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2,786,915

RELAY

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FIG. 1

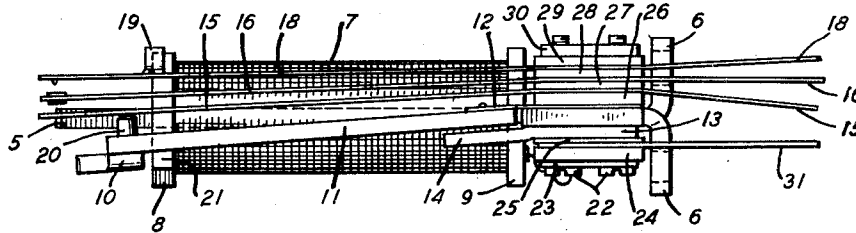


FIG. 2

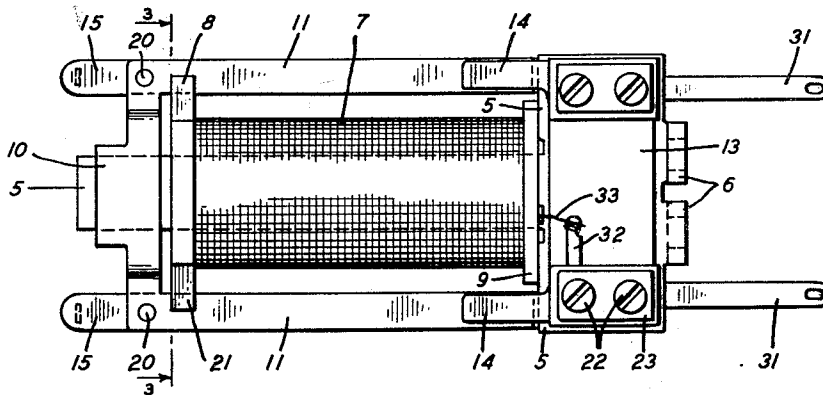
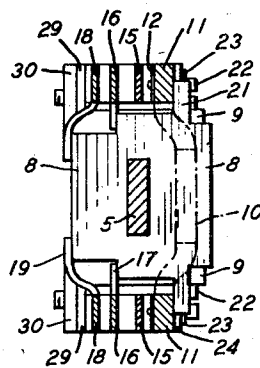


FIG. 3



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RELAY

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3 Claims. (Cl. 200—87)

This invention relates to electromagnetic switching devices and particularly to electromagnetic relays for use in telephone circuits and switching systems.

Objects of the invention are a simplification and improvement of the structure of relays and particularly flat-type relays thereby to facilitate quantity production, to minimize wear and increase the operating life, and to increase the efficiency and improve the operating characteristics.

To obtain maximum magnetic pull between the core and armature of a relay when the coil of the relay is energized, the hinge gap in the magnetic circuit of a relay should have the lowest possible magnetic reluctance. To this end, it is known to provide a magnetic shunt bridging the hinge gap between the armature and core of a relay, such an arrangement being disclosed in Patent 2,178,656, granted November 7, 1939, to P. W. Swenson. However, in a relay which includes a magnetic shunt across the hinge gap, and the structure is one in which the armature is designed to be in contact with the shunt, the friction therebetween reduces the efficiency of the relay and results in wear which affects the operation and the life of the relay. One of the features of this invention is the provision of a magnetic shunt across the hinge gap of a relay to minimize the reluctance of the magnetic circuit, this shunt comprising a piece of magnetic material, one end of which overlies and is fixed to the core, the other end overlying the hinged end of the armature with a small clearance therebetween. Since the shunt is not at any time in engagement with the armature, it does not introduce friction or wear and does not adversely affect the operation or the useful life of the relay.

When a relay releases, the armature returns to normal position against a back stop which limits the armature travel. A well known type of back stop provided in flat-type relays is shown in the aforementioned P. W. Swenson patent and comprises an L-shaped screw stud having one end fixed to and protruding from the front end of the core, the other end extending at right angles past the end of the armature and having a nut thereon which limits the movement of the armature upon release of the relay. While the stud and nut type of armature back stop permits ready adjustment of the armature travel, it is subject to wear; and, since such a back stop is positioned at the extreme end of the armature, maximum armature rebound results.

