MULTIPLE RELAY ASSEMBLY

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This invention relates in general to electromagnetic relays, and is more particularly concerned with relays capable of dual function operations.

An object of the present invention is to provide a relay assembly so constructed that it will respond as two specific relays in an electrical assembly circuit commonly used as a line and cut-off relay in a telephone line circuit.

Another object of the present invention is to provide a multiple relay assembly using wire springs, designed for molding the springs into three insulator blocks which can be assembled without requiring any spring or contact adjustment.

Another object of the invention is to provide in a multiple relay assembly, having wire spring pile-ups in a ternate arrangement and individual armatures for actuating the wires of two of said pile-ups whereby, one of said springs is actuated regardless of which armature is moved to control certain common circuits associated with each spring pile-up.

According to one feature of the invention, in a multiple electromagnetic relay assembly, a pair of armatures are adapted to be operated independently by separate energizing coils mounted on a common support to actuate associated contact springs, including certain springs so shaped and mounted that they can be actuated by either armature to control circuits common to both sets of armatures and coils.

Other objects and features will become apparent from a perusal of the following specification taken in combination with the accompanying drawings wherein:

Fig. 1 is a side view of the relay assembly.

Fig. 2 is a top view of the relay assembly.

Fig. 3 is a slightly distorted perspective view with certain portions omitted to show the cooperation between the armatures and their respective combs and wire springs.

Fig. 4 is a circuit diagram incorporating the present invention into a telephone line circuit.

It has been estimated that approximately 40% of the relays used in telephone equipment are either line or cut-off relays. It is therefore the main purpose of the present invention to provide a combined line and cut-off relay capable of performing the same functions of the two relays. It should however be understood that the present invention need not necessarily be limited to any specific function such as being a line and cut-off relay, but to any combined dual function relay operation as the relay could easily be adapted to, and which will become apparent in the ensuing description.

Referring to Figs. 1, 2 and 3 there is shown an "L-shaped" heelpiece 5 for mounting the entire mechanism thereon. Mounted longitudinally by means of bolts, such as 3, a pair of coils 1 and 2 are fastened to the heelpiece 5 upon the screws being inserted into threaded holes in the cores of said coils. Each coil will constitute an associated armature assembly, either 6 or 7 which are mounted to the upper end of the heelpiece by means of bolts 6b and 7b fastened into threaded holes therein. The armatures have arms 6a and 7a extending at different lengths, and contain grooved supports 6r and 7r for vertically supporting combs or cards 25 and 35 respectively, and the width of said cards being perpendicular with the longitudinal axis of the heelpiece 5. Another comb or card 17 has a projecting lower end for being tightly inserted into a slot 5s in the heelpiece 5 and also stands vertically, however, the width of comb 17 is parallel with the longitudinal axis of heelpiece 5 for a reason to be explained in the ensuing description. The combs 17, 25, and 35 are made of any insulating material to insulate the springs associated therewith from each other. Also mounted on the upper part of heelpiece 5 are three insulator blocks 10, 20, and 30 with all three blocks held together by a pair of overlapping plates 9L and 9u. The upper plate 9u and the lower plate 9L holding the plates together at opposite ends, and having a pair of bolts 9b inserted through holes provided in the plates and the middle insulator block 20, and fastened into threaded holes (not shown) in the heelpiece 5.

Each of the insulator blocks 10, 20, and 30 are molded to include wire contact springs at predetermined locations. Block 10 contains five fixed springs 11, 12, 13, 14, and 15 bent at an angle of approximately 90 degrees horizontally for insertion into holes or slots provided in comb 17. Blocks 20 and 30 each contain three wire contact springs 21, 22, 23, and 31, 32, and 33, respectively, extending horizontally. Contact springs 21, 22, and 23 extend through holes provided in comb 25 in horizontal alignment with block 20. Likewise contact springs 32 and 33 extend through holes provided in comb 25, however, contact spring 31 extends through a vertical elongated slot 35s of comb 35 and rests on a slot 25s of comb 25 for reasons to be explained in the ensuing description. It is to be pointed out that insulator block 10 extends horizontally further than blocks 20 and 30, for the reason that the springs associated therewith are fixed springs and the added length of the block adds to their stability, and are less inclined to bend or get out of alignment. On the other hand, the springs of blocks 20 and 30 are springs to be tensioned to engage the fixed springs of block 10, and for this reason the blocks are shorter horizontally and the springs longer for permitting the tensioning and engagements thereof. It is also to be pointed out that at the points of contact, between certain springs precious metal inlays (not shown) may be provided for a better electrical contact therebetween.

