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F. E. WOOD

2,422,764

ELECTROMAGNETIC RELAY

Filed May 11, 1944

FIG.3

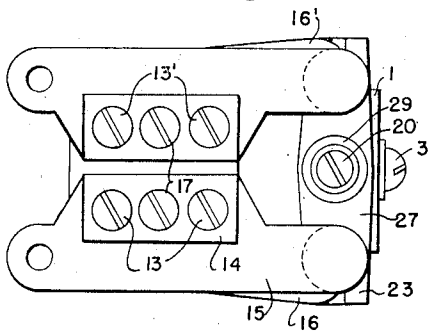


FIG. 2

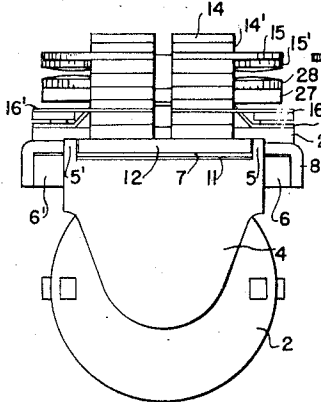


FIG. 1

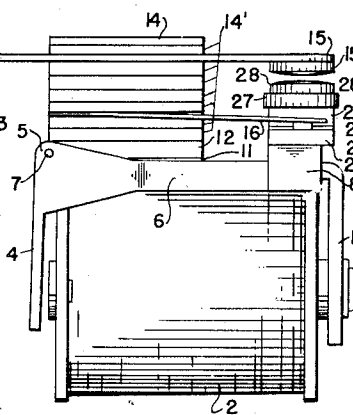


FIG.4

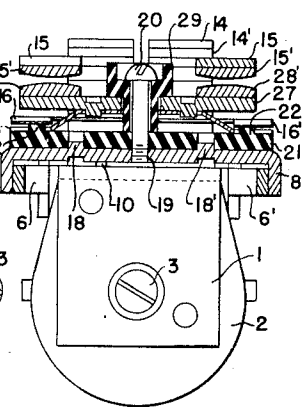


FIG. 5

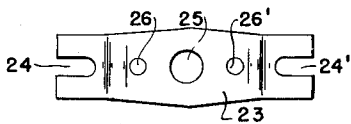


FIG.6

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ELECTROMAGNETIC RELAY

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4 Claims. (Cl. 200—165)

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The present invention relates in general to improvements in electromagnetic relays and, more particularly to relays of the diminutive power type.

The principal object of the invention is to provide a suitable diminutive power type relay for making and breaking circuits of high ampere inductive load.

One feature of the invention is the mounting arrangement of the movable contacts whereby the contacts are not always in the same alignment, but may make at different points at different times so that they will wear evenly instead of pitting as is customary in contacts carrying a heavy current.

Another feature of this invention is that the movable contacts are easily removable for adjustment or replacement and the design is such that extra spring tension is provided to insure a snappy break action of the contacts.

The one sheet of drawings comprising Figs. 1 to 6, inclusive, taken in connection with the following detailed description is believed sufficient to make the invention clear.

Fig. 1 is a side view of the relay showing the general construction and placing of parts.

Fig. 2 is an end view taken from the left of Fig. 1.

Fig. 3 is a top view of Fig. 1.

Fig. 4 is an end view taken from the right of Fig. 1 showing only the spring contacts and the movable contact assembly in cross section.

Fig. 5 is a top view in detail of the leaf spring supporting the movable contact bar.

Fig. 6 is a view taken from the bottom of Fig. 5.

Referring to the drawings the electromagnetic relay will now be described in detail. As best shown in Figs. 1 and 2 the relay has a substantially L-shaped magnetic heel-piece 1 to which is fastened a coil 2 by means of the mounting screw 3, and a movable magnetic armature 4 pivotally mounted upon the free end of the heel-piece 1.

