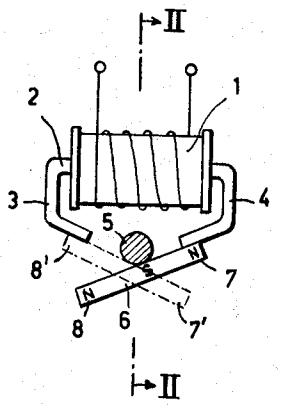
March 27, 1962 D. F. F. HOLDWAY 3,027,499

ELECTROMAGNETIC SYSTEM

Filed Sept. 26, 1958

FIG.1



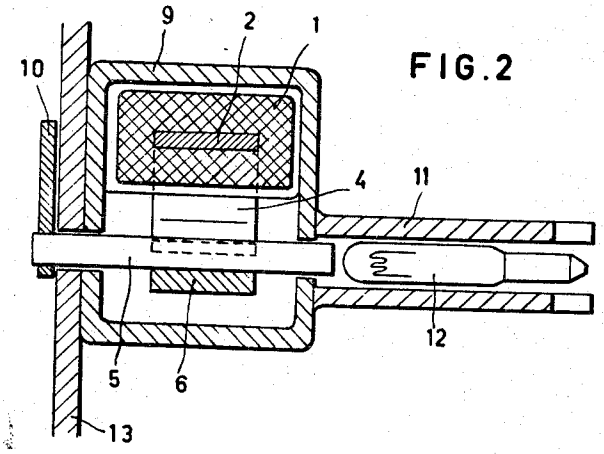




FIG.2

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# ELECTROMAGNETIC SYSTEM

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The invention relates to an electromagnetic system consisting of a magnetizable core surrounded by a winding and a permanent magnetic armature pivoting about an axis and particularly to an indicating instrument comprising such an electromagnetic system.

Polarized relays are known in which an armature is capable of taking two stable positions, dependent on the preceding direction of flow through one or more windings, the position achieved by the armature being maintained after the termination of the energization. For operating the contacts in such polarized relays a small angle of rotation of the armature and strong magnetic forces are required.

The object of the invention is to provide an electromagnetic system in which an armature is capable of taking two stable end positions which are spaced apart by a relatively large angle, so that the two end positions of the armature, if desired, may be clearly observed by means of a pointer on the shaft of the armature.

For this purpose, in the electromagnetic system of the invention each of the ends of the magnetisable core emerging from the winding carries a pole shoe both of which are located symmetrically with respect to the axis and an armature which is pivotable about the axis between two angular end positions is provided with two separate permanent magnetic poles of the same polarity. Each of the latter said poles cooperating with an associated pole shoe in such a way that in each of the two end positions of the armature one of the poles is near or engaging the associated pole shoe.

The invention is further explained hereinbelow with reference to the drawings.

FIGURE 1 diagrammatically represents a front view of the electromagnetic system according to the invention.

FIGURE 2 is an axial section of an indicating instrument with an electromagnetic system according to the invention.

In FIG. 1 the core **2** is surrounded by the energization winding **1**. At the ends extending from the coil of the winding **1** the core **2** carries the two pole shoes **3** and **4** respectively which may be secured to the core **2** or may be integral therewith. The shaft **5** is arranged symmetrically with respect to the winding **1** and the core **2** and in the embodiment of FIG. 1 the free ends of the pole shoes **3** and **4**, which are also symmetrically arranged, are directed towards the shaft **5**, the free ends forming an obtuse angle with each other. The armature **6** is in the form of a strip-shaped piece and is symmetrically fixed to the shaft **5**. The armature is magnetized permanently in such a manner that both free ends extending from the shaft **5** form like poles. In the embodiment of FIG. 1 these are the north poles **7** and **8**. In the middle of the armature and adjacent the position of fixation of the armature to the shaft **5**, the armature is magnetized with a polarity opposite to that of both poles **7** and **8**.

When the energization winding **1** is deenergized and one of the free poles of the armature, such as the pole **7**, as represented in full lines in FIG. 1, rests against the associated pole shoe **4**, the armature is in a stable position, the magnetic force caused by the pole **7** keeping the armature in the given position. If in this condition of the system a current is passed through the energization winding **1** such that the pole shoe **4** obtains the same polarity



as the pole **7** of the armature resting against it (in the given embodiment becoming north magnetic), the other pole shoe **3** simultaneously will take the opposite polarity, so that in the given embodiment the pole shoe **3** becomes south magnetic. Thereby the pole **7** will be repelled by the pole shoe **4** and the pole **8** will be attracted by the pole shoe **3** with the result that the armature shifts to the position **7'/8'** drawn in FIG. 1 in dot and dash lines. It will be clear that the armature after deenergization will remain in the new position, the pole **8'** exerting an attractive force on the pole shoe **3** which force is greater than the attractive force between the pole **7'** and the pole shoe **4** of the unenergized core **2**. By means of a temporary passage of current of the opposite direction in the winding **1** the armature **6** may be returned to the position represented in FIG. 1 in full lines.

The angle between both stable end positions of the armature **6** is determined by the shape and dimensions of the pole shoes **3** and **4** and of the armature **6**, as well as by the position of the shaft **5**. In the embodiment of FIG. 1 this angle is approximately 45°.

