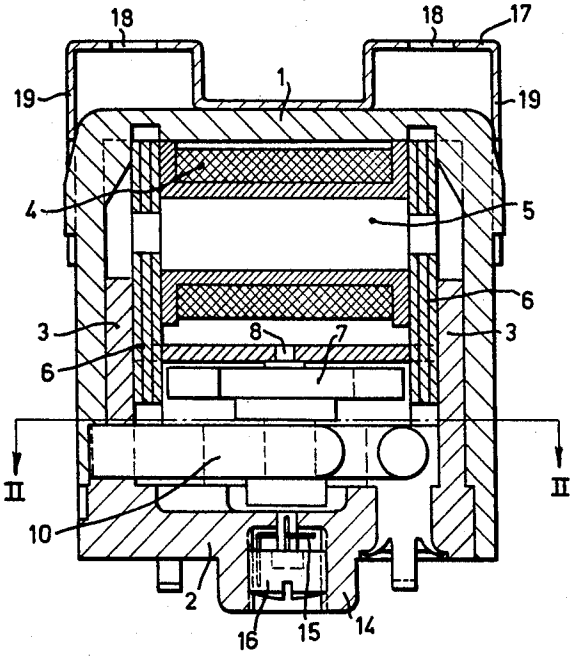
Nov. 17, 1964 B. S. LOMAN 3,157,764

ELECTROMAGNETIC RELAY

Filed May 9, 1961

FIG. 1



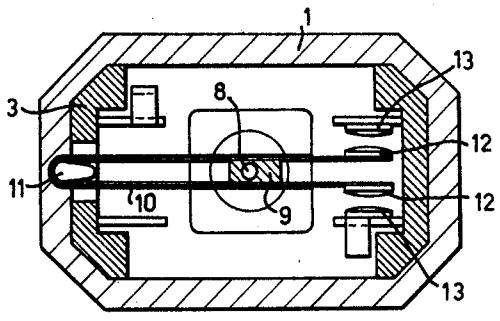


FIG. 2

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ELECTROMAGNETIC RELAY

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This invention relates to an electromagnetic relay.

Many electromagnetic relays of the kind employed as motor-starting relays often have the disadvantage that their operation is entirely dependent upon the position in which the relay is mounted. Moreover, such relays are often not sufficiently precisely adjustable with respect to the current values at which actuation of the relay contacts will take place and also the sensitivity cannot always be easily adjusted.

Accordingly among the several objects of the invention is the provision of an improved construction of an electromagnetic relay, which obviates or at least minimizes the above-mentioned disadvantages.

Other objects will be in part apparent and in part pointed out hereinafter.

Briefly according to the invention the relay is provided with a rotatable armature, which in the nonenergized state is subject to the tension of a spring acting thereon biasing the armature into a non-aligned position with respect to the poles of the electromagnet.

A part of the shaft or spindle which mounts the armature for rotation is provided with a portion of substantially rectangular cross-section which is engaged on opposite sides thereof by the legs of a U-shaped leafspring extending perpendicularly to the axis of rotation of the armature. Each of the legs of the spring carry, at their free ends extending past the armature shaft, a movable electrical contact. The operation of the relay according to the present invention is wholly independent of the position in which is is mounted.

The present invention also provides means for adjusting the sensitivity of the relay with precision, which means includes a coil spring having a portion extending perpendicularly to and fastened at its inner end to one of the ends of the armature shaft, with the outer end of the spring fastened to a coaxial adjusting screw adjacent the periphery thereof, which screw is threaded into the frame of the relay.

The invention will now be further described with reference to the drawing, in which there is represented one embodiment of an electromagnetic relay according to the invention, in which:

FIGURE 1 shows a section of the relay along the plane determined by the axis of the electromagnet and the axis of the rotatable relay armature which extends perpendicular thereto; and

FIGURE 2 represents a section along plane II—II of FIGURE 1.

The represented relay is disposed in a housing which consists of a cover or cap 1 and a base 2 form fitting therein, and which has at each end thereof an upstanding part 3 extending perpendicular to base 2, and by which the base 2 is guided into oriented position within the cover or cap 1.

Disposed within the cover or cap 1 is an electromagnet which consists of a coil 4 and a core 5, on whose ends there are fastened lamellar pole-pieces 6, which, when

the housing is closed, extend along and are maintained in position by the inner side of the upstanding parts 3 of the base.