Inserted under the upper plate 9u and fastened therein by bolts 9b are three flat guide spring extensions 41, 42, and 43 cut from one piece of thin metallic material, namely member 40. Metallic member 40 has two corresponding holes therein for accepting the insertion there-through of bolts 9b, although not shown. The middle flat guide spring extension 42 extends horizontally a short distance, and has a slot 42s for encompassing a projection 17p of comb 17. Guides spring extension 41, is bent downwardly and extends a distance further than the other extensions, and has a slot 41s for encompassing a projection 35p of comb 35. Likewise, guide spring extension 43 is bent downward and extends a short distance, and has a slot 43s for encompassing a projection 25p of comb 25. The guide spring extensions 41, 42, and 43 will thus act as stabilizing means for their respective combs, and insure that the combs will remain in an erect position.

Operation

Upon the energization of coil 2, armature 7 will be magnetically attracted to the core thereof, and at pivot pin 7p the armature 7 will pivot. Arm 7a will cause comb 35 to move upwards, which will in turn tension
wire contact springs 31, 32 and 33 upwards. The movement thereof will cause spring 31 to engage spring 11; spring 32 to disengage from spring 11 and engage spring 12; and spring 33 to engage spring 13. It is to be pointed out that the movement of comb 35 and its associated springs will have no physical effect on the springs of comb 25. Upon deenergization of coil 2, the upward tensioning of springs 31, 32, and 33 will aid in the rapid restoration of armature 7 to its normal position, and again without physically effecting the springs of comb 25.

Upon the energization of coil 1, armature 6 will be magnetically attracted to the core thereof, and at pivot pin 6p, the armature 6 will pivot. Armature 6 will cause comb 25 to move upwards, which will in turn tension wire contact springs 21, 22 and 23, and by means of slot 25a tension wire contact spring 31 upwards.

The upward tensioning of spring 31 in this instance will cause this spring to move upwards the length of elongated slot 35x of comb 35 and engage spring 11 without causing any movement of comb 35. The spring movements thereof will cause spring 21 to engage spring 11; spring 22 to disengage spring 14; spring 23 to disengage spring 15. The deenergization of coil 1 with the aid of the tensioned springs will rapidly restore the springs 21, 22, 23, and 31 to normal, and again effecting the movement of comb 35.

Due to the fact that the springs at one end are baked into their respective blocks and supported by the combs at their other ends, it should be quite apparent that little or no adjustments of the springs are necessary.

Circuit adaptation

As previously mentioned the present invention is adaptable and preferable to a telephone line circuit. In Fig. 4 a line circuit utilizing the present invention is shown with contacts numbered to correspond with the spring numbers of Figs. 1, 2, and 3. In showing Fig. 4 it is therefore considered unnecessary to explain the circuit connections of the wires to the terminal ends of each spring however, a brief description of the line circuit will now be consummated. First of all coil 1 will represent the cut-off relay coil of the line circuit and coil 2 will represent the line relay coil.

Upon a calling subscriber lifting his telephone receiver, a loop circuit is closed to operate the line relay (coil 2); the circuit extending from battery, winding of the line relay, contacts 22, 14, negative lead, through the subscriber's loop, positive lead, contacts 15, 23, to ground. The operation of the line relay at contacts 31 closes the cut-off relay to the test conductor leading to a line finder. At contacts 32 ground is closed to the incoming bank of the associated banks via the CN lead, and a circuit via the connector banks to the cut-off relay is opened. At contacts 33 ground is closed to the start lead, the line finder. The line finder, connecting to this line, grounds the C lead operating the cut-off relay. The cut-off relay operating, locks out contacts 21. At contacts 22, the line relay is removed from the subscriber's line. At contacts 23 ground is removed from the positive lead. The line relay restores opening at contacts 33 the circuit to the start lead. At the upper contacts 32 (12), ground is removed from the CN lead, the lower contacts 32 (11) replace the ground via contacts 21. Also, it will be recalled that the cut-off relay will also close contacts 31 (11) to maintain ground on the C lead.

Briefly, when the subscriber receives a call, the connector grounds lead CN to operate the cut-off relay. The cut-off relay "cuts off" or removes the line relay from the line and grounds the C lead to busy this line circuit.

From a brief description of one of many types of circuits in which the present invention could be adapted, it is quite apparent that the compactness of the invention is definitely an asset. For instance, in the circuit example disclosed a relay assembly of the type disclosed would be all that would be needed to represent a line circuit, and that would be using than prior types using two separate relays. Also, the little if not no adjustment of the relay assembly, eliminates the need for excessive maintenance.

While one embodiment of the invention has been disclosed, it will be understood that various modifications may be made thereby within the true spirit and scope of the invention. Having fully described the invention, what I believe to be new and desire to protect by Letters Patent is set forth in the appended claims.

