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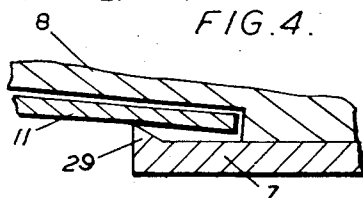
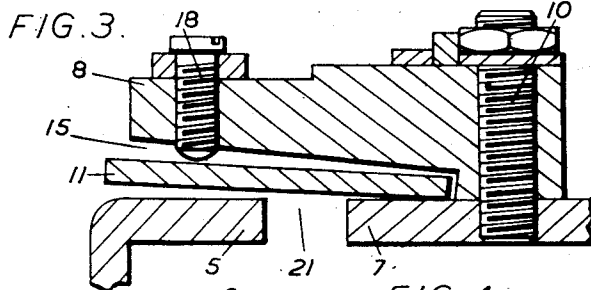
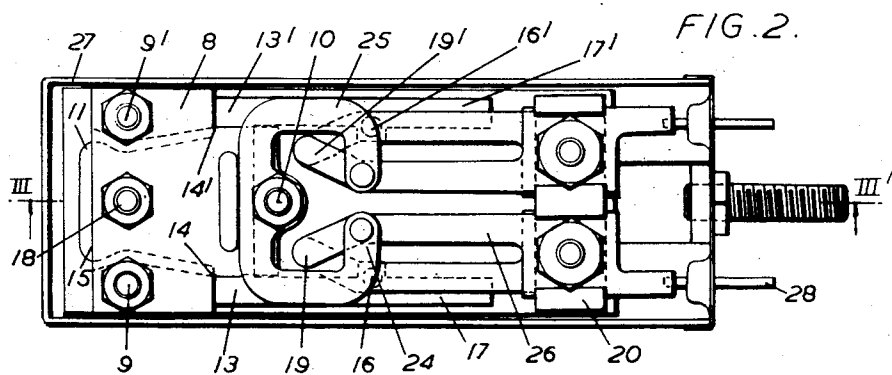
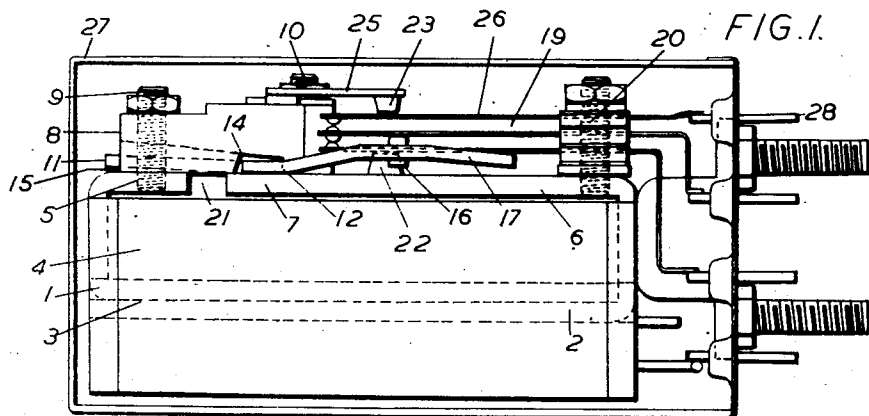
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ELECTROMAGNETIC LIGHT-CURRENT CONTACT-MAKING RELAYS

Filed Sept. 18, 1952

2 Sheets-Sheet 1



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FIG. 5.

