June 26, 1928. 1,675,148

D. G. ACKERLY

ELECTROMAGNETIC DEVICE

Filed Oct. 18, 1926

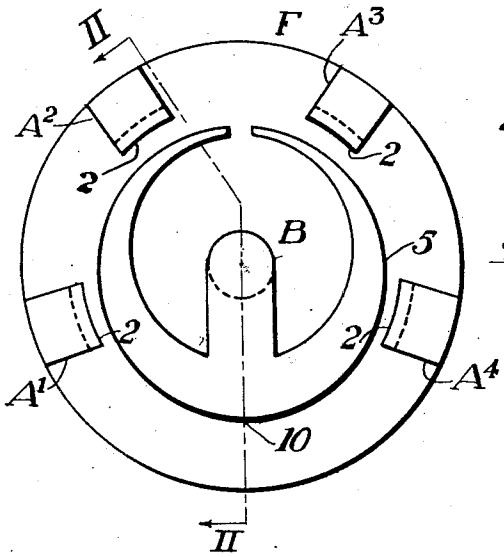


Fig. 1.

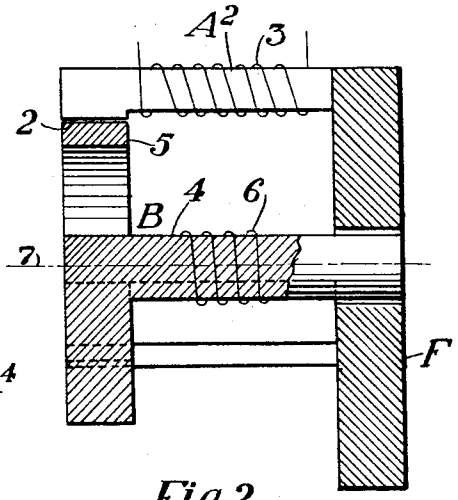


Fig. 2.

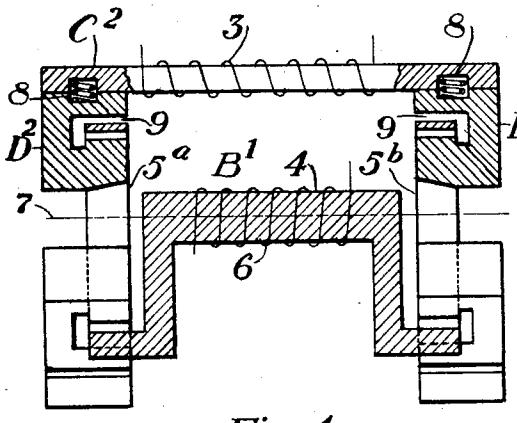


Fig. 4.

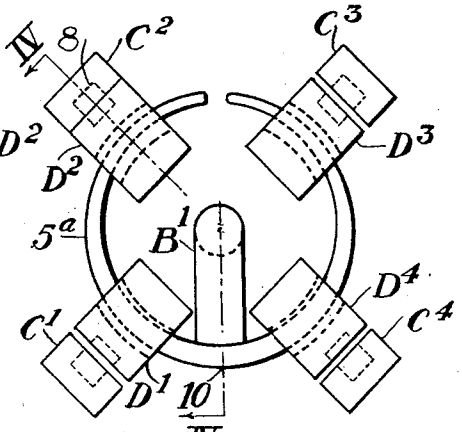


Fig. 3.

INVENTOR:
R. G. Ackerly,
by A. L. Vindle
His attorney

Patented June 26, 1928. 1,675,148

UNITED STATES PATENT OFFICE.

DONALD G. ACKERLY, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTROMAGNETIC DEVICE.

Application filed October 18, 1926. Serial No. 142,221.

My invention relates to electromagnetic devices, and particularly to devices having a plurality of windings and a movable member capable of assuming a plurality of different positions depending upon which of the windings is supplied with current. Devices embodying my invention are particularly well adapted for use as electrical relays, although they are not limited to this particular adaptation.

I will describe two forms of devices embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a view showing in front elevation one form of electromagnetic device embodying my invention. Fig. 2 is a sectional view on the line II—II of Fig. 1. Fig. 3 is a view showing in front elevation a modified form of electromagnetic device embodying my invention. Fig. 4 is a sectional view on the line IV—IV of Fig. 3.

Similar reference characters refer to similar parts in each of the several views.