What is claimed is:

1. In a multiple electromagnetic relay assembly, a heel-piece, a first and second relay commonly secured to said heel-piece including a first and second armature respectively controlled thereby, a plurality of wire springs arranged in a terminate-pile-up with each pile-up extending from individual insulator blocks, a first insulator comb including an elongated slot therein mounted on said first armature, and a second insulator comb including an extending projection thereon mounted on said second armature, a third insulator comb secured to said heel-piece, a first of said wire spring pile-ups extending through said first comb including one wire spring extending through said elongated slot, a second of said wire spring pile-ups extending through said second comb, said one wire spring of said first pile-up resting on the extending projection of said second comb, a third pile-up of said wire spring pile-ups bent at right angles to and overlapping said first and second spring pile-ups, said third spring pile-up extending through said third comb to act as stationary springs, said first comb moving said first wire spring-pile-up into engagements and disengagements with said stationary third wire spring pile-up including said one wire spring making engagement with a certain one spring of said third spring pile-up by movement of said first armature responsive to energization of said first relay, said second comb moving said second wire spring-pile-up into engagements and disengagements with said stationary third wire spring pile-up by movement of said second armature responsive to energization of said second relay, said projection of said second comb causing said one wire spring of said first spring pile-up to engage said certain one wire spring of said third spring pile-up, in which said one wire spring is moved within said elongated slot of said first comb without effecting the actuation of said first spring pile-up.

2. In a multiple electromagnetic relay assembly as claimed in claim 1, including guice springs extending from said insulator blocks for engaging and stabilizing said comb in an erect position.

3. In a multiple electromagnetic relay assembly, a heel-piece, a first and second relay mounted on said heel-piece including an armature for each relay, each of said armatures having an extending arm, a plurality of wire springs arranged in a terminate-pile-up with each pile-up extending from individual insulator blocks, a first insulator comb including an elongated slot therein mounted on said first armature for movement thereby, a second insulator comb including an extending projection thereon mounted on said second armature for movement thereby, a third insulator comb secured to said heel-piece, a first of said wire spring pile-ups extending through said first comb including one of said wire springs extending through said elongated slot, a second of said wire spring pile-ups extending through said second comb and said one wire spring of said first pile-up resting on the extending projection of said second comb, a third pile-up of said wire spring pile-ups bent at right angles to and overlapping said first and second spring pile-ups, said third spring pile-up extending through said third comb and acting as stationary springs, said first wire spring pile-up engaging and disengaging said third wire spring pile-up including said one wire spring engaging a certain wire spring of
said third spring pile-up by said first comb responsive to pivoting of said first armature arm upon energization of said first relay, said second wire spring pile-up engaging and disengaging said third spring pile-up by said second comb responsive to pivoting of said second armature arm upon energization of said second relay, said projection of said second comb causing said one wire spring of said first spring pile-up to engage said certain wire spring of said third spring pile-up, in which said one spring is moved within said elongated slot of said first comb without effecting the actuation of said first spring pile-up.

4. In a multiple electromagnetic relay assembly as claimed in claim 3, including conductors connected to each wire spring whereby the engagements and disengagements between wire springs closes and opens electrical circuits associated therewith.

5. In a multiple electromagnetic relay assembly, a heel-piece, a line relay and a cut-off relay mounted on said heel-piece, an armature for each relay pivotally supported on said heel-piece including an extending arm on each armature, a first comb having an elongated slot therein mounted on said line relay armature arm and movably controlled thereby, a second comb having a perpendicular projection thereon mounted on said cut-off relay armature arm, a third comb mounted on said heel-piece and perpendicular to said first and second combs, three insulator blocks having a plurality of wire springs molded therein with each spring located at different predetermined locations and each block constituting a separate spring pile-up, a first of said spring pile-ups extending through said first comb including one of said springs extending through said elongated slot, a second of said spring pile-ups extending through said second comb including said one spring of said first pile-up resting on said perpendicular projection, a third of said spring pile-ups bent at right angles to said first and second pile-ups and extending through said third comb in a fixed position, said first comb causing said first spring pile-up to engage and disengage said third spring pile-up by movement of said line relay armature responsive to energization of said line relay, said second comb causing said second spring pile-up to engage and disengage said third spring pile-up by movement of said cut-off relay armature responsive to energization of said cut-off relay, said projection of said second comb causing said one spring of said first spring pile-up to engage a spring of said third spring pile-up in which said spring moves within said elongated slot of said first comb without causing actuation thereof, whereby said one spring of said first spring pile-up engages said spring of said third spring pile-up regardless of which relay is energized.

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