March 10, 1942. H. T. SEELEY 2,275,924

ELECTROMAGNETIC DEVICE

Filed April 12, 1939

Fig.1.

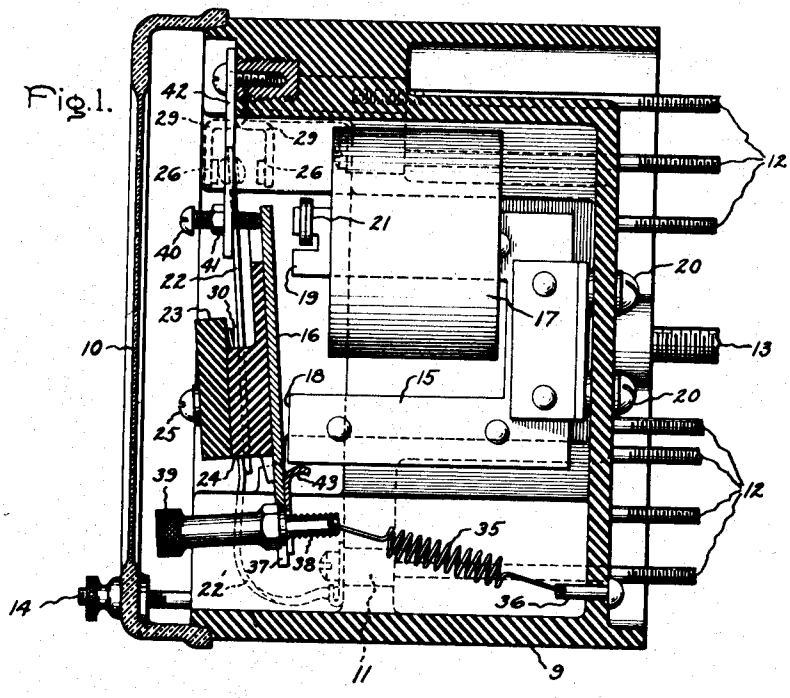


Fig.2.

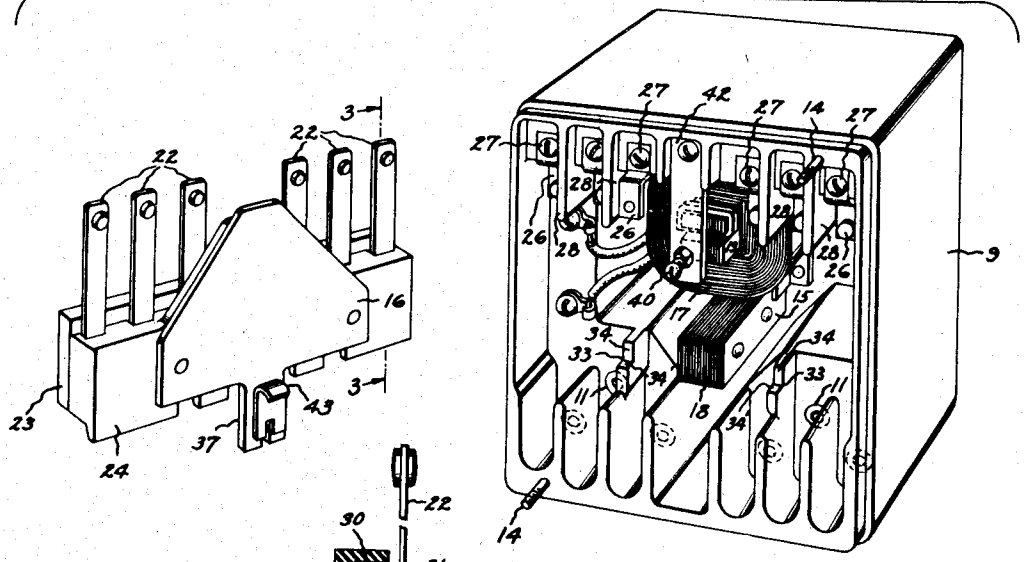
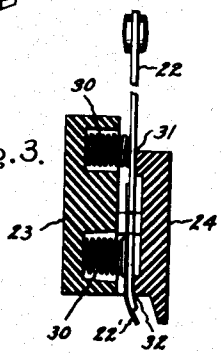


Fig.3.