As best shown in Figs. 1, 2 and 4 the armature 4 carries a pair of spaced-apart operating arms 6 and 6' each having upwardly extending ears 5 and 5' provided with aligned holes therein. A pivot pin 7 is inserted into the aligned holes and the outer ends of the pivot pin 7 are flanged over in order to rigidly secure the pivot pin to the

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armature 4. The operating arms 6 and 6' extend along the heelpiece on opposite sides and parallel thereto, and are provided at the end thereof with a crossarm 8 welded or otherwise rigidly secured to the two ends of the operating arms. The cross-arm 8 normally rests upon a non-magnetic rivet residual 10 shown in Fig. 4 secured to and extending upwardly from the upper surface of the heelpiece 1.

In order to provide a bearing surface for the pivotal armature pin 7, a non-magnetic bearing plate 11 is carried upon the upper surface of the heelpiece 1 adjacent to the free end thereof, and the pivot pin 7 is rotatably held against the upper surface of the bearing plate 11 in a pivot pin receiving slot formed in the bottom surface of the clamping plate 12. This mounting arrangement just described is shown in detail in my pending application Serial No. 477,230, filed February 26, 1943, now Patent No. 2,397,635, issued April 2, 1946. Located directly above and fastened to the clamping plate 12 by the screws 13 and 13' are two similar spring pile-ups. Each pile-up consists of an end plate such as 14, insulators such as 14', a stiff contact spring 15 with a heavy duty contact 15' on the free end, and a long flexible tension spring 16. These pile-ups are fastened to the clamping plate 12 as a unit by screws 13 and 13' and then the units are fastened to the heelpiece 1 of the relay by screws 17 to thereby clamp the armature bearing pin 7 and bearing plate 11 between the plate 12 and heelpiece 1.

The crossarm 8 fastened to the two ends of the operating arms 6 and 6', and upon which the assembly for the movable contacts is mounted as shown in the cross section view of Fig. 4, has two upwardly extending lugs 18 and 18' equal distances from their respective ends of the cross-arm, and a threaded hole 19 into which a screw 20 fits. The movable contact assembly consists of first an insulating strip 21 which has two holes registering with the extending lugs 18 and 18', a clearance hole for the screw 20, and raised lugs 22 and 22' on the upper side at each end slightly higher than the thickness of spring 23. Second a curved leaf spring 23 made of bronze or similar material arranged directly above insulator 21 and shaped as shown in Figs. 5 and 6. The forks 24 and 24' on each end of the leaf spring 23 slide

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around the insulator lugs 22 and 22', while the free ends of the tension springs 16 and 16' rest on top of lugs 22 and 22' and exert pressure to maintain the armature at normal position as shown in Fig. 4. The middle portion of the leaf spring has a center clearance hole 25 for bushing 29 and on each side of it lug receiving holes 26 and 26' to receive the lugs in the lower side of bar 27. Third a contact bar 27 with heavy duty contacts 28 and 28' on the upper surface of each end of the bar, a center clearance hole for bushing 29 and on the underside of the bar on each side of the clearance hole, the downwardly extending lugs formed to fit into the lug receiving holes 26 and 26' of the leaf spring 23.

The parts are assembled in the same order as just described. The one screw 20 which holds the assembly together fits into a tubular bushing 29 which insulates the screw from the movable contact assembly. The tubular bushing 29 is smaller than the clearance holes in bar 27 and leaf spring 23 through which it passes, thereby allowing the contact bar 27, and the leaf spring 23 to have endwise and sidewise movement relative to the bushing. The tubular bushing 29 also has an enlarged shoulder which limits the upward movement of the contact bar 27 under pressure of spring 23 when the relay is unoperated.

Upon energization of the coil 2 the armature 4 is attracted and rotates about its pivot pin 7 in a counterclockwise direction, against the tension of the springs 16 and 16' as viewed in Fig. 1, from its normal position to its operated position. This action causes the crossarm 8 carried on the ends of the operating arms 5 and 6' to move upwards as seen in Fig. 4. The movable contact assembly will move upwards until the contacts 28 and 28' on the contact bar 27 hit the fixed contacts 15' of the stiff contact spring 15. Further upward movement of the crossarm 8 has a tendency to cause the leaf spring 23 to flatten out and build up pressure until at the end of the movement considerable tension has been stored in the leaf spring. The leaf spring 23 is thus effective to cause a snappy break of the contacts later because of the novel construction of the assembly. The leaf spring 23 is held in place by the bushing 29 and the two extending lugs 22 and 22' of the insulation strip 21 which fit into the corresponding forks 24 and 24' of the leaf spring 23. This arrangement permits the forks at the ends of the leaf spring 23 to move inward and outward guided by the lugs 22 and 22'. This arrangement will maintain constant contact pressure.

