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ELECTROMAGNETIC RELAY

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FIG. 1.

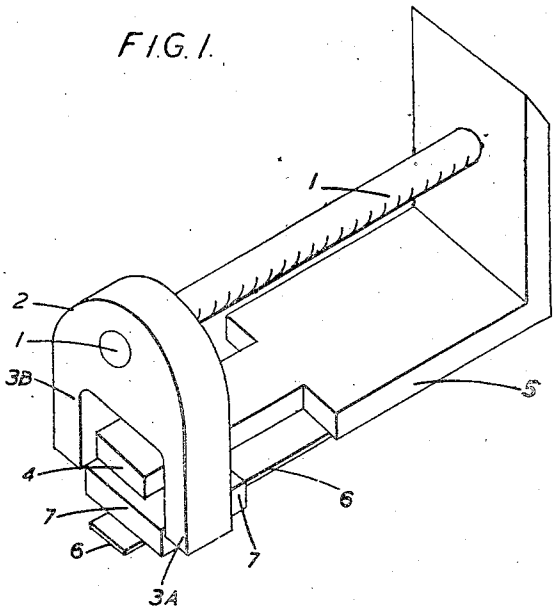
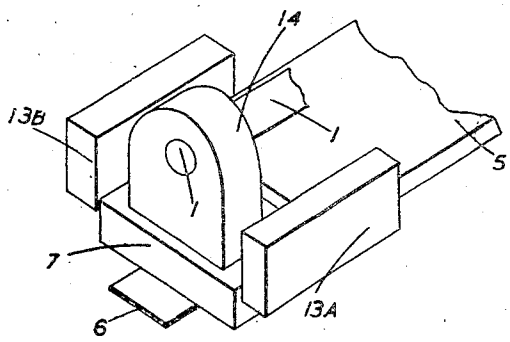


FIG. 2.



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ELECTROMAGNETIC RELAY

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8 Claims. (Cl. 175—338)

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The present invention relates to electromagnetic relays and is particularly concerned with the improvement of the magnetic circuit of vibrating relays.

The relays with which the invention is concerned are of the kind in which the armature is carried by an elastic reed adapted to execute free vibrations at some definite frequency, or to be driven by alternating current which is applied to an operating winding and which may have the same frequency as that natural to the reed. The reed may control contacts which are periodically operated thereby.

The invention is directed to the improvement of the magnetic circuit of the relay whereby the operating winding is enabled to exercise a better control over the reed.

According to the invention, there is provided a magnetic circuit for an electromagnetic relay having an armature carried by a vibratable reed, comprising a core adapted to carry an operating winding or windings, a yoke magnetically connected to the core, and two pole-pieces, one being bifurcated, with two substantially parallel limbs, the other pole-piece and the armature being arranged between the said parallel limbs, the core, yoke and pole-pieces being composed of magnetic material.

Two embodiments of the invention will be described with reference to Figs. 1 and 2 of the accompanying drawing.

Fig. 1 shows a preferred embodiment. The magnetic circuit of the relay comprises a core 1 on which any suitable operating winding (not shown) may be mounted having a pole-piece 2 shaped in the form of a U with two down-turned limbs 3A and 3B between which is placed the other pole-piece 4, which is constituted by the end of a portion of reduced width of the yoke 5, which makes contact with the back end of the core 1.

The vibrating reed 6 is assembled below the yoke 5 by means not shown and carries the armature 7 which is also placed between the limbs 3A and 3B of the pole-piece 2 and is normally spaced away from the pole-piece 4. All the details 1, 2, 5 and 7 should be made of soft iron or other suitable magnetic material.

The air spacing between the pole-piece 4 and the limbs 3A and 3B of the pole-piece 2 should preferably be large compared with the spacing between the armature 7 and these limbs, as indicated in Fig. 1, in order that the magnetic flux may not be unduly shunted away from the armature. This armature will then lie mainly in the

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normal path of the magnetic flux between the pole-pieces and the reluctance of this path is decreased as the armature approaches the pole-piece 4. If a suitable winding is mounted on the core 1 and is energised with direct current, the armature will be attracted towards the pole-piece 4 and will ultimately rest thereon. When the energising current is cut off, the reed will be released and will execute free vibration at its natural period. The reed may be adapted to control any desired assembly of contacts (not shown).

The efficiency of electromagnets having a relatively large armature movement is improved by the use of a bifurcated pole-piece such as 2, and the improvement is greatest when the air-gap between 7 and 4 is large, that is, just before the armature begins to move when the operating winding is energised. The pole-piece 4 should preferably be arranged so that it will hold the armature and reed in the fully deflected position when the winding is continuously energised. This pole-piece assists in the initial attraction of the armature, but has the maximum effect when the air gap is small.