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ELECTROMAGNETIC DEVICE

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10 Claims. (Cl. 200—87)

My invention relates to improvements in electromagnetic devices and more particularly electromagnetic multi-contact relay devices and especially electromagnetic devices for alternating current circuits.

In electromagnetic devices, and particularly relays of the hinged armature type, the pole faces and movable parts have been considered to require a nicety of alignment which, although costly, is necessary to assure a stable bearing in the attracted position of the armature. Otherwise the armature, while in the attracted position, is not sufficiently stable to avoid undue hum or chatter in consequence of current variation with alternating current operation. This produces not only a disagreeable noise but also causes an undesirable wear of the parts. Moreover, in multi-contact relay devices unbalance in pressure between contacts due to either structural variations or desired changes in arrangement of circuit closing and opening sequences of the contacts requires a stable armature condition in both the attracted and unattracted positions, and particularly in the attracted position, with the use of alternating current. Also, any pin type of bearing requires more refinement in structural details and, in general, more parts as well as greater complexity in assembly and replacement of parts.

In accordance with my invention, I eliminate precision finishing and reduce cost by an improved electromagnetic device in which the armature mounting provides the maximum of stability by virtue of the principle that three triangularly spaced points determine a plane and thus provide a uniform and stable bearing. Further, in accordance with my invention, I provide an electromagnetic device with an armature mounting which, in order to obtain simplicity and uniformity in structure as well as ease in assembly and in replacement of the parts, eliminates the pin and socket type of pivotal mounting and consequently the wear and erratic operation possible therewith. Also, in accordance with my invention, I provide an electromagnetic device with a long life, quiet action, and a friction reducing armature mounting in which the relative motion of the parts moving over each other at the bearing surfaces is made as small as possible. Likewise, in accordance with my invention, I provide an improved electromagnetic multi-contact relay device whose contacts may be quickly and easily arranged in a variety of ways for circuit opening or circuit closing action, or both, in the attracted and unattracted positions of the armature with a maximum of stability in both positions. These and other objects of my invention will appear in more detail hereinafter.

My invention will be better understood from the following description when considered in connection with the accompanying sheet of drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawing Fig. 1 represents a vertical sectional elevation of an electromagnetic multi-contact relay device embodying my invention; Fig. 2 is an exploded perspective view of the embodiment of my invention shown in Fig. 1; and Fig. 3 is a detail partly in section on the line 3—3 of Fig. 2 of the contact mounting shown in Figs. 1 and 2.

For the purpose of illustrating my invention, I have shown a multi-contact electromagnetic relay device comprising a case 9 within which the electromagnet and contact structure may be housed and closed in by a cover 10. For simplicity and economy the case 9 may be made of moulded, insulating material, examples of which are well known to the art with moulded-in-place inserts, sockets or the like 11 for the reception of terminal studs 12, panel mounting studs 13, cover screws 14, etc. The cover 10 may also be of a moulded, transparent material, examples of which are well known to the art.

As shown, the electromagnetic structure comprises a magnetic member 15, a cooperating armature 16, and an energizing winding 17. The magnetic member 15 may be U-shaped, as shown, with two polar projections or faces 18 and 19 presented to the armature 16. As shown, the magnetic member 15 is secured to the rear wall of the case by suitable means, such as screws 20, and for alternating current use is laminated and has one pole face 19 provided with a flux shading winding 21 to reduce chatter or hum.