Between the free ends of the pole pieces 6 there is positioned an armature 7, formed of a bar or strip of mild steel which is rotatable about an axle or shaft 8 extending perpendicular to the axis of the core 5, with the ends of the shaft 8 rotatably supported or journalled for rotation in the base 2 and in a crosspiece disposed between the upstanding parts 3 as shown in FIG. 1. In the nonenergized state of the relay the strip-form armature 7 is held by spring means to be described below, in a position in which the longitudinal axis of this armature forms a fairly small angle with the plane of the drawing, in such a way that the left end of the armature is disposed above this plane and the right end below this plane (see FIGURE 1).

A cam element 9 of susbtantially rectangular cross section is positioned between armature 7 and base 2 and is rigidly mounted on the shaft 8 for rotation therewith as shown in FIG. 2. Element 9 is so mounted that in one direction, element 9 is asymmetrical with respect to this shaft 8 (see FIGURE 2). The element 9 is disposed between and surrounded by the legs of a double-curved or U-shaped leaf spring 10, the bight portion of which engages with and is disposed about an upstanding post 11, provided by base 2 and disposed in an opening in one of the parts 3 as shown in FIG. 2. The legs of spring 10 bias element 9 for movement to the position shown in FIG. 2 in which the armature 7 is biased to the non-energized, non-aligned position described above. The legs of the leaf spring 10 are spring biased for movement toward each other and each of the legs respectively, carry at their free outer ends, an electrical contact 12, which constitute the movable contacts of the relay. The relay also includes a pair of stationary electrical contacts 13 secured to suitable terminals on base 2 and positioned for engagement with movable contacts 12 as shown in FIG. 2.

When coil 4 of the relay is energized by current of a predetermined value the armature 7 will rotate (against the bias of spring 10) in such a way that the longitudinal axis of the armature 7 comes to lie in the plane of the drawing in which position the longitudinal axis is aligned with the pole-pieces 6. Armature 7 in rotating from the non-energized, non-aligned or from the starting position of the armature shown in FIGURE 1, to the energized-aligned position described above, causes element 9, to rotate counterclockwise from the FIG. 2 position to spread the legs of the leaf spring 10 apart and move the contacts 12 into contact with the stationary contacts 13. The asymmetrical position of the element 9 with respect to the axle or shaft 8 (as shown in FIG. 2) compensates for the fact that the corner of the element 9 which moves the upper leg of the leaf spring 10 (as shwon in FIG. 2) is farther from the curved end or bight portion of the said spring than the corner which acts on the lower leg of the leaf spring 10 and advantageously assures that both of the movable contacts 12 are displaced by the same distance from the starting position shown in FIGURE 2.

In order to be able to easily adjust the sensitivity of the above-described relay, externally of the relay, a coil spring 15 is disposed on the end of the axle or shaft 8 which extends through the base 2 into the central bore

of a projection 14 formed on the base 2. Coil spring 15 is rigidly connected at its inner end, with the corresponding end of the axle 3, and at its outer end, it is fastened to the inner wall of an adjusting screw 16, which is threaded into the threaded central bore of the projection 14. In this way, a controllable torsion couple can be exerted on the armature axle or shaft 3 for adjusting the sensitivity of the relay.

Finally, for easy and quick mounting of the relay, there is provided a bow or bracket 17 which is provided with mounting holes 18. Each of the legs 19 of this bracket is provided with an opening, receives and interfits with correspondingly-shaped projections on the cap 1 for snap mounting of the bracket on the cap or housing 1 of the relay.

It is to be understood that the execution details of the described relay may be modified in various manners without thereby departing from the framework of the invention.

I claim:

1. An electrical switching device comprising a housing, a coil and a pair of pole pieces; an armature disposed within said housing intermediate said pole pieces; said armature being in a magnetic circuit with said coil and pole pieces; shaft means mounting said armature for rotation about an axis which is substantially perpendicular to the longitudinal axis of said coil and for rotation between a first position in which said armature is aligned with said pole pieces and a second position in which said armature is out of alignment with said pole pieces; substantially U-shaped electrically conductive spring means including a pair of legs interconnected adjacent one end thereof by a bight portion; said shaft means including a member of substantially rectangular cross section rotatable in response to rotation of said armature; said substantially rectangular member being disposed intermediate the legs of said electrically conductive U-shaped spring means; said legs being biased for movement toward each other and into engagement with said substantially rectangular portion; each of said legs adjacent the other ends thereof carrying an electrical contact positioned for engagement with a respective one of a pair of stationary electrical contacts mounted within said housing.