The arrangement of Fig. 1 permits the armature to be moved along the axis of the reed without appreciably affecting the efficiency of the magnetic circuit. This feature is valuable, since it allows the vibrating system to be tuned without impairing the operation of the relay.

Fig. 2 shows a fragmentary sketch of a slightly different arrangement of the armature and pole-pieces according to the invention, which is exactly the same in principle. The back ends of the core 1 and yoke 5 may be as shown in Fig. 1, and are not shown in Fig. 2.

The core 1 is provided with a plain pole-piece 14 which corresponds in function with the pole-piece 4 of Fig. 1. A bifurcated pole-piece is provided for the yoke 5 by means of the blocks 13A and 13B of magnetic material fixed thereto and embracing the pole-piece 14 and the armature 7 carried by the reed 6 arranged below. It will be evident that the principal difference between Figs. 2 and 1 is that the bifurcated pole-piece is carried by the yoke instead of by the core. As in the case of Fig. 1, the air-gaps between the pole-piece 14 and the blocks 13A and 13B should preferably be large compared with the armature air-gaps.

In either case, the limbs 3A, 3B or 13A, 13B will always have the same magnetic polarity, so that they constitute a single divided pole piece and not separate pole-pieces.

It will be evident that the blocks 13A and 13B could, if desired, be formed integrally with the yoke 5. and in Fig. 1, the limbs 3A and 3B could be separate pieces.

What is claimed is:

1. In an electromagnetic device in which a variable flux is produced, means forming a magnetic circuit comprising, a substantially rigid core assembly having a double gap at which the flux divides into two substantially parallel paths, said double gap being formed by a fixed central pole piece positioned between two rigidly connected spaced pole pieces with the gaps being formed on the opposite sides of the central pole piece, and a vibrating armature formed by an iron piece positioned with one face substantially parallel to one face of said central pole piece and with two opposite edge faces parallel to and spaced from the respective faces of said spaced pole pieces, said iron piece being mounted to vibrate in the planes of said edge faces transversely of the adjacent face of said central pole piece and parallel to the adjacent faces of said spaced pole pieces.

2. In an electromagnetic device, means forming a magnetic circuit having an air gap therein comprising, a rigid core assembly having a double gap at which the flux divides into two parallel paths, said double gap being formed by a central core portion positioned between a pair of parallel side core portions with each of the side core portions having a pole face parallel to and adjacent a pole face of the central core portion whereby the two parallel paths are respectively from the above-mentioned pole faces of the central core portion to the respective pole faces of the side core portions, and a vibratable armature positioned adjacent said central core portion and adapted to vibrate toward and away from said central core portion, said vibratable armature having edge portions which are positioned adjacent said side core portions during the time that the armature is nearest said central core portion whereby a part of the magnetic flux in each of said parallel paths is diverted through said edge portions of said armature.

3. In an electromagnetic relay, the combination of, a core construction adapted to carry an

operating winding, a yoke magnetically coupled to the opposite ends of said core construction and forming a magnetic path for the magnetic flux of said core construction, said yoke having two pole-piece structures one of which is bifurcated with two parallel limbs having opposing faces and the other of which is positioned adjacent said limbs, and a vibratable armature formed by a movable pole piece carried by a vibrator reed with the movable pole piece positioned at the edge of the zone between said limbs and mounted to vibrate parallel to the opposing faces of said limbs to and from said other pole-piece structure.

4. A device as described in claim 3 wherein, said birfucated pole-piece structure is formed by a single member attached to one end of said core construction, and wherein said other pole-piece structure is an integral portion of an L-shaped yoke portion attached to the other end of said core construction.

5. A device as described in claim 3 wherein, said movable pole piece is adjustably attached to said vibrator reed whereby the natural frequency of vibration of said vibratable armature may be adjusted.

6. A device as described in claim 3 wherein, said vibratable armature has an elongated vibratable reed attached at one end to said yoke and carries said movable pole piece adjacent its other end, and wherein the natural frequency of vibration of said vibratable armature may be changed.

7. A device as described in claim 3 wherein, said bifurcated pole-piece structure is formed by a pair of separate pole pieces attached to a yoke frame member and wherein said other pole-piece structure is formed by a single member attached to one end of said core construction.

8. A device as described in claim 3, wherein said vibrator reed is elongated and is attached to said core at one end and carries said movable pole piece adjacent its other end with the vibrator reed extending substantially parallel to one face of said other pole-piece structure and substantially parallel to said limbs, and wherein said core construction and yoke are formed of iron.

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