

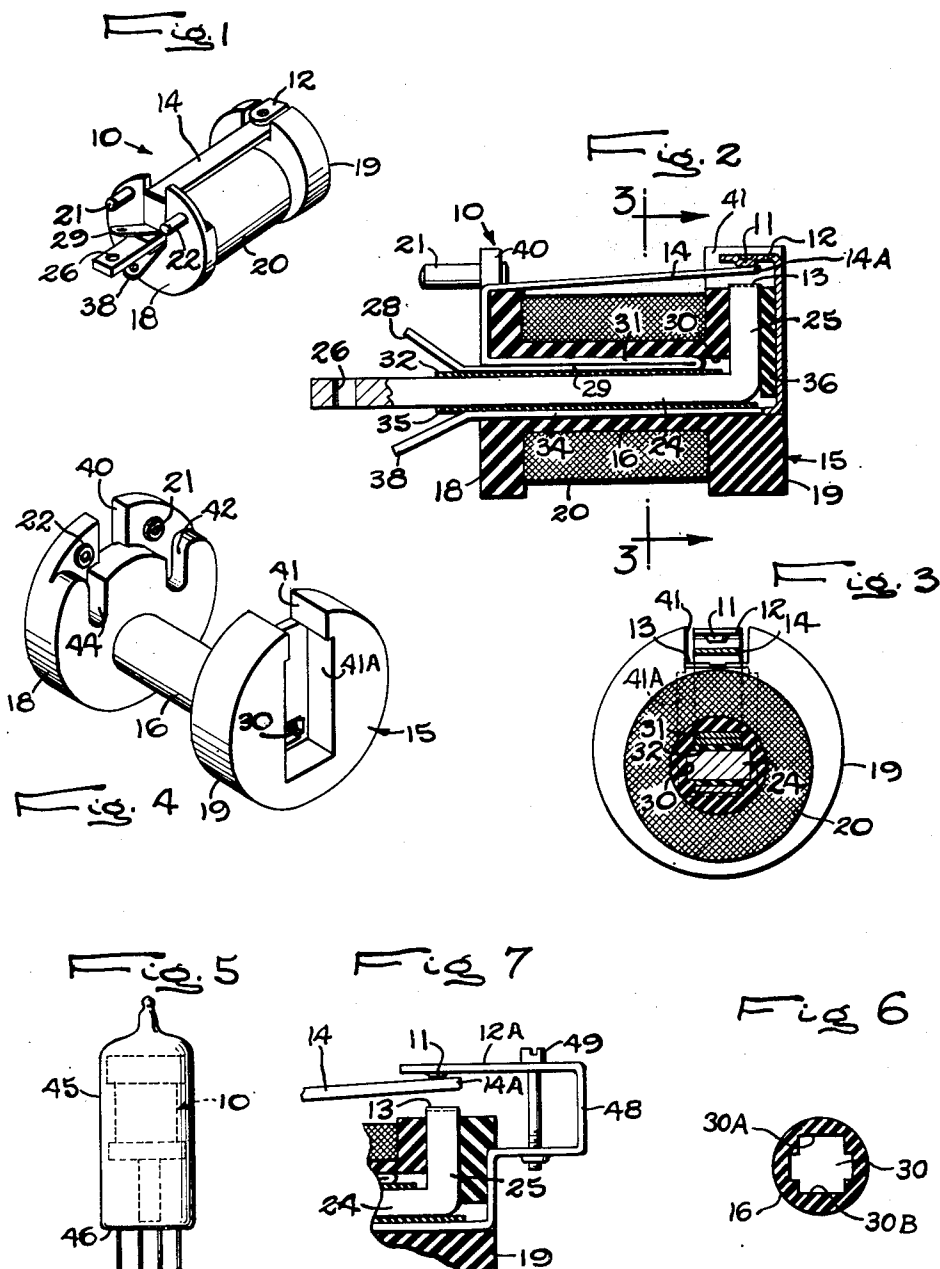
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RELAY

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RELAY

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The present invention pertains generally to electromagnetic relays and more specifically to a novel relay of this type having particular but by no means exclusive utility in applications where small size, light weight and sturdiness are of cardinal importance.

One object of the present invention is to provide a relay of greatly simplified construction wherein certain ones of the parts perform more than one function so as to reduce the total number of parts to an absolute minimum.

Another object is to provide a relay of the foregoing character which will be susceptible of economical manufacture on a mass productive basis yet capable of reliable operation over a relatively long life span.

A further object is to provide a relay of the type set forth which will be sensitive and precise in operation but sufficiently rugged to withstand a considerable amount of rough handling.

Another object is to provide a relay of the foregoing type and having a movable member which will remain substantially free from the adverse effects of vibration and shock.

