June 20, 1944. F. A. ZUPA 2,351,730

RELAY

Filed Sept. 23, 1942

FIG. 1

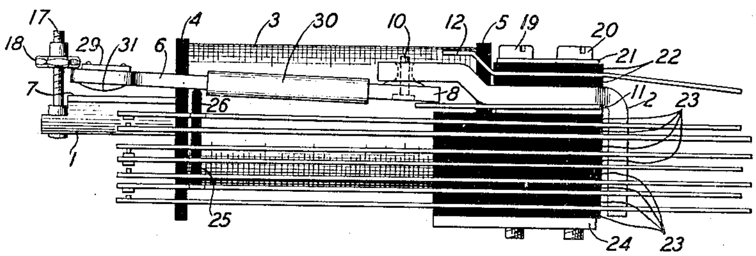


FIG. 2

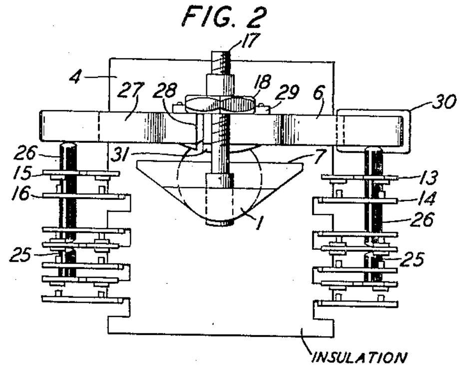


FIG. 3

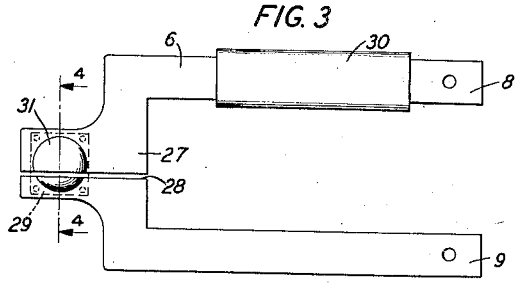
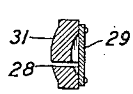


FIG. 4



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2,351,730

RELAY

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5 Claims. (Cl. 175—338)

This invention relates to relays and more particularly to relays for use in the circuits of telephone systems.

It is often necessary that certain relays of a telephone system be responsive to alternating current, as for example, a relay which responds to ringing current incoming over a trunk for signaling the presence of an incoming call on the trunk. Relays which have been used heretofore for this purpose, in order to secure adequate sensitivity, have been especially designed with relatively low contact pressures and with single contact springs.

It has been found desirable to provide a relay having as great sensitivity as those previously used but with greater contact pressures and with contact springs having twin contacts of the type generally provided in standard direct current relays employed in telephone circuits whereby more reliable circuit controls may be secured. A relay of the direct current type, such as is disclosed in Patent No. 2,294,327 granted to me on August 25, 1942, does have adquate contact pressures and twin contacts but cannot be operated effectively in response to alternating current.

It is the object of the present invention to so modify a relay of this direct current type that it may be responsive to alternating current to maintain its contacts firmly engaged without any tendency to chatter. This object is attained by dividing the forward cross reach of the armature into two magnetically separated but non-magnetically joined sections, one of which is surrounded by a short-circuited coil or copper sleeve to provide a phase displacement of the flux in one section of the armature with respect to the other section.

The invention will be more readily understood from the following detailed description taken in connection with the accompanying drawing in which:

Fig. 1 is a top plan view of a relay of the direct current type hereinbefore referred to, modified in accordance with the present invention;

Fig. 2 is an enlarged front end view of the relay shown in Fig. 2;

Fig. 3 is a detail view of the armature of the relay showing the manner in which the armature is divided into magnetically separated sections and the manner in which a phase displacement of the flux in one section of the armature with respect to the other section is secured; and

Fig. 4 is a sectional view of the front end of the armature as viewed along section line 4—4 of Fig. 3.

As hereinbefore stated the relay disclosed in the drawing is of the general type disclosed in Patent No. 2,294,327, granted to me, and consists of a core 1 secured at its rear end to a mounting bracket 2, an energizing coil 3 surrounding the core having front and rear spoolheads 4 and 5 of insulating material, an armature 6 the forward cross reach of which cooperates with the enlarged pole face 7 of the forward end of the core 1 and the rear ends of the legs 8 and 9 of which are pivoted by pivot pins 10 to the forwardly extending arms of the mounting bracket 2, reed springs 11, coil terminal lugs 12, a spring pile-up on each side of the relay coil 3 each comprising suitable contact springs such as 13, 14, 15, 16, etc., and a back-stop structure comprising the screw 17 secured to the forward end of the core 1 and the back-stop nut 18 threaded thereon.

The reed springs 11, coil terminal lugs 12 and the springs of the spring pile-ups are suitably clamped to the mounting bracket 2 by screws 19 and 20 which pass through holes in the clamping plates 21, insulating strips 22, the bracket 2, the reed springs 11, insulating strips 23 and the springs of the spring pile-ups into threaded holes in the clamping plates 24. Terminal lugs 12 and the springs of the spring pile-ups are insulated from each other and from the bracket 2 by the interposed insulating strips 22 and 23 and the screws 19 and 20 are surrounded by the usual sleeves of insulating material (not shown) where they pass through the holes in the terminal lugs and the springs of the spring pile-ups. For enabling the movable springs of the spring pile-ups to be moved with respect to the fixed springs, studs of insulating material, such as studs 25 and 26, are ring-staked to certain of the movable springs with the outer ends of the studs 26 engaged against the legs of the armature 6.