Upon release or deenergization of the relay coil, the stored up pressure in the leaf spring 23 starts the armature moving very rapidly, but still holds the contacts closed. When the armature has gained speed and momentum, the underside of the upper portion or shoulder of the tubular insulator 29 strikes the contact bar 27 and snaps its contacts loose from the stationary contacts. The long thin tension springs 16 and 16', the tensioned ends of which rest upon the lugs 22 and 22' of the insulation strip 21 completely restores the relay armature to normal. On the initial restoring action it is the combination of the stored up tension of the leaf spring 23 and the long thin tension springs 16 and 16' being applied to the operating arms that start the restoring action.

When the relay is completely restored to normal position the crossarm 8 rests on residual 10. This residual 10 acts as a fulcrum so that the pressure applied to the crossarm by the long tension springs 16 and 16' tends to twist the arma-

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ture 4. This tends to take up any play between the pivot pin and its associated bearing surfaces and thereby prevents vibration of the armature from an external source.

While the invention has been described as embodied in a particular form, it is capable of employment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a circuit closing arrangement, an operating member, a pair of contacts through which a circuit is to be closed, an insulating bar keyed to said member by means of a pair of holes in each end of the bar and pins on said member extending into said holes, a contact bar for engagement with said contacts, projections on said insulating bar, a flat bowed spring mounted between the contact bar and the insulating bar having slots in each end slidable over said projections when the spring is flexed, retaining means for limiting the movement of the contact bar away from said member by means of said spring, a pair of tension springs engaging the ends of said projections and tending to move the contact bar away from said contacts, said bar moved to engage said contacts when the member is moved against the tension of said tension springs, said tension springs permitting free movement of said flat bowed spring along said projections when the flat spring is flexed or bowed, said tension springs and said flat spring acting together to cause a quick movement of the contact bar away from said contacts.

2. In a circuit closer, a pair of contacts, means for closing a circuit through said contacts comprising a metallic contact bar, a metallic operating bar, a strip of insulation mounted on said operating bar between said bars, a leaf spring mounted between said strip and said bar tensioned to hold said bars apart, a bushing mounted on said operating bar limiting the movement of the two bars caused by said spring, a pair of tension springs resting against said strip and normally biased to hold the assembly including said bars away from said contacts, means for moving said operating bar against the tension of said tension springs to cause said contact bar to engage said contacts.

3. In a circuit closer, a pair of stationary contacts, an assembly comprising a movable member and a contact bar mounted in parallel relation with a leaf spring between the two normally pressing the two apart, a bushing secured to the member, having a shoulder limiting the movement of the bar away from the member, and secured to the member to hold the assembly together as a unit, a pair of leaf tension springs exerting pressure on the ends of the member under the contacts and holding the assembly in position away from the contacts, means for applying a counter force to move the member against the tension of the pair of tension springs to move said assembly bodily to cause said bar to engage said contacts and compress said leaf spring, said contact bar moved toward said member when said leaf spring is compressed, said leaf spring and said tension springs aiding in separation of the bar from the contacts when said counter force is no longer applied.

4. In a circuit closer, a pair of stationary contacts, a contact bar, means for securing said bar to said member comprising a bushing rigidly secured to the member and having a shoulder limiting movement of the bar away from the member, a leaf spring between the bar and the member

normally maintaining the two spaced apart with said bar against said shoulder, a pair of tension springs exerting pressure on said member normally holding the bar away from said contacts, and means for moving said member against the tension of said pair of springs to thereby move said bar to cause engagement of the contact bar with said stationary contacts and compress said leaf spring.

FREDRIC E. WOOD. 10

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