Still another object is to provide a relay particularly well suited for what are known in the electronics art as plate circuit applications and which will be susceptible of construction in multipole as well as single pole models.

Other objects and advantages will become apparent as the following detailed description proceeds, taken in connection with the accompanying drawings wherein:

Figure 1 is a perspective view of an illustrative relay embodying the present invention.

Fig. 2 is a longitudinal sectional view taken vertically through the relay of Fig. 1 and showing the core piece and armature stop member in broken section.

Fig. 3 is a transverse sectional view through the relay of Fig. 1 and taken in the plane of the line 3—3 in Fig. 2.

Fig. 4 is a perspective view showing details of the bobbin member of the relay.

Fig. 5 is a diagrammatic view illustrating one type of enclosure which can be provided for the relay shown in Fig. 1.

Fig. 6 is a transverse sectional view through the barrel of the bobbin member of Fig. 4 and showing the longitudinal passage therein.

Fig. 7 is an enlarged fragmentary sectional view detailing a modification of the contact arrangement of a relay similar to that shown in Fig. 1.

While the invention is susceptible of various modifications and alternative constructions, cer-

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tain preferred embodiments have been shown in the drawings and will be described below in considerable detail. It should be understood, however, that there is no intention to limit the invention to the specific forms disclosed, but on the contrary, the intention is to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more specifically to the drawing, the invention is there shown embodied in an illustrative relay 10 which happens to be of the single pole, double throw style having what is known in the art as a form C contact arrangement. This simply means that the relay has a pair of fixed contacts arranged in spaced apart relation with a movable contact shiftable therebetween. In the present instance, outer fixed contact 11 is defined by a dimple in an arm 12 which overlies inner fixed contact 13 and serves as a stop member for the armature 14. The latter is of hingeless construction, being inherently resilient and having a free end portion 14A extending between the contacts 11, 13, and serving as the movable contact. All of these contacts are heavily silver plated and the silver thereon is preferably "coined" or worked to give it a fair degree of hardness.

The relay 10 is assembled upon a bobbin 15 of insulating material and which may be of molded or built-up construction. The bobbin 15 is substantially spool shaped, comprising a hollow central portion or barrel 16 which terminates in a pair of flanges or bobbin heads 18, 19. An actuating coil 20 surrounds the barrel 16, the ends of the coil being connected to coil terminals 21, 22, mounted on bobbin head 18.

In order to simplify the construction of the relay 10, the total number of parts is reduced to an absolute minimum by utilizing certain of the current carrying members to define the magnetic circuit. Accordingly, the relay 10 includes a central core piece 24 having a substantially perpendicular arm 25 which terminates at the inner fixed contact 13. The piece 24 is formed of a suitable ferrous metal and has a relatively large cross-sectional area. In addition, the surface of this member is heavily plated with silver or some other highly conductive metal. The end portion of the core piece 24 remote from the contact 13 serves as a combined terminal lug and a mounting extension, being formed with a hole 26 to receive both an electrical and a mechanical connection. The other important element of the magnetic circuit is armature mem-

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ber 14 which, in the present instance, is fashioned from a strip of resilient ferrous metal and is rigidly fixed at its end remote from the contacts 11, 13, 14A. Like the core piece 24, the surface of the armature is heavily plated with highly conductive metal. At its fixed end, the armature 14 is provided with a terminal in the form of a solder lug 28. As shown in the drawing, the spring tension of the armature is such as to hold the contact element 14A normally in abutment with the outer fixed contact 11, the armature swinging toward the core piece 24 upon energization of the actuating coil 20.

Provision is made for assembling the relay 10 with its parts in proper electrical, magnetic and mechanical relation without the use of screws or other conventional fastening devices. This is accomplished by mounting all the mechanical and current carrying elements, except the actuating coil 20, within the hollow barrel 16 of the bobbin. Accordingly, the bobbin 15 is fashioned with a longitudinal passage 30 of substantially uniform cross section throughout its length (Figs. 3, 4 and 6). The passage 30 is adapted to receive the core piece 24 with a relatively snug sliding fit and to house the central portion of the same. Above the core piece 24, the passage 30 has a longitudinal groove 30A in its top wall, such groove being somewhat narrower than the core piece and of appropriate size to slidably receive an extension of the fixed end of the armature. Such extension may, for example, comprise two thicknesses of metal in the form of integral leaves 29, 31 or, alternatively, the leaves 29, 31 may be separate thicknesses of material spot welded or otherwise secured together. The leaves 29, 31 of the armature extension are electrically separated from the core piece 24 by means of an insulator strip 32 of mica or other suitable sheet insulation housed within the groove 30A. Similarly, the passage 30 is formed with a second longitudinal groove 30B narrower than the core piece 24 and underlying the same. The groove 30B slidably receives and houses central portion 34 of armature stop member 12. The portion 34 of stop member 12 is electrically isolated from the core piece 24 by means of insulator 35, similar to the insulator 32, and housed within the groove 30B. For the purpose of retaining the core piece 24, the armature extension, the insulators 32, 35 and the central portion 34 of the armature stop member in assembled relation within the barrel 16, an appropriate frictional means may be utilized. This may conveniently be effected by making the portion 34 of the armature stop member of resilient material and forming the same with an initial curvature. As an incident to deformation of the portion 34 during assembly of the foregoing parts within the passage 30 and grooves 30A, 30B, a frictional force would be set up within the passage 30 tending to hold such parts in place. To supplement such frictional action and to positively preclude the core piece 24 or the portion 34 of the armature stop member from slipping out of the passage 30, terminal lug 33 of the armature stop member 12 is bent so as to diverge outwardly from the mounting extension of the core piece 24. Short circuiting between the member 12 and the perpendicular arm 25 of the core piece is prevented by interposing an insulating spacer block 36 between these members.