As illustrated, the contact structure comprises a plurality of contacts which are resiliently mounted in a contact carrier shown as comprising two cooperating, insulating members 23 and 24 suitably secured to each other and the armature 16 as by screws 25. The contacts 22 may be interconnected with their respective terminals 12 by suitable means, such as flexible connections 22'. Cooperating stationary contacts 26 suitably secured to the case 10 as by screws 27 between arc barriers 28 in the case have an offset 29 such that they can be arranged either circuit closing or circuit opening in the attracted position of the armature. Thus in the illustrated arrangement I have shown six pairs of cooperating

contacts 22, 26 of which, as viewed in Fig. 2, the three to the right of the magnetic member 15 and the second and third to the left are circuit closing and the first to the left is circuit opening in the attracted position of the armature. For pressure equalization in the two positions of the armature the contacts 22 may be controlled by springs 30 in the contact-carrying member 23 with the contact 22 arranged to fulcrum at the point 31 on the contact-carrying member 24 in the unattracted position of the armature and at the point 32 in the attracted position of the armature. With this arrangement and suitable control of the compressions of the springs 30 high and substantially equal contact pressures may be obtained in the attracted position of the armature 16 without the necessity of having the armature work against a strong spring bias when in the unattracted position. This arrangement also insures substantially equal, although lower, pressures on all contacts closed in the unattracted position.

Further, in accordance with my invention, I provide a stable three-point bearing for the armature in the attracted position. As shown, this stable bearing comprises three triangularly spaced points or bearing surfaces so disposed as to insure stability regardless of how many of the cooperating pairs of contacts 22 and 26 are circuit opening or circuit closing in the attracted position of the armature. Thus two of the supports may be notches 33 in the material of the case 9 and the third support may be, for example, the pole face 19 although another third supporting means could be substituted in the case for the pole face 19 in the event that it was desired to have a predetermined air gap at this pole face with the armature in the attracted position. As shown, the notches 33 are L-shaped and open toward the pole piece 19. Also, as shown, these notches include an angle of substantially 90 degrees plus the angular travel of the armature. For the best results in stability and bearing, the faces 34 of the notches 33 are approximately coplanar with the third support which, in the illustrated embodiment of my invention, is the pole face 19. The notches 33 are positioned on each side of the magnetic member 15 and are widely spaced therefrom relatively to the third bearing point or pole face 19 to provide stability.

The armature 16 may be of flat magnetic material, as shown, with one edge bearing on the nearly horizontal faces of the notches 33 in the unattracted position as more clearly shown in Fig. 1. The movement of the armature to the unattracted position may be effected by a biasing spring 35 which also prevents the armature from sliding forward when the magnet is deenergized. This may be anchored to the case by any suitable means, such as a rivet 36, insertable through a hole in the case and to a depending projection or portion 37 of the armature 16 by a flat, threaded member 38 which engages a slot in the portion 37 of the armature and which can be moved relatively to the armature by turning an adjusting screw 39 which engages a recess in the portion 37 of the armature. The arrangement of the biasing spring is such that, by pulling outwardly while holding the armature against the faces 34 of the notches 33, one can release the member 38 and the adjusting screw 39 from the slot in the depending portion 37 of the armature. In order to adjust the position of the armature for contact closure in the unattracted position, there may be provided suitable means, such as a screw 40 and lock nut 41, which are carried by a depending portion 42 suitably secured to the case 9. In order to prevent sticking of the armature 37 the lower leg of the magnetic member 15 is made too short to reach the armature.

With the arrangement shown, it will be noted that the armature 16 pivots directly and solely on the supports or notches 33 without the need for any pin and socket bearings which tend to wear more because of the greater relative travel of the bearing surfaces. However, upon being drawn to the attracted position, the armature comes to a full and even bearing against the faces 34 of the notches 33 and the pole face 19. To prevent dislocation in handling or shipment, the armature 16 may be provided with a projecting portion 43 which, in the unattracted position of the armature, engages the lower side of the magnetic structure 15 as viewed in Fig. 1.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electromagnetic device comprising a magnetic member having two polar projections, two L-shaped supports positioned below one of said polar projections and spaced from each other and from said member with their openings toward said one of said polar projections, and a cooperating armature member pivoting directly and solely on said supports and in the attracted position abutting said supports and said one of said polar projections.