2. The switching device as set forth in claim 1 and wherein said substantially rectangular member is mounted asymmetrically with respect to said shaft means whereby to effect substantially equal displacement of each of said legs of said U-shaped spring means when said rectangular portion rotates in response to rotation of said armature when said coil is energized by current of a predetermined value.

3. The switching device as set forth in claim 1 and including spring means connected with said shaft means urging said armature for rotation to said second position.

4. The switching device as set forth in claim 3 and wherein said last named spring means is also connected with an adjusting screw threadedly engaged with said housing and accessible exteriorly of said housing.

5. The switching device as set forth in claim 4 and wherein said last named spring means comprises a coil spring.

6. A switch comprising a housing; first and second electrical contacts mounted in said housing, one of which is movable into and out of engagement with the other of said contacts; a movable armature; rotatably mounted shaft means mounting said armature for rotation with said shaft means in a first direction for effecting contact engagement and in a second direction opposite to said first direction for effecting contact disengagement; magnetic means for moving said armature in said first direction at predetermined electrical conditions; cam means mounted for rotation with said shaft means and armature; means mounting said first contact and comprising a resilient spring member biased into engagement with said cam means whereby rotation of said armature in said first direction causes said cam means to displace said resilient spring member to effect contact engagement and rotation of said armature in said second direction results in movement of said resilient spring member to effect contact disengagement; and biasing means interconnected with said shaft means for biasing said armature for movement in said second direction, and said biasing means being movable relative to said shaft means for adjusting the bias exerted by said biasing means on said armature.

7. A switch comprising a housing; first and second electrical contacts mounted in said housing, one of which is movable into and out of engagement with the other of said contacts; a movable armature; rotatably mounted shaft means mounting said armature for rotation with said shaft means in a first direction for effecting contact engagement and in a second direction opposite to said first direction for effecting contact disengagement; magnetic means for moving said armature in said first direction at predetermined electrical conditions; cam means mounted for rotation with said shaft means and armature; means mounting said first contact and comprising a resilient spring member biased into engagement with said cam means whereby rotation of said armature in said first direction causes said cam means to displace said resilient spring member to effect contact engagement and rotation of said armature in said second direction results in movement of said resilient spring member to effect contact disengagement; biasing means interconnected with said shaft means for biasing said armature for movement in said second direction; and adjustable screw means interconnected with said biasing means and engaged with and accessible exteriorly of said housing to vary the bias exerted by said biasing means on said armature.

8. A switch comprising a pair of stationary contacts; a pair of movable contacts positioned for movement into and out of engagement with said stationary contacts; a substantially U-shaped electrically conductive spring member comprising a pair of legs each having a respective one of said movable contacts mounted on one end thereof and a bight portion interconnecting the other end of each of said legs; cam means having a substantially rectangular cross section and being disposed intermediate the legs of said substantially U-shaped spring means; said legs being biased for movement toward each other and into engagement with said cam means; shaft means mounting said cam means for rotation in a first direction for camming said movable contacts for movement in one direction relative to said stationary contacts against the bias of said legs, and in a second direction for moving said movable contacts in an opposite direction relative to said stationary contacts; and biasing means interconnected with said shaft means for biasing said cam means for movement in said second direction, said biasing means being movable relative to said shaft means for adjusting the bias exerted by said biasing means.

9. The switch as set forth in claim 8 and wherein said one direction is in a direction toward engagement with said stationary contacts and said opposite direction is in a direction away from said stationary contacts.

10. The switch as set forth in claim 8 and wherein said substantially rectangular cam means is mounted asymmetrically with respect to said shaft means whereby to effect substantially equal displacement of each of said legs of said U-shaped spring member upon rotation of said cam means.

11. An electrical switching device comprising a housing; an armature disposed within said housing; magnetic means including a coil and a pair of pole pieces for causing rotary movement of said armature at predetermined electrical conditions; shaft means mounting said armature for rotation about an axis which is substantially perpendicular to the longitudinal axis of said coil; a substantially U-

shaped electrically conductive spring member including a pair of legs interconnected at one end thereof; cam means on said shaft means having a substantially rectrotation of said armature; said cam means being disposed intermediate the legs of said spring member; said legs being biased for movement toward each other and into engagement with said cam means; and an electrical contact mounted adjacent the other end of each of said legs for engagement with a respective one of a pair of stationary electrical contacts mounted within said housing.

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