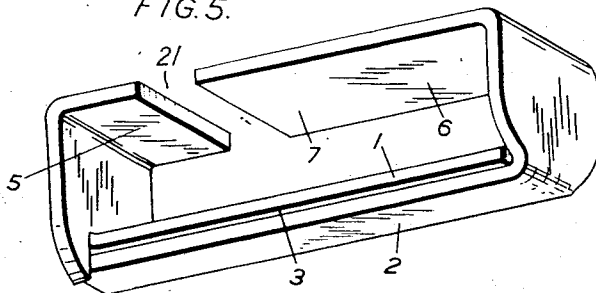


FIG. 6

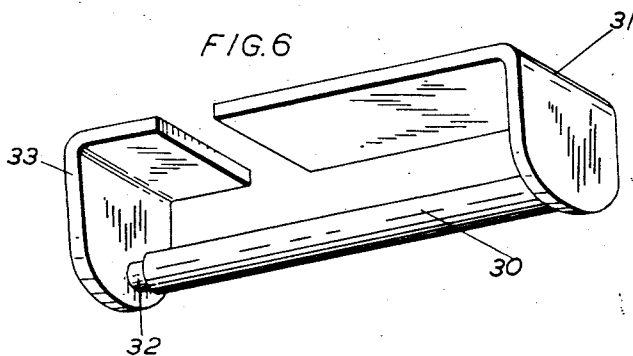
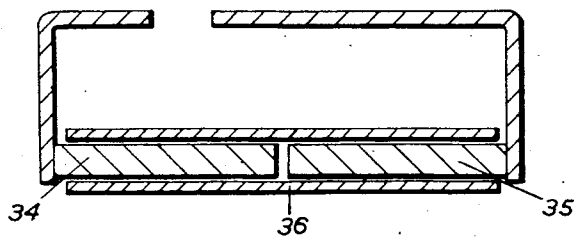


FIG. 7.



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## ELECTROMAGNETIC LIGHT-CURRENT CONTACT-MAKING RELAYS

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Claims priority, application Great Britain  
September 24, 1951

3 Claims. (Cl. 317-165)

This invention relates to electromagnetic light-current contact-making relays.

The main feature of the invention is an electromagnetic relay in which the core consists of a plurality of parts, not physically connected but in close contact with one another so as to form a low reluctance magnetic junction.

The invention will be described with reference to the accompanying drawings in which:

Fig. 1 shows a view in elevation of a relay according to the present invention, the side portion of the container having been removed.

Fig. 2 shows a plan view of the relay, the top of the container having been removed.

Fig. 3 is a section of part of the relay, along the line 111-111' of Fig. 2.

Fig. 4 shows an alternative method of positioning two of the members of Fig. 3.

Figs. 5, 6 and 7 show alternative arrangements of the core of the relay.

In a relay having a cylindrical winding and a substantially flat armature lying parallel to the axis of the core, it is desirable that the core passing through the winding and the pole-pieces bridged by the armature should be formed from one piece of magnetic material, so that the reluctance in this part of the magnetic circuit is reduced to the minimum for a relay of the required dimensions. In general, it is not practicable to achieve this as it implies forming the pole-pieces after the coil is wound and assembled, and in previous designs the core and pole-pieces have been provided by two parts which are joined together by screws or nuts, or by riveting.

The reluctance of the junction is then dependent on the degree of contact between the mating surfaces of the parts and any unavoidable gap represents a reluctance equivalent to a length of magnetic material of corresponding cross-section given by the product of the gap length, and the effective permeability of the magnetic material, the latter being of the order of 2000 to 5000. It is, therefore, difficult to ensure that the required accuracy of parts and security of riveting is maintained in production to keep this reluctance consistently low.

It is proposed to overcome this difficulty by providing a yoke and core assembly consisting of two or more parts which overlap and are in close contact within, and throughout the length of the winding. With this arrangement it is no longer necessary for the parts to be mechanically joined by riveting or the like, as the reluctance presented by the junction between the parts is relatively low and not critically dependent on the degree of contact between them.

In this case the gap is effective over an area approximately equal to that of the surfaces in contact, and its effective length in terms of magnetic material of the cross-sectional area of the core will be reduced in the ratio of this area relative to the cross sectional area of the core. For a relay of conventional proportion the ratio would be of the order of 20:1, so that a gap of .010" could be accepted as equivalent to a riveted or screwed

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junction with an effective gap of .0005", which is a reasonable minimum for junctions of this nature. In practice, it should be possible to restrict the gap between the overlapping surfaces to considerably less than .010 and the reluctance of this magnetic circuit will then be reduced, with a corresponding improvement in efficiency. The invention will be described with reference to one particular embodiment consisting of a relay as disclosed in British Patent No. 723,806.

Referring to Fig. 1, this embodiment of the invention is seen to have a core consisting of two parts 1 and 2 having a low-reluctance magnetic junction at 3 within the winding 4. The forward end of the part 1 is bent upwards and rearwards to form a pole-piece at 5 while the part 2 is bent so as to form the yoke 6 and a pole-piece at 7.

The pole-pieces 5 and 7 are secured in alignment by a bridge-piece 8. The pole-pieces are secured to the bridge-pieces by three bolts or studs, securely staked, seen in Fig. 2 at 9, 9' and 10. The bolt 10 also serves to secure the member 25, to be described later.

Referring again to Fig. 1, a substantially flat armature 11 rests on the yoke 6 at the point 12. The armature is shaped at 13 and 13' of Fig. 2 to co-operate with the slots 14 and 14' of the bridge-piece 8. In this way the armature is protected against excessive motion in its own plane. The forward part of the armature passes through the bridge-piece and protrudes from the opening 15. The contact springs are controlled by insulating studs 16 and 16' mounted on the limbs 17 and 17' of the armature 11. When the relay is not energized the armature rests against the adjusting screw 18 as shown in Fig. 3. The use of the screw facilitates any desired adjustment of the rest position of the armature. Alternatively, if the rest position of the armature be pre-determined this adjusting screw may be replaced by a fixed stud.

