the upper contact sleeve 82 of silver or other suitable contact metal. The arm 80 is connected through the coil spring portion 84 with the stationary leg 86 having at an intermediate point a hump 88. The movable contact member of the switch (Fig. 7) comprises a movable arm 90 the end of which is

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straight instead of being bent at any angle and carries a contact sleeve 92. The arm 90 is connected through the coil spring portion 94 with the fixed leg 96 in which is formed a hump 98. The lower contact member (Fig. 8) requires no spring action except for resilience to hold it-
 5 self within the space 144 of the insulating base member 72. This lower member comprises a contact carrying arm 100, the end of which is bent at right angles and carries a sleeve 102. The end of the arm is bent into a square shaped formation 106 which connects with the
 10 fixed leg 108, the latter having a loop 110 therein, which together allow the spring to be snapped firmly into position.

The base insulator 72 is shown as having duplicate sets of formations thereon, holding duplicate sets of contact
 15 springs. Beginning at the left hand side of the base, as shown in Fig. 5, it will be seen that the base has a flange 112 extending along the lower edge thereof, but terminating at each end short of the corresponding end of the base, as indicated at the points 114 and 116. Projecting
 20 laterally from the upper surface of the base at each end are short flanges 118 and 120. Near the center of the base is a lug 122 which is formed with what may be termed a saddle 124. Behind the saddle the base has an
 25 upwardly projecting lug 126 and a second bifurcated or Y-shaped lug comprising lug portions 128 and 130 which are separated by a groove 134. This Y-shaped lug, which is joined to the base by a leg 136 overhangs a space or undercut pocket 138. The inner face of the lug 126 and
 30 the adjacent face of the lug portion 128 provide between them a vertical guide channel 140. In a part of the base back of the lugs 126, 128 and 130 (Fig. 5) is a recess 142 which communicates with the undercut pocket 138 be-
 35 neath the lug portion 128. At the back of the recess 142 is a slot 144 extending completely through the base and at one side of this slot is an overhanging flange 146. Beyond the slot 144 is a center slot 148 at each side of which is an
 40 overhanging flange 150. At the right hand side of lug portion 136 in line transversely with the saddle 124 there is a saddle member 152. At the front end of the base is a center slot 154 at each side of which is an overhanging
 45 flange 156. A duplicate set of formations is shown at the right of the slots 148 and 154.

Considering now a single set of contact springs as shown in Figs. 6, 7 and 8, the lower contact element
 50 shown in Fig. 8 is first applied to the base by having its bent end 106 inserted through the recess 142 into the pocket 138. The rear end of the leg portion 108 will project through the slot 144 under the flange 146 and the coil portion 110 will seat in the back of the recess so as to retain the contact member in the recess. The contact sleeve 102 will rest on the upper surface of the block at one side of the slot 144.

The movable contact member shown in Fig. 7 is next applied. This member is fitted in position by engaging
 55 the hump 98 over the saddle 124 and pressing it down until the fixed leg 96 rests on the flange 112. The end portions of the fixed leg are engaged under the flanges 118, 120 so that the contact spring is held firmly in position. The upper arm 90 passes through the slot 140 which guides the arm while permitting vertical movement there-
 60 of. The contact sleeve 92 bears against the sleeve 102 of the lower contact member and the proper contact pressure may be secured by correct initial formation of the spring.

The upper contact spring is now applied by pressing the hump 88 over the saddle portion 152 and forcing it down
 65 until the fixed leg 86 of the spring rests on the bottoms of the depressions in the base and is engaged by the lugs 150 and 156 which hold the spring in position. The upper arm 80 of the spring passes through and is guided by the slot 134. The arm also rests upon the bottom of the slot which supports the arm in a position where the contact sleeve 82 is normally out of contact with the sleeve 92 on the movable arm. The ends of the three spring contact
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members are connected to the proper terminals 24. It will be understood that when duplicate switches are provided, as in the construction shown, the second set of three spring contact members will be engaged with the
 5 identical formations at the right hand side of the base.

The arms 90 of the movable contact members pass over and are normally engaged by the insulating lifter member 62 above described. In the construction shown it will be seen that when the coils 10 are energized and the armature 36 attracted to the pole pieces, the movement of the beam or armature carrier will raise the lifter 62 and
 10 move the arms 90 upward so as to move the contact sleeves 92 out of engagement with the contacts 102 and into engagement with the contacts 82. Upon de-energization of the coils, contacts will move back owing to their
 15 resiliency into engagement with contacts 102.

The formation of the contact members, particularly the upper and movable contact members, of spring wire having resilient coil portions and relatively long resilient contact carrying arms, provides a very satisfactory construction in which it is easy to secure adequate pressure between the contacts without danger of jamming or bending the contact members due to faulty adjustment resulting in
 20 excessive pressure between the contacts. It will be seen that the upper fixed contact arm 80 can readily yield to any sufficient extent required upon engagement with the contact 82 of the movable contact 92. The requisite characteristics to assure proper contact engagement can be readily built into the parts at the time of formation so that no special bending or adjustment of contact members is required. The long spring arms carrying the contacts are also guided in their movement by the walls of the slots in the insulating block. Furthermore, the lowermost position of the arm 80 is determined by its engagement with the bottom of the groove 134 so that the normal position of the upper contact is fixed. At the same time the necessary initial spring resistance can be secured by setting the arm 80 to the proper angle so that when the contact member is applied to the base and the arm 80 engages the bot-
 25 tom of the slot, the spring will be correctly tensioned.

It will be observed that the three contact spring members are all secured in position by being merely fitted into engagement with the formations molded in the insulating base or block. No auxiliary fastening means are required and no soldering, except to connect the ends of the springs to the terminals. The cost of assembling is thus reduced to a minimum.