In the event that manufacturing or service considerations so require, frictional holding of the parts within the barrel 16 may be dispensed with and these members may be secured with a suit-

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able cement. This expedient simplifies assembly and is desirable in instances where the relay is subject to severe vibration. It is also desirable in plate circuit applications where a slight relative movement of the parts within the barrel would disturb the adjustment of the relay.

Aside from cementing the parts within the barrel as described above, additional provision is made in the construction of the relay 10 for protecting the armature and contact assembly against being put out of adjustment or damaged due to striking or rough handling. This is accomplished primarily by the use of recesses in the bobbin heads of proper size and shape to bring the foregoing parts within the peripheries and the end surface planes of the bobbin heads. It is also accomplished in part by forming the bobbin with its barrel 16 disposed in slightly eccentric relation to the bobbin heads 18, 19. Referring more specifically to Fig. 4, it will be perceived that the bobbin head 18 has a radial slot 40 in its end surface starting at its outer periphery and terminating at the passage 30. The slot 40 is shaped so as to receive the stationary hinged portion of the armature with its outer surface flush with the end face of the bobbin head 18 and with the flexible portion of the armature well within the peripheral surface of the head 18. Similarly, the bobbin head 19 is slotted as at 41 and 41A to receive the contact assembly of the relay. This slot also runs radially and terminates at the passage 30. The slot 41, 41A houses the contact assembly within the outer peripheral surface of the bobbin head 19 and with the upstanding portion of armature stop member 12 flush with the end surface of the head 19. As indicated in the drawing, portion 41A of the slot is somewhat wider than the portion 41. The purpose of this is to accommodate the spacer block 36 and to prevent the same from sliding upwardly and impeding the movement of the armature.

In order to simplify the connections to the actuating coil 20 and to economize to the maximum possible extent on insulation for the same, the bobbin head 18 is fashioned with additional recesses 42, 44 running along its inside face. These recesses are adapted to receive the ends of the coil 20 and to guide them outwardly to the inside ends of coil terminals 21, 22. The coil ends are preferably solder connected to these terminals.

In addition to protecting the relay, the recessing arrangement described above facilitates housing of the relay in certain types of enclosures or envelopes of glass or drawn steel, for example. Referring to Fig. 5, the relay 10 is indicated diagrammatically as enclosed in a glass envelope 45 comparable in size to a miniature vacuum tube and having a similar type pronged base 46. The tube may, for example, be gas filled or evacuated, depending upon the needs of the particular installation in which it is used.

To further increase the versatility of the relay 10, its construction may be slightly modified as indicated in Fig. 7. Turning once more to the drawing, it will be noted that the relay is provided with a modified armature stop 12A which also serves as a mounting for the outer fixed contact 11. The member 12A is formed with a U-shaped offset 48 in that portion which runs perpendicular to the passage 30. The parallel side portions of the offset are spanned by a finely threaded adjusting screw 49. As will readily be appreciated, the setting of the relay may be adjusted with nicety and precision by altering the spacing between the fixed contacts 11, 13 through the use

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of the screw 49. A similar adjusting offset and screw may, of course, be interposed between the armature and its extension.

The relay 10 possesses a number of advantages in addition to those already discussed herein. For example, the spool-like formation of the bobbin lends itself readily to winding the coil 20 directly thereon. This eliminates the need for winding the coil separately and later transferring it into the relay assembly.

The contact mounting arrangement used in the relay 10 need not be confined to a single pole type relay, being equally applicable to multiple pole constructions simply by providing a passage of the proper shape in the bobbin and one or more additional insulating strips.