The contact spring-sets 19 and 19' are mounted in the insulating block 20 of Fig. 2. It has previously been customary to mount such blocks on the pole-piece 5, that is, adjacent to the pole gap. In order to reduce the dimensions of the relay the insulating block 20 is mounted directly on the yoke 6, at that end of the relay distant from the pole gap 21.

The upper-most and lower-most contact springs are outwardly tensioned against insulating stops such as 22 and 23 of Fig. 1. This arrangement is provided in order to minimise contact bounce. The stop 22 is mounted directly upon the yoke 6. The opposing stop 23 is mounted upon one limb 24 of the member 25. This member 25 is of a material possessing good elastic properties so that by bending this member the stop 23 may be made to exert any desired amount of spring pressure on the upper contact spring 26. In this way the contact-gaps may be readily adjusted. The whole assembly may be conveniently enclosed in a container 27, leads being brought out from the spring-sets to connectors, 28 for example.

An alternative pivoting arrangement for the armature is shown in Fig. 4. The armature rocks about a knife-edge 29 formed by shearing the edge of the pole-piece, being located against this edge by the bridge-piece 8.

The arrangement of the split-core will be more easily understood by reference to Fig. 5. The core-members 1 and 2 are seen disposed in parallel planes and each having a major surface in close contact with a major surface of the other.

An alternative arrangement of the split-core is shown in Fig. 6, where a tube-member 30 is mounted on the yoke 31 and a rod-member 32 on the piece 33. The rod-member 32 is shown fitting coaxially within the tube-member 30 in order to minimise the reluctance at the junction in the magnetic circuit. Fig. 7 shows in section

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a magnetic core in which two rod-members 34 and 35 are employed, each extending through one half of the length of the winding, and closely surrounded by a single tube-member 36. In both Figs. 6 and 7, the tube and rod-members have been shown having circular cross-section. Their cross-section could of course be of any convenient shape consistent with the formation of a good magnetic junction.

While the principles of the invention have been described above in connection with specific embodiments, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What we claim is:

1. An electromagnetic relay comprising a coil winding, an armature and a core, said core consisting of a pair of U-shaped parts, each part having a pair of limbs and a connecting portion, a first limb of each part forming part of said core and the other limb of each part forming a magnetic gap therebetween, said winding maintaining said first limbs in frictional securing engagement along substantially the entire axial length of said winding longitudinally in a first plane so as to form a low reluctance magnetic junction between said first limbs, the respective ends of said winding abutting against the opposite connecting portions of each U-shaped part, said gap lying in a plane parallel to said first plane, said armature adapted to complete said gap.

2. An electromagnetic relay comprising a coil winding, an armature and a core, said core consisting of a pair of U-shaped parts, each part having a pair of limbs and a connecting portion, a first limb of each part forming part of said core and the other limb of each part forming a magnetic gap therebetween, the first limb of a first one of said parts having a hollow portion with an inside diameter substantially equal to the outside diameter of the first limb of the second one of said parts, the first

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limb of said second part adapted to be telescoped coaxially within the hollow portion of said first part there to be retained by the frictional securing engagement between said parts along the axial length thereof thereby forming a low reluctance magnetic junction between said limbs, said winding adapted to be positioned coaxially around the outer surface of the hollow portion of said first part, the respective ends of said winding abutting against the opposite connecting portions of each of said U-shaped parts, said gap lying in a plane parallel to the common axis of said telescoped limbs, said armature adapted to complete said gap.

3. An electromagnetic relay comprising a coil winding, an armature and a core, said core comprising a paramagnetic sleeve and a pair of U-shaped parts, each part having a pair of limbs and a connecting portion, a first limb of each part having an outside diameter substantially equal to the inside diameter of said sleeve, said first limbs adapted to fit coaxially within said sleeve from opposite ends thereof and to have their corresponding free ends in mutual abutment within the sleeve, said first limbs adapted to be retained by the frictional securing engagement with said sleeve along the axial length thereof thereby forming a low reluctance magnetic junction between respective of said limbs and said sleeve, said winding adapted to be positioned coaxially around the outer surface of said sleeve, the respective ends of said winding abutting against the opposite connecting portions of each U-shaped part, said gap lying in a plane parallel to the common axis of said first limbs and said sleeve, said armature adapted to complete said gap.

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