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Electromagnetic Relay

Field Of The Invention

This invention concerns an electromagnetic relay, and more specifically, an internal configuration of such a relay which allows the yoke and the core to be securely fixed to the base with a high degree of precision in the assembly process.

Background Of The Invention

An example of an existing electromagnetic relay is shown in Figure 4. In order to reduce the number of parts, coil 2 is wrapped around a spool 1a which is formed as a single piece with base 1. An L-shaped yoke 3 is inserted from above into a hole provided in the center of the aforesaid base 1. A core 4 is inserted from above into the central hole 1b of the aforesaid spool 1a. The protruding upper end of the core serves as magnetic pole 4a. The protruding lower end, 4b, is caulked to the horizontal portion of the aforesaid yoke 3 to form electromagnetic element 5.

In this electromagnetic relay, movable member 7, which is supported by hinged spring 6 on the upper end of the aforesaid yoke 3 in such a way that the member is free to move, is made to rotate by the presence or absence of excitation in the aforesaid electromagnetic element 5. The rotation of member 7 causes movable contact terminal 8, which is anchored in the aforesaid base 1, to rotate. The movable contact 8a on this terminal is caused to make contact with or move away from fixed contact 9a on fixed contact terminal 9.

In the electromagnetic relay described above, reinforcement ribs cannot be created on the upper surface of base 1 to secure

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the attachment of yoke 3 to the base, because this would interfere with the wrapping of coil 2 on spool 1a. For this reason, the supporting length of a yoke 3 with the base 1 is necessarily limited, and it is impossible to securely attach yoke 3 to base 1 with a high degree of precision. As a result, the operating characteristics are liable to vary.

Another problem is the length of core 4. In order for core 4 to be forced into central hole 1b of spool 1a and fixed there, the hole must be formed with a high degree of precision. This makes manufacture of the parts extremely problematical. Even when a hole 1b has been created into which the entirety of core 4 can be inserted and fixed, a great deal of force is needed to drive the core into the hole. This results in a difficult assembly process. For this reason, existing relays had a central hole 1b which is formed so as to allow a microscopic space between the outer surface of core 4 and the inner surface of hole 1b. As a result, core 4 is liable to rattle, and it is not possible to attach either core 4 or yoke 3 securely to the base with any degree of precision. With this design, the operating characteristics are liable to vary.

Summary Of The Invention

The object of this invention is to provide an electromagnetic relay whose core and yoke could be securely attached to the base with a high degree of precision so that the operating characteristics of the relay would not vary.

To achieve the objectives outlined above, the electromagnetic relay of this invention is designed as follows. A coil is wrapped around a spool formed integrally with a base. An iron core is inserted from above into the central hole in the aforesaid spool. A magnetic pole is formed on the upper end of the core which protrudes from the spool. The lower protruding end of the core forms an electromagnetic element which is caulked

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to the horizontal portion of an L-shaped yoke.. This yoke is inserted from below into a through hole in the aforesaid base. The presence or absence of excitation causes the contact to open or close. Several bosses are provided on the interior surface of the central hole in the aforesaid spool. These bosses, which serve as supports, are in the vicinity of the lower edge of the hole, and may be provided in other places as well.

The aforesaid bosses may alternatively be provided on the interior surface of the hole in the aforesaid spool between the aforesaid core and yoke.

The angle between two of the aforesaid bosses, which are placed so that they are linearly symmetric with respect to a center line perpendicular to the axis of the aforesaid central hole, may be between 80 and 130°.

Brief Description of The Invention

Figure 1 is a perspective drawing of an electromagnetic relay which is an ideal embodiment of this invention.

Figure 2 is a perspective drawing of the base of the relay pictured in Figure 1.

Figure 3 also shows the base pictured in Figure 2. (a) is a cross section taken along line III-III. (b) shows the bottom surface, and (c) is an enlarged view of the essential components.

Figure 4 is a cross section of an electromagnetic relay which is an example of the prior art.

Detailed Description Of The Invention

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We shall next discuss an ideal embodiment of this invention with reference to appended Figures 1 through 3.

The electromagnetic relay of this invention has an electromagnetic element 23, which comprises spool 11 and base 10, of which spool 11 is an integral part. As can be seen in Figure 2, the aforesaid spool 11 has a central hole 12, into which core 22, which will be discussed below, is to be inserted. On the upper end of the spool is rim 13. Near the base of the aforesaid spool 11 is slot 10a, into which yoke 21, which will be discussed below, is to be inserted.

As can be seen in Figure 3, the aforesaid spool 11 has two bosses 14 which are formed on the interior surface of hole 12 at its lower edge, between yoke 21 and core 22. These bosses 14, as shown in Figure 3 (c), are in locations which are symmetrical with respect to center line 12a and form two angles of 120° each with that line. When core 22 is inserted into the central hole 12 and comes to contact with the bosses, the bosses will be deformed by the pressure of the core 22. Thus the core 22 can be held tightly by these bosses. Another purpose of these bosses is to separate core 22 as far as possible from the vertical portion of yoke 21 so as to reduce the flux leakage and ensure that the relay will remain stable in its assembled state.

It is not critical that there be two bosses 14. One boss would also be acceptable, as would three or more. These bosses 14 must be positioned so that the angles discussed above are no greater than 180°, and they should at least exceed 90°.