Another feature of my invention is a flat-type relay designed to reduce rebound of the armature when the relay is released, thereby minimizing false contact operation and minimizing wear which affects the operating characteristics of the relay. According to this feature, the front spoolhead of the relay is provided with lugs against which the armature rests when in the non-operated position, thereby eliminating the stud and nut type backstop heretofore provided. Since the point at which the armature engages this spoolhead lug is closer to the center of percussion of the armature, mechanical oscilla-

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tions of the core and armature are minimized, and as a result rebound is minimized and there is less wear on the back stop so that the desired positioning of the armature is maintained. It is also to be noted that this improvement also constitutes a simplification of the structure and facilitates quantity production.

The drawing which consists of three figures shows a relay embodying the features of this invention, which is hereinafter described in detail. The invention is not limited in its application and form to the structure shown and includes equivalent arrangements.

Referring to the drawing—

Figs. 1, 2 and 3 show top, side and sectional end views, respectively, of a flat-type relay to which the invention has been applied.

The relay shown in the drawing comprises a T-shaped flat core 5, a U-shaped armature 10, and a coil 7 around the core between spoolheads 8 and 9. The core and armature are punched out of a sheet of magnetic material such as soft iron. The coil 7 may be a form wound coil which is slipped into place around the tongue of core 5. The broadened rear end of the core 5 constitutes an assembly plate and has two lugs 6 oppositely extending at right angles to the length of the core for mounting the relay on a mounting plate or other supporting structure. The legs 11 of the armature extend along the upper and lower sides of the coil, substantially parallel to the core, the rear ends of the legs 11 abutting the front edges of the upper and lower extensions of the rear end of core 5. An armature hinge plate 12 of soft iron or other suitable magnetic material lies adjacent one face of the rear end of core 5 and has two forwardly projecting short legs which are riveted to the ends of armature legs 11 so as to form reed hinges for the armature. The cross reach at the front end of the armature is bowed out of the plane of the core, the flat middle surface of the bow being opposite and substantially parallel to one side of the end of the core so that there is a uniform air gap between the opposing surfaces of the front ends of the armature and core when the armature is in normal position.

A plate 13 of magnetic material lying adjacent the other face of the rear end of core 5 has legs 14 extending forward across the hinge gaps between the core and armature legs to reduce the reluctance of these gaps. The legs 14 are offset slightly from the plate and extend forward at a small angle to the axis of the core so as to lie substantially parallel to the armature legs when the armature is in normal position. The legs 11 of the armature do not, at any time, come into contact with the legs 14 of plate 13 and no friction or wear is introduced due to use of this hinge-gap shunt structure. The clearance between the armature legs 11 and the legs 14 of the hinge-gap shunt minimizes the magnetic pull therebetween, which opposes the magnetic pull at the pole-face ends of the core and armature. By interchanging positions of the armature hinge plate and hinge-gap shunt relative to the armature and core, the magnetic pull between the legs 11 and 14 aids the magnetic pull at the pole-face ends. In this case, the legs 14 would be longer and parallel to the core with sufficient offset to provide a clearance.

A set of contact springs 15, 16 and 18 mounted on the rear end of core 5, extend forward adjacent and parallel to the upper leg 11 of the armature and a like set of springs mounted on the rear end of the core extend forward adjacent and parallel to the lower leg of the armature. Each set of contact springs is fixed to the core by screws 22 in a pileup which includes clamp plates 23 and 30, connecting terminals 31, magnetic shunt plate 13, rear end of core 5, hinge plate 12 and the contact springs, together with insulating strips 24, 25, 26, 27, 28 and 29 which electrically separate the contact springs and coil terminals from each other and from the other elements in the pile-

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up. Each of the ends of the coil 7 extends through spoolhead 9 and is there soldered to and connected by a conductor 33 to a lug 32 projecting from the associated one of terminals 31. The rear ends of the contact springs and coil terminals are tinned to facilitate the soldering of conductors thereto.