Referring first to Figs. 1 and 2, the device comprises a plate F of magnetizable material provided with four outstanding field members A^1, A^2, A^3 and A^4, which field members are parallel and are radially disposed around a center line 7 which is perpendicular to the plane of the plate F. Each field member A is provided at its outer end with a pole 2 facing inwardly toward the center line 7. Each field member A is provided with a winding 3 which may be supplied at times with current from a source not shown in the drawing. The reference character B designates an armature mounted on pivots (not shown) to oscillate on an axis coincident with the center line 7 and having an arcuate member 5 which coacts with the pole pieces 2. As here shown, this member 5 is in the form of two horns, each of which is tapered from the point at which the horns join, to the free end of the horn, although this specific shape is not essential to my invention. The armature B is biased to the position in which it is shown in Fig. 1, in which position the air gap between the member 5 and each pole piece 2 is greater than the minimum and the parts are so arranged that as the armature B swings in either direction from this position, the air gap between the member 5 and the pole pieces A^1 and A^2 or the pole pieces A^4 and A^3 will diminish. This may be accomplished by having the periphery of arcuate member 5 circular and displacing the center of curvature of such periphery from the axis of rotation of the armature, or it may be accomplished by making the periphery of member 5 an ellipse whose major axis extends though point 10 on the member. In either case the distance from axis 7 to any pole face 2 is constant, and is determined by the distance from the axis to point 10 plus the minimum air gap obtained when one of the windings 3 is energized.

It will be seen from the foregoing that with the armature B in the position shown in Fig. 1, if the winding on pole member A^4 becomes energized, the armature will swing in counterclockwise direction until the point 10 on the armature registers with the pole piece 2 on member A^4. Similarly, if the winding on member A^3 becomes energized, the armature B will swing in counterclockwise direction until point 10 registers with pole piece 2 on member A^3. Energization of the winding on field member A^1 or A^2 will similarly swing armature B in clockwise direction until point 10 registers with the pole piece on one or the other of these members.

The armature B may be utilized to control electrical contacts or other elements in any desired manner. For example, it may be utilized to close any one of four contacts according as the armature is acted upon by the winding on any one of the four field members, in which event the device will constitute a five-position relay.

Referring now to Figs. 3 and 4, the device in the form here shown comprises four parallel field members C^1, C^2, C^3 and C^4 radially disposed around the center line 7 and each having at each end a pole piece D^1, D^2, D^3 or D^4, which projects inwardly toward the center line 7. The inner surface of each pole piece D is provided with a slot 9. Each field member C is provided with a winding 3. The armature, which is here designated B^1, is mounted to oscillate on an axis coincident with the center line 7, and comprises an axial member 4 and two arcuate members 5^a and 5^b. The member 5^a passes through the slots 9 in the pole pieces on one end of the field member C, while the arcuate member 5^b passes through the slots 9 in the pole pieces

D on the other ends of the field members C. The parts are so arranged that when the armature B^1 is in the position in which it is shown in Fig. 3, the air gap between member 5^a or member 5^b and each of its associated pole-pieces D^2 is greater than the minimum. This is preferably accomplished by properly tapering the members 5^a and 5^b. It will be apparent that as in Figs. 1 and 2, energization of the winding on any field member will cause the armature to swing until the point 10 lies within the slot 9 in the pole piece of such field member.

As here shown, each field member C is movable toward and away from the associated pole-pieces D, and is biased away from such pole-pieces by a spring 8. When the winding 3 on any field member is energized, such field member is drawn toward the associated pole-pieces against the biasing action of the two springs 8. By this means an increased reluctance is introduced into the magnetic circuit for each field member, except when such field member is energized. This tends to decrease the magnetic leakage through each field member which is not directly magnetized by its associated magnet winding 3.

By means of the structure shown in Figs. 3 and 4, the radial forces on the armature B^1 may be practically annuled and so the stresses on the bearings of the armature are reduced to a minimum. To annul these stresses to the maximum degree, the members 5^a and 5^b should always be in the center of each slot 9, so that in any slot the air gaps on both sides of the movable member are the same.

The axial portion 4 of the armature B or B^1 is preferably provided with a winding 6 which is either energized continuously or is energized when any one of the operating windings 3 is energized. This winding 6 increases the sensitivity of the device.

Although I have herein shown and described only two forms of devices embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. An electro-magnetic device comprising a plurality of field poles radially disposed around a center line and each having a slot extending inwardly from one of its side faces, a winding for each pole, and an armature mounted to oscillate on an axis coincident with said center line and having an arcuate member passing through said slots, said armature being biased to such position that the air gap between said member and each field pole is greater than the minimum.

2. An electro-magnetic device comprising a plurality of parallel field members radially disposed around a center line and having a pole piece at each end projecting inwardly toward said line, each pole piece having a slot extending inwardly from its inside face, a winding on each said field member, and an armature mounted on an axis coincident with said center line and having two arcuate members passing respectively through the slots in the pole pieces on one end and the poles on the other end of said field members, said armature being biased to such position that the air gap between each said member and each associated pole piece is greater than the minimum.

3. An electro-magnetic device comprising a plurality of parallel field members radially disposed around a center line, a pole piece associated with each member and projecting inwardly toward said center line, each field member being movable toward and away from the associated pole piece, means for biasing each field member away from its associated pole piece, each pole piece having a slot extending inwardly from one of its side faces, a winding for each field member, and an armature mounted to oscillate on an axis coincident with said center line and having an arcuate member passing through said slots, said armature being biased to such position that the air gap between said member and each field pole is greater than the minimum.

In testimony whereof I affix my signature.

DONALD G. ACKERLY.