Bosses 14 may also extend continuously from the lower edge of hole 12 to its upper edge. By adjusting the length of bosses 14 in an appropriate fashion, we can adjust the amount of force needed to drive core 22 into the hole. This has the effect of simplifying the design.

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Coil 20 is wrapped around the aforesaid spool 11, and yoke 21, which has been bent into an L shape, is inserted from bottom into through hole 10a in the aforesaid base 10. The upper end of the core which protrudes from the hole serves as magnetic pole 22a. The lower end of the core is caulked to the horizontal portion of the aforesaid yoke 21 (not pictured) to form an electromagnetic element 23 which is integral to base 10.

Movable member 24, which is bent into the shape of a shallow V, is supported on the upper end of the aforesaid yoke 21 by hinged spring 25 in such a way that member 24 is free to move. Movable Terminal 26, the terminal for movable contact 26a, and fixed terminal 27, the terminal for fixed contact 27a, are forced into and secured in slots 10b and 10c in the aforesaid base 10. The upper end 26b of the aforesaid movable contact terminal 26 is bent outward.

Card 30, on whose front and rear surfaces are protrusions 31 and 32, is placed vertically between the vertical portion of movable member 24 and movable contact terminal 26. Protrusion 31 slides along portion 26b of movable contact terminal 26, and it engages in the aperture in terminal 26. Protrusion 32 on the aforesaid card 30 engages in the aperture (not pictured) in the vertical portion of movable member 24. This completes the assembly of the internal components.

Components 28 in Figure 1 are the coil terminals. The wire drawn out from coil 20 is tied and soldered to the horizontal ends of these terminals, which are then bent toward the sides.

In this embodiment, there are two rounded projections 33 at the base of protrusion on card 30 to prevent the protrusion from getting stuck in the aperture. This insures that card 30 will not get hung up on movable member 24 and simplifies the assembly process.

When no voltage is applied to coil 20, electromagnetic

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element 23 is not excited, and the spring force of movable contact terminal 26 pushes card 30 toward element 23. Movable contact 26a moves away from fixed contact 27a.

When voltage is applied to the aforesaid coil 20 and electromagnetic element 23 is excited, the horizontal portion of movable member 24 is drawn toward magnetic pole 22a of core 22. Member 24 rotates in opposition to the spring force of movable contact terminal 26, which is pushed by card 30 so that its terminal 26a comes in contact with fixed contact terminal 27a. The horizontal portion of movable member 24 adheres to pole 22a of core 22.

When voltage is no longer applied to the aforesaid coil 20, the spring force of movable contact terminal 26 pushes card 30 back, movable member 24 rotates in the opposite direction, and movable contact 26a moves away from fixed contact 27a and reverts to its original position.

As should be clear from the above explanation, the electromagnetic relay of this invention has several bosses near the lower edge of the hole in the center of the spool, which is formed integrally with the base. These bosses, which support the core, allow the core to be securely immobilized in the hole in the spool with a high degree of precision during assembly. They also allow the yoke to be securely caulked to the core with a high degree of precision so that the operating characteristics of the relay will not vary.

These bosses are provided in the vicinity of the lower edge of the hole in the spool between the core and the yoke. This allows the core to be held well away from the yoke so as to reduce flux leakage and prevent any decrease in attraction.

The angle between two bosses which are symmetric with respect to a center line orthogonal to the axis of the aforesaid hole is between approximately 80 and 130°. This scheme allows

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the cora to be held in the hole in the spool in a stable state.

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What is claimed is:

1. An electromagnetic relay, comprising:

a coil wrapped around a spool formed integrally with a base;

a metal core inserted from above into a central hole in said spool;

a magnetic pole formed on an upper end of said metal core which protrudes from said spool;

a L-shaped yoke inserted from bottom into said base, and said L-shaped yoke fixed to a lower protruding end of said metal core;

a movable member being free to move which is supported on upper end of said yoke by a hinged spring;

a movable contact terminal having a movable contact actuated by said movable member;

a fixed terminal having a fixed contact to accept said movable contact; and

a boss on an interior surface of said central hole in said spool in order to hold said metal core in said central hole in a stable stage.

2. An electromagnetic relay according to claim 1, wherein said boss is in a vicinity of said lower edge of said central hole in said spool.

3. An electromagnetic relay according to claim 1, wherein said boss is provided between said core and said L-shaped yoke.

4. An electromagnetic relay according to claim 1, wherein a plurality of said boss are provided between said core and said L-shaped yoke.

5. An electromagnetic relay according to claim 4, wherein said plurality of said boss are linearly symmetric with a center line perpendicular to an axis of said central hole.

6. An electromagnetic relay according to claim 5, wherein

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an angle between said plurality of said boss is between 80 and 130°.

7. An electromagnetic relay according to claim 1, wherein said boss is formed integrally with said spool.

8. An electromagnetic relay according to claim 1, wherein said boss is deformed by a pressure of said metal core so as to hold said metal core tightly when said metal core is inserted into said central hole and comes to contact to said boss.

9. An electromagnetic relay according to claim 1, wherein a cross section of said boss is triangle.

10. An electromagnetic relay according to claim 1, wherein a cross section of said boss is half circle.



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