FIGURE 2 shows in axial section an indicating instrument in which a magnetic system as represented in FIG. 1 is applied. The composing parts of this system are mounted in a casing **9** of non-magnetic material which in a manner, not shown in the drawing, is made in two pieces for mounting the inner parts. One of the ends of the shaft **5** extends through an opening in the casing **9** and carries thereon a pointer **10**. In the embodiment according to FIG. 2 the shaft **5** is made of a transparent material and the casing **9** is provided with a tubular extension **11** extending coaxially with the shaft at the side remote from the free end of the shaft. In the sleeve **11** a signal lamp **12** is arranged. At the free end of the transparent shaft **5** it may be observed whether the lamp **12** is burning.

The indicating instrument according to FIG. 2 may efficiently be applied as a switch point indicator in a miniature track diagram, as are generally used in railway control and signal systems. An angle of 45° between the final positions of the armature **6** and the indicating member **10** is suitable for this purpose. As shown in FIG. 2 the casing **9** is mounted at the rear side of the panel **13** carrying at the front side the track diagram of the railway section. The shaft **5** extends both through an opening in the casing **9** and a corresponding opening in the panel **13**, and the indicating member representing the switch points is mounted at the front of the panel **13** on the extending end of the shaft **5**.

The shifting of the indicating instrument may be achieved by current pulses of different directions derived from the position of the switch in the railway section.

The armature preferably is made of a ferro-ceramic material such as "Ferroxdur." This not only allows the making of a strip-shaped piece with like poles at the ends, but also has the advantage that substantially no demagnetization occurs notwithstanding the large air gap which always is present and the opposition of like poles during each energization.

What is claimed is:

1. An electromagnetic system comprising a magnetizable core, a winding surrounding said core and a permanent magnetic armature pivotable about an axis, said magnetizable core having ends emerging from said winding and including pole shoes, a straight line through said pole shoes being spaced from said axis which is equidistant from said pole shoes, said armature being pivotable about said axis between two end positions and having two separate permanent magnetic poles of the same polarity, each of said poles cooperating with an associated pole shoe of said core, one of the poles of said armature being opera-

tively disposed with respect to the associated pole shoe in each of the two end positions of the armature.

2. An electromagnetic system comprising a magnetizable core, a winding surrounding said core and a permanent magnetic armature pivotable about an axis, said magnetizable core having ends emerging from said winding and including pole shoes, a straight line through said pole shoes being spaced from said axis which is equidistant from said pole shoes, said armature including a shaft and a strip-shaped piece of permanent magnetic material symmetrically secured to said shaft, said armature having ends extending from said shaft and constituting permanent magnetic poles of the same polarity, said armature being pivotable about said axis coaxial with said shaft between two end positions, each of said poles cooperating with an associated pole shoe of said core, one of the poles of said armature being operatively disposed with respect to the associated pole shoe in each of the two end positions of the armature.

3. An electromagnetic system comprising a magnetizable core, a winding surrounding said core and a permanent magnetic armature pivotable about an axis, said magnetizable core having ends emerging from said winding and including pole shoes, a straight line through said pole shoes being spaced from said axis which is equidistant from said pole shoes, said armature including a shaft and a strip-shaped piece of permanent magnetic material symmetrically secured to said shaft, said armature having two ends extending from said shaft and being permanent magnetic poles of the same polarity, said armature being pivotable about said axis coaxial with said shaft over an angle of at least 30° between two end positions, each of said poles cooperating with an associated pole shoe of said core, one of the poles of said armature being operatively disposed with respect to the associated pole shoe in each of the two end positions of the armature.

4. An electromagnetic system comprising a magnetizable core, a winding surrounding said core and a permanent magnetic armature pivotable about an axis, said magnetizable core having ends emerging from said winding and including pole shoes, a straight line through said pole shoes being spaced from said axis which is equidistant from said pole shoes, said armature including a shaft and a strip-shaped piece of permanent magnetic material symmetrically secured to said shaft, said aramture having two ends extending from said shaft and constituting permanent magnetic poles of the same polarity, said armature being pivotable about said axis coaxial with said shaft between two end positions, said end positions being defined by the engagement of the poles of said armature with the respective pole shoes.

5. An electromagnetic system comprising a magnetizable core, a winding surrounding said core and a permanent magnetic armature pivotable about an axis, said magnetizable core having ends emerging from said winding and including pole shoes, a straight line through said pole shoes being spaced from said axis which is equidistant from said pole shoes, said armature including a shaft and a strip-shaped piece of permanent magnetic material symmetrically secured to said shaft, said armature having two ends extending from said shaft and constituting permanent magnetic poles of the same polarity, said armature being pivotable about said axis coaxial with said shaft over an angle of at least 30° between two end positions, said end positions being defined by the engagement of the poles of said armature with the respective pole shoes.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,354,555 | Sias | July 25, 1944 |
| 2,716,232 | Power | Aug. 23, 1955 |
| 2,866,965 | Houdek et al. | Dec. 30, 1958 |

OTHER REFERENCES

Hunrath: Abstract of application Serial Number 641,163, published Oct. 11, 1949.