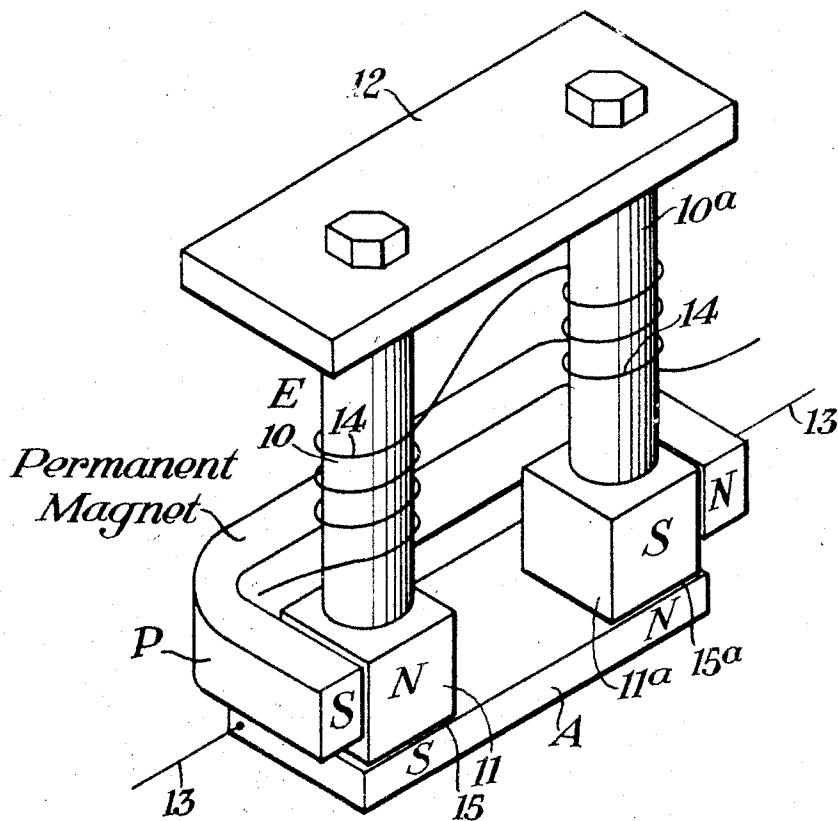


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T. J. O'MEARA ET AL
ELECTROMAGNETIC APPARATUS

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ELECTROMAGNETIC APPARATUS

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Our invention relates to electromagnetic apparatus of the type comprising an electromagnet and an armature coacting therewith in the usual manner. One feature of our invention is the provision, in combination with apparatus of this character, of a permanent magnet co-acting with the electromagnet and the armature in such manner as to affect the time required for the armature to release when the electromagnet becomes de-energized.

We will describe one form of apparatus embodying our invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a view showing one form of electromagnetic apparatus embodying our invention.

Referring to the drawing, the reference character E designates an electromagnet of the usual type, comprising two parallel cores 10 and 10^a connected by a back strap 12, which cores terminate in pole pieces 11 and 11^a, respectively. The cores are provided with the usual energizing winding 14. Coacting with the electromagnet E in the usual manner through air gaps 15 and 15^a is an armature A pivotally mounted on trunnions indicated diagrammatically by the axial lines 13, whereby the armature may swing toward and away from the pole pieces 11 and 11^a.

The reference character P designates a permanent magnet having its poles located in close relation with the two pole pieces 11 and 11^a, respectively, of the electromagnet E.

As shown in the drawing, the adjacent poles of the electromagnet and the permanent magnet are unlike, that is, the south pole S of permanent magnet P is located adjacent the north pole N of the electromagnet E, and the north pole N of the permanent magnet is located adjacent the south pole S of the electromagnet. It follows that when the electromagnet E is energized, the permanent magnet opposes the electromagnet in creating magnetic flux through the armature air gaps 15 and 15^a and the armature A. When the winding 14 of the electromagnet E becomes de-energized, some of the magnetic flux in the electromagnet E and the armature A will persist in the direction

in which it was originally set up by the electromagnet, but the tendency of this magnetism to persist and hold the armature in the closed position will be opposed by counter directional flux from the permanent magnet through the pole pieces 11 and 11^a, air gaps 15 and 15^a and the armature, so that the armature will release more quickly than if the permanent magnet were not present.

We will now assume that the permanent magnet P is turned around so that the adjacent poles of the two magnets are alike. The permanent magnet will then assist the electromagnet in creating magnetic flux through the armature air gaps 15 and 15^a and the armature A. Then when the winding 14 becomes de-energized, the permanent magnet will tend to maintain the armature in its closed position because the flux from the permanent magnet through the pole pieces 11 and 11^a, the armature air gaps 15 and 15^a and the armature will be in the same direction as the flux originally set up due to current in winding 14. It follows that the permanent magnet will delay the release of the armature beyond the normal period required for the release if the permanent magnet were not present. It is, of course, understood that the permanent magnet and the air gaps separating this magnet from the electromagnet poles and armature, must be so proportioned that the armature will release before the flux in the relay cores and armature originally set up by current in winding 14, reaches its minimum value.

Apparatus embodying our invention is particularly well adapted for, though in no way limited to, use in connection with direct current relays of the type used in railway signaling.

Although we have herein shown and described only one form of electromagnetic apparatus embodying our 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 our invention.

Having thus described our invention, what we claim is:

1. In combination, an electromagnet, an

armature co-acting therewith, and a permanent magnet having its poles closely associated with the two poles respectively of said electromagnet, whereby the release of said
5 armature is expedited or delayed according as adjacent poles of the electromagnet and permanent magnet are unlike or like.

2. In combination, an electromagnet comprising the usual cores terminating in pole
10 pieces, an armature co-acting in the usual manner with said electromagnet, and a permanent magnet having one of its poles located close to one pole piece of said electromagnet and its other pole located close to the other
15 pole piece of the electromagnet.

In testimony whereof we affix our signatures.

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