Due to the relatively small size and low mass of the movable element, namely, the armature, the relay 10 is virtually independent of the effects of shock and vibration regardless of the position in which the relay may be oriented.

While not necessarily limited to embodiments of small size, relays constructed as disclosed herein lend themselves to a degree of miniaturization not heretofore obtainable.

Relays embodying the present invention have been found to have excellent operating characteristics. For example, one such relay, which was designed for direct current operation, performed reliably on test at five milliamperes with a power consumption of 80 milliwatts. Other relays, also embodying the invention, have been operated continuously at 1.75 watts maximum power with a temperature rise of only 83° C.

I claim as my invention:

1. In a relay, the combination of a bobbin of insulating material having a longitudinal passage therein, a coil on said bobbin, a core piece housed within said passage and having at one end a substantially perpendicular arm portion terminating in an inner fixed contact, an armature stop member having a first portion housed within said passage and another portion carrying an outer fixed contact, said first portion being deformable from an initially curved to a substantially flattened shape upon assembly of said relay, an armature member having an extension housed within said passage, said armature member having a free end portion disposed between said fixed contacts and adapted to serve as a movable contact, and insulator strips located within the passage and interposed between said armature stop member and said core piece and between said extension of said armature and said core piece, respectively, said deformable first portion of said armature stop member being adapted to serve as a frictional retaining means so as to preclude withdrawal of said core piece, said armature stop member, and said armature extension from the passage.

2. In a relay, the combination of a bobbin having a longitudinal passage therein, a coil on said bobbin, a core piece housed within said passage and having at one end a substantially perpendicular arm portion terminating in an inner fixed contact, an armature member having an extension housed within said passage, said armature extension being electrically insulated from said core piece but mechanically wedged thereagainst, an armature stop member having an intermediate portion housed within said passage and electrically insulated from said core piece and said armature extension, said armature stop member terminating at one end in an outer fixed contact overlying said inner fixed contact, said

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armature stop member terminating at the other end in a terminal lug bent outwardly from said core piece so as to lock the intermediate portion of said armature stop member and also said core piece within said longitudinal passage.

3. In a relay, the combination of a bobbin having a longitudinal passage therein, a coil on said bobbin, a core piece housed within said passage and having at one end a substantially perpendicular portion terminating in a fixed contact, an armature stop member having an intermediate portion housed within said passage and electrically insulated from said core piece, said armature stop member terminating at one end in a portion overlying said fixed contact and terminating at the other end in a terminal lug bent outwardly from said core piece so as to preclude withdrawal of the latter and said armature stop member from said passage.

4. In a relay, the combination comprising a spool-shaped bobbin having a hollow barrel interposed between a pair of spaced apart bobbin heads, said heads having radial recesses therein, a coil mounted on said barrel, a resilient armature of the leaf spring type nested within said recesses, a pair of spaced apart fixed contacts disposed in straddling relation with the free end of said armature and nested within one of said recesses, said contacts and the movable portion of said armature being located within the outer peripheral surfaces of said bobbin heads and within the planes of their outer end faces.

5. In a relay, the combination of a bobbin of insulating material having a longitudinal passage therein, a coil on said bobbin, a core piece housed within said passage and having at one end a substantially perpendicular arm portion terminating in an inner fixed contact, an armature stop member having a portion housed within said passage and an offset carrying an outer fixed contact, an armature member also having a portion housed within said passage, said armature member having a free end portion disposed between said fixed contacts and adapted to serve as a movable contact, and an adjusting screw spanning the offset of said armature stop member to permit adjustment of said outer fixed contact relative to said inner fixed contact.

6. In a relay, the combination of a spool-shaped bobbin of insulating material having a hollow barrel interposed between and eccentrically of a pair of spaced apart bobbin heads, said heads having recesses therein running radially of said barrel and through those marginal portions of said heads having the greatest radial width, a coil mounted on said barrel, a resilient armature of the leaf spring type nested within said recesses, a pair of spaced apart fixed contacts disposed in straddling relation with the free end of said armature and nested within one of said recesses, said contacts and the movable portion of said armature being located within the outer peripheral surfaces of said bobbin heads and within the planes of their outer end faces.

7. In a relay, the combination comprising a hollow bobbin having a longitudinal passage therein, an actuating coil on said bobbin, a generally L-shaped core piece housed within the passage of said bobbin, an armature disposed in generally parallel relation with said passage, said armature having an extension projecting well within said passage and frictionally retained therein, said armature extension being insulated electrically from said core piece, said armature

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and said core piece each comprising magnetic material plated with metal having a relatively high conductivity whereby said parts comprise both a magnetic and an electrical circuit within said relay, and a stop disposed in relatively closely spaced relation with said core piece and overlying relation with the free end of said armature, said stop forming no part of the magnetic circuit of said relay.

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