In accordance with the present invention, the forward cross reach 27 of the armature 6 is severed by a slot 28 and the two severed sections are reunited by a plate 29 of non-magnetic material riveted or otherwise secured to both sections whereby the two sections are firmly secured together but magnetically separated by an intervening narrow air-gap. The leg 8 of the armature is surrounded by a sleeve 30 of good electrically conductive material, such as copper, which, in effect, is a short-circuited winding. In place of the sleeve, a low resistance winding short-circuited upon itself could be used. To minimize chatter or vibration on the alternating current operation of the relay the pole face of the armature at the point of engagement with the pole face 7 of the core 1 is provided with an embossment 31. The embossed portion 31 may be an integral part of the armature and formed when the armature is stamped out or may be a separate insert of either magnetic or non-magnetic material. The embossment may be formed instead on the pole face 7 of the core 1.

The division of the armature into two magnetically separated sections in effect provides two separate armatures which mechanically function as a single armature since they are rigidly united by the plate 29 but which magnetically function as separate armatures. The copper sleeve 30 surrounding the leg 8 of one of the sections serves to produce a phase displacement of the flux in that section of the armature with respect to the other section. For example, assuming the coil 3 to be energized in response to one polarity of the alternating current and the armature 6 to be in its attracted position and the energizing current changes polarity, then when the current passes through the zero point in its change from one polarity to the other, the flux in one section of the armature having the leg 9, will decay rapidly but due to the short-circuited sleeve 30 the flux in the section of the armature having the leg 8 will be retarded in its decay sufficiently to hold the armature attracted until a flow of flux is again established in the opposite direction in both sections of the armature upon the reenergization of the coil 3 in response to the opposite polarity of the energizing current. At this time flux flow in the unsleeved section of the armature will build up rapidly and before a reversal of flux flow is produced in the sleeved section of the armature.

It is thus apparent that by a very simple modification of the armature of an efficient direct current type relay, such a relay may be converted for alternating current operation and that since the direct current relay has adequate spring pressures and twin contacts on all of its springs, a very reliable and efficient alternating current relay is made available.

What is claimed is:

1. In an electromagnetic device, a heel-piece, a core secured thereto, a coil surrounding said core, an armature hinged to said heel-piece with its free end attractable toward said core upon the energization of said coil, said armature being divided into two magnetically separated sections and a short-circuited coil surrounding one of said sections whereby a phase displacement of the flux in that section with respect to the other section is secured to render said device effectively operable by alternating current.

2. In an electromagnetic device, a heel-piece, a core secured thereto, a coil surrounding said core, a U-shaped armature having its forward cross reach positioned for attraction toward the pole face of the forward end of said core upon the energization of said coil and having the ends of its legs hinged to said heel-piece, said armature having its cross reach severed by a slot to divide said armature into two magnetically separated sections, a plate of non-magnetic material secured to the two sections of the cross reach to non-magnetically join said sections, and a copper sleeve surrounding the leg of one of said sections whereby a phase displacement of the flux in that section with respect to the other section is secured to render said device effectively operable by alternating current.

3. In an electromagnetic device, a heel-piece, a core secured thereto, a coil surrounding said core, a U-shaped armature having its forward cross reach positioned for attraction toward the pole face of the forward free end of said core upon the energization of said coil and having the ends of its legs hinged to said heel-piece, said armature having an embossed portion on its pole face opposite the pole face of said core and having its cross reach severed by a slot forming an air-gap to divide said armature into two magnetically separated sections, a plate of non-magnetic material secured to the two sections of said cross reach to non-magnetically join said sections, and a copper sleeve surrounding the leg of one of said sections whereby a phase displacement of flux in that section with respect to the other section is secured to render said device effectively operable by alternating current.

4. In an electromagnetic device, a heel-piece, a core secured thereto, a coil surrounding said core, an L-shaped armature hinged to said heel-piece at one side of said core, a second L-shaped armature, surrounded by a copper sleeve, hinged to said heel-piece at the other side of said core, the short legs of said armatures joined by a plate of non-magnetic material, whereby said armatures are forced to move at the same time in response to energization of said coil, the sleeve on said second armature causing a phase displacement of the flux in that armature with respect to the flux in the other armature, to render said device effectively operable by alternating current.

5. In an electromagnetic device, a heel-piece, a core secured thereto, a coil surrounding said core, an L-shaped armature hinged to said heel-piece at one side of said core, a second L-shaped armature hinged to said heel-piece at the other side of said core, said second armature surrounded by a copper sleeve and carrying an embossed lug for controlling the extent of motion of said armature, the short legs of said armatures joined by a plate of non-magnetic material, whereby said armatures are forced to move at the same time in response to energization of said coil, the sleeve on said second armature causing a phase displacement of the flux in that armature with respect to the flux in the other armature, to render said device effectively operable by alternating current.

FRANK A. ZUPA.