2. An electromagnetic device comprising a case provided with two substantially parallel L-shaped spaced notches, a stationary magnetic member mounted in said case and comprising two pole faces one of which is approximately coplanar with one of the faces of each of said notches, and an armature of flat magnetic material pivoting directly and solely in said notches and in the attracted position engaging said one pole face, said notches and said one pole face forming a stable three-point bearing for the armature in the attracted position.

3. An electromagnetic device comprising a magnetic member having two spaced pole faces, a support of non-magnetic material for said magnetic member provided with two spaced notches positioned on opposite sides of the magnetic member and spaced therefrom, each of said notches having a face approximately coplanar with one of said pole faces, and an armature of flat magnetic material having one edge pivoting directly in said notches and in the attracted position abutting said one pole face, said notches and said one pole face providing a stable three-point bearing for the armature in the attracted position.

4. An electromagnetic device comprising a magnetic member having two spaced pole faces, a support of nonmagnetic material for said magnetic member provided with two spaced notches positioned on opposite sides of the magnetic member and spaced therefrom, each of said notches having a face approximately coplanar with one of said pole faces, an armature of flat magnetic material having one edge pivoting directly in said notches and in the attracted posi-

tion abutting said one pole face, said notches and said one pole face providing a stable three-point bearing for the armature in the attracted position, and means for limiting the movement of the armature in the unattracted direction.

5. An electromagnetic device comprising a magnetic member having two polar projections, a support for said member provided with two L-shaped notches spaced from each other and from said member and open toward one of said polar projections and a cooperating armature member pivoting directly and solely in said notches and in the attracted position abutting said notches and said one of said polar projections in a stable three-point bearing.

6. An electromagnetic device comprising a magnetic member having two polar projections, a support for said member provided with two L-shaped notches positioned below one of said polar projections and on opposite sides of said member and open toward one of said polar projections and a cooperating armature pivoting directly and solely in said notches and in the attracted position abutting said notches and said one of said polar projections in a stable three-point bearing.

7. In an electromagnetic multi-contact relay device, a magnetic member having a polar projection, a case for said member provided with two notches positioned below said polar projection and on opposite sides of said member, an armature pivoting directly and solely in said notches and in the attracted position engaging said polar projection and said notches in a stable three-point bearing, a plurality of independent contacts carried by said armature, at least two of said contacts being mounted for movement on opposite sides of said member, and cooperating contact means mounted in said case for engagement by said movable contacts in the attracted position of the armature.

8. In an electromagnetic multi-contact relay device, a magnetic member having a pole face, a case of insulating material for said member provided with two notches positioned below said polar projection and on opposite sides of said member, each of said notches having a face approximately coplanar with said pole face, an armature of flat magnetic material having an edge pivoting directly in said notches and in the attracted position abutting said pole face and said coplanar notch faces in a stable three-point bearing, a plurality of independent contacts mounted resiliently on and carried by said armature, at least two of said contacts being mounted for movement on opposite sides of said member and cooperating contact means mounted in said case for engagement by said movable contacts in the attracted position of the armature.

9. An electromagnetic device comprising a magnetic member having a polar projection, three triangularly spaced supports, two of which are formed as L-shaped notches positioned below said polar projection and on opposite sides of said member and spaced therefrom with their openings toward said polar projection, and a cooperating armature member pivoting directly in said two L-shaped notches and in the attracted position abutting all three of said supports.

10. An electromagnetic device comprising a magnetic member having a polar projection, three mutually substantially equidistant supports, two of which are formed as L-shaped notches positioned below said polar projection and on opposite sides of said member and spaced therefrom with their openings toward said polar projection and exceeding 90° by a predetermined amount, and a cooperating armature member pivoting directly in said notches and in the attracted position abutting all three of said supports.

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