While the major adjustments between the contact members are built into the assembly by the design of the spring contact members and the formation of the base which can be precision molded to very accurate dimensions, means are also provided for adjusting the relay so as to secure exact "pull-on" and "drop-out" adjustments, and also to provide a coupling adjustment by which the point of engagement of the lifter with the movable contact arms can be varied. As already indicated the drop-out adjustment is determined by adjustment of the residual stop 46, the pull-on adjustment is determined by adjustment of the de-energizing or back-stop screw 64, while the coupling adjustment is accomplished by varying the angular position of the arm 50 and lifter with relation to the armature, as determined by the ad-
 30 justment of the screw 56.

It will be understood that the switch construction described is applicable to other structures than the particular relay construction illustrated. The switch construction may also be assembled in single or multiple units as conditions of use may require.

While certain preferred embodiments of the invention have been illustrated and described in detail, it is to be understood that changes may be made therein and the invention embodied in other structures. It is not, therefore, the intention to limit the patent to the specific constructions illustrated, but to cover the invention broadly in whatever form its principle may be utilized.
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I claim:

1. In a switch construction for sensitive relays and the like, a one piece base of insulating material and spring wire contact members mounted thereon, said spring wire members each comprising a fixed leg and a spring contact carrying arm reversely bent into substantially parallel relationship with and overlying said fixed leg, said base having integral engaging and interlocking with the fixed legs of said spring wire contact members, said interlocking engagement constituting the sole means for securing said contact members to said base, said base having guide formations thereon for engaging and guiding said contact carrying arms.

2. In a switch construction for sensitive relays and the like, a base of molded rigid plastic having spaced flanges, saddle portions and grooved lugs thereon, spring contact members having fixed leg portions engaged by said flanges on the base, said fixed legs having humps engaging said saddle portions, said spring contact members having spring contact carrying arms bent back over the base and spaced above the same and engaging in and guided by the grooves in the grooved lugs on the base.

3. In a switch construction for sensitive relays and the like, a base of insulating material having lugs thereon providing a guide groove between them, a spring wire contact element having a fixed leg mounted on said base, and being reversely bent to form an elongated, spring supported freely movable contact carrying arm having a contact on the free end thereof, said flexible arm portion being freely movable in its plane of movement in said slot, the walls of said slot guiding said arm against substantial deviation from said plane of movement.

4. In a switch construction for sensitive relays and the like, a base of insulating material having contact holding formations thereon, a lower contact element carried by said base, an upper contact element carried by said base and a movable contact element carried by said base, said upper and movable contact elements each being formed of spring wire and comprising a fixed leg portion interlocked with the holding formations on said base, the leg portion and base formations engaging each other to interlockingly hold the leg portion against longitudinal and rotative movement, a coil spring portion carried by said fixed leg portion and a resilient elongated arm portion carried by said coil portion, the elongated arm portions of each of said contact elements having a contact at the end thereof, the contact on the movable contact element being movable into and out of engagement with the contacts on the lower and upper contact elements, said insulating base having portions forming guide grooves in which the contact carrying arms of the movable and upper contact elements are guided.

5. In a switch construction for sensitive relays, a base of insulating material, and a plurality of flexible spring contact carrying elements mounted thereon, each of said elements including a base leg fixed to the insulating base and a reversely bent long flexible spring wire arm overlying said base leg and having a contact formation on

the free end thereof the contact formations on the respective spring arms being located one above the other, guide means on the insulating base for guiding the movements of the spring arms of said spring contact carrying elements for movement in planes substantially at right angles to the plane of the insulating base, means for limiting the downward movement of the spring arm of one of said contact carrying elements to a position in which the contact formation thereon is normally above and out of contact with the contact formation on the spring arm of the other contact carrying element, but is unrestrained except by its own resilience against movement in a direction away from the contact formation on the spring arm of said other spring contact carrying element, the spring arm of said other contact carrying element being movable in a direction to bring the contact formation thereon into engagement with the contact formation on the arm of the first named contact carrying element.

6. In a switch construction for sensitive relays and the like, a base of insulating material having a longitudinal seat thereon and having an overhanging flange at each end of said seat, and a spring wire contact carrying element comprising a leg and an arm bent into substantial parallelism, said leg constituting a fixed supporting leg and being received on the longitudinal seat on said base and held under tension thereon by said overhanging flanges, said arm being spaced above the base and being freely movable in a plane at right angles to the plane of the base, and having a contact formation on the free end thereof, and means on the base forming a guide groove for guiding said contact carrying arm against substantial deviation from its plane of movement.

References Cited in the file of this patent

UNITED STATES PATENTS

1,082,310	Erickson	Dec. 23, 1913
1,167,067	Hill	Jan. 4, 1916
1,318,178	Reed	Oct. 7, 1919
1,503,980	Carichoff	Aug. 5, 1924
1,521,591	Beck	Jan. 6, 1925
1,528,761	Goff	Mar. 10, 1925
1,553,314	Goff	Sept. 15, 1925
2,061,920	Piffath	Nov. 24, 1936
2,235,861	Wood	Feb. 19, 1946
2,261,809	Nesius	Nov. 4, 1941
2,277,443	Livingston	Mar. 24, 1942
2,360,922	Wilckens	Oct. 24, 1944
2,395,300	Slauson	Feb. 19, 1946
2,400,452	Wood	May 14, 1946
2,410,136	Vincent	Oct. 29, 1946
2,488,669	Knos	Nov. 22, 1949
2,515,769	Graybill	July 18, 1950
2,547,131	Lewus	Apr. 3, 1951

FOREIGN PATENTS

5,596	Great Britain	Apr. 13, 1916
608,960	Great Britain	Sept. 23, 1948