The contact spring 16 has a lug 17 projecting therefrom into normal engagement with an extending portion of the spoolhead 8; and the contact spring 18 has a lug 19 extending therefrom to normally engage the adjacent outside edge of the spoolhead 8. Thus, the spoolhead 8, which may be made of phenol fibre or similar solid, wear-resistant, insulating material, is formed with surfaces against which the contact springs 16 and 18 normally rest. An insulating stud 20 fixed in the armature at the front end of each leg 11 extends laterally into engagement with the contact spring 15 and this spring is tensioned to normally hold the armature against a projection 21 of spoolhead 8. Thus, each of the top and bottom projections 21 of spoolhead 8, constitute an armature back stop which limits the armature travel and which establishes the normal position of the armature and the desired air gap between the armature and core. This back stop is not subject to any appreciable wear, and the air gap remains constant for a much larger number of operations than with prior art back stop structures. Furthermore, this back stop is closer to the center of percussion of the moving armature than is the case in prior art relays. When a moving body strikes another at the center of percussion of the first, the mechanical oscillations set up in both bodies do not tend to move the bodies out of engagement. Thus, rebound of the armature and resultant false contact closures and opens when the relay coil is deenergized, are minimized.

In the contact spring arrangement shown, the springs 15, 16 and 18 are normally not in electrical contact with each other. When the coil 7 is energized, the armature 10 moves away from the back stop 21 and the stud 20 forces the spring 15 to engage spring 16 and, in sequence, into engagement with contact spring 18. When the operating circuit is opened, the coil deenergizes and the armature and contact spring return to normal position. Other contact spring arrangements may be provided, the projection of the spoolhead 8 being designed to establish desired spring and armature positions and limits of travel.

What is claimed is:

1. A relay comprising a core of magnetic material, an energizing coil around said core, spoolheads of a wear-resistant insulating material at the ends of said coil, an armature of magnetic material extending along the side of said coil, a flat reed of magnetic material hinging one end of said armature adjacent an abutting edge of one end of said core, a plate of magnetic material adjacent to and in contact with a side of said one end of said core, said plate having a portion extending across the hinge gap adjacent and parallel to but not in contact with the side of the hinged end of the armature, means comprising a projection on the front spoolhead forming a back stop for said armature, said projection arranged to cooperate with that segment of said armature adjacent the center of percussion thereof, and contact springs actuated by movement of the armature when said coil is ener-

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gized, one of said contact springs being tensioned to normally hold the armature against said back stop.

2. An electromagnetic relay comprising a magnetic core the rear end of which is broadened and extended to facilitate assembly and mounting an energizing coil surrounding said coil in front of said rear end, spoolheads of wear-resistant insulating material at the ends of said coil, an armature of magnetic material, the front end of said armature opposing and normally spaced apart from the front end of said core, said armature extending rearward along and parallel to said coil, the rear end of said armature abutting an extension of the rear end of the core, a flat reed of magnetic material fixed parallel to and adjacent one side of the rear end of the core, said reed having a projection riveted to the side of the rear end of said armature to form a hinge, a plate of magnetic material fixed parallel and adjacent to and in contact with the other side of the rear end of said core, said plate having a projection extending forward across the hinge gap alongside but not in contact with the hinged end of the armature, said projection offset from the plane of the body of the plate in a plane substantially parallel to the plane of the working surfaces of said armature in its unoperated position so as to introduce a minimum clearance between the opposing sides of the projection and the armature, and contact springs mounted on the rear of said core for actuation by said armature.

3. A relay comprising, in combination, a core of magnetic material, an energizing coil associated with said core, spoolheads of insulating material at the ends of said coil, an armature extending along a side of said core, a flat magnetic spring hinging one end of said armature adjacent an abutting edge on one end of said core, a plate of magnetic material adjacent to and in contact with the side of said one end of said core, said plate having a portion extending across the hinge gap adjacent to but not in contact with the side of said hinged end of the armature, and a projecting lug on the spoolhead more closely adjacent the other or free end of said armature and disposed to cooperate with that segment of the armature adjacent the center of percussion of the armature, said springs normally tensioning said armature against said lug to introduce a desired air gap between said free end and the adjacent other end of said core.

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