

Nov. 17, 1931.

W. S. ROBERTS ET AL

1,832,583

ROTARY ELECTRO-MAGNETIC MECHANISM

Filed July 7, 1930

2 Sheets-Sheet 1

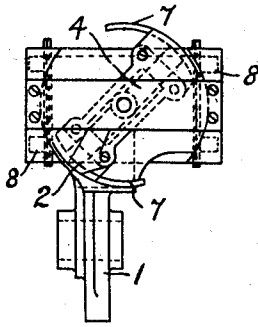


Fig. 1.

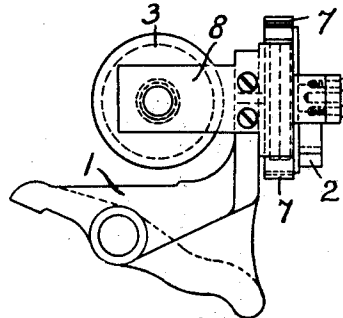


Fig. 2.

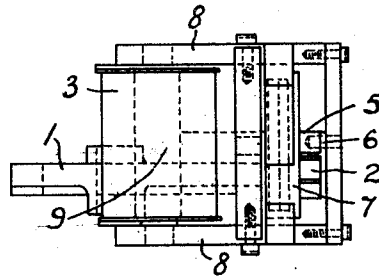


Fig. 3.

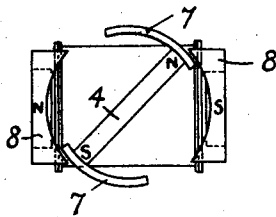


Fig. 4.

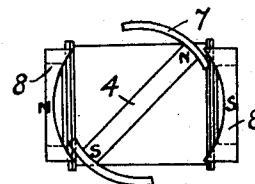


Fig. 5.

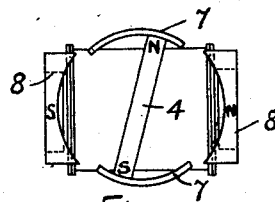


Fig. 6.

Inventors.
Walter Sydney Roberts & Joseph Hallam Burton.
by Howard M. Conibe
Attorney.

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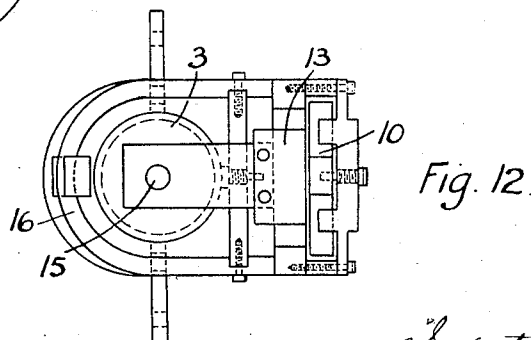
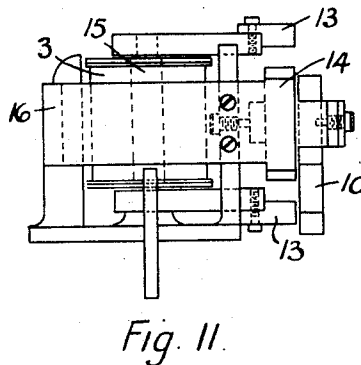
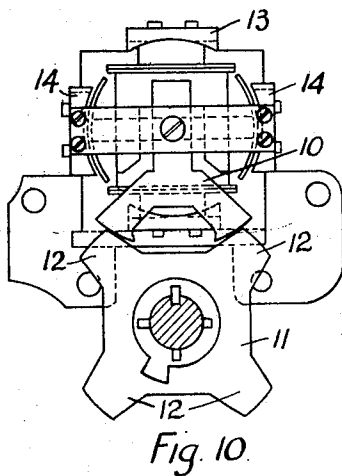
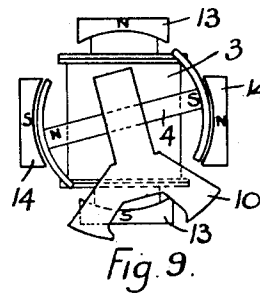
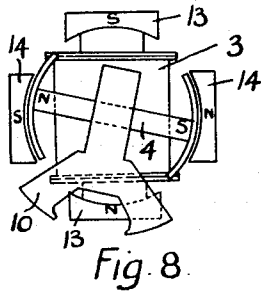
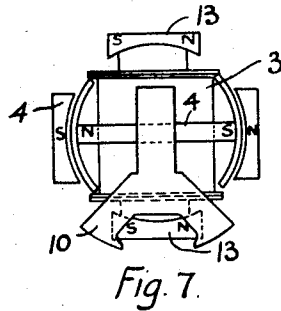
W. S. ROBERTS ET AL

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ROTARY ELECTRO MAGNETIC MECHANISM

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2 Sheets-Sheet 2



Inventors.
Walter Sydney Roberts & Joseph William Burton.
by Edward A. Connelley
Attorney.

UNITED STATES PATENT OFFICE

WALTER SYDNEY ROBERTS, OF ORMSKIRK, AND JOSEPH HALLAM BURTON, OF LIVERPOOL, ENGLAND, ASSIGNORS TO THE RAILWAY SIGNAL COMPANY LIMITED, OF LONDON, ENGLAND, A COMPANY OF GREAT BRITAIN

ROTARY ELECTRO-MAGNETIC MECHANISM

Application filed July 7, 1930, Serial No. 466,329, and in Great Britain July 26, 1929.

This invention relates to rotary electro-magnetic mechanisms of the polarized type such for instance as are generally employed in connection with token instruments for the control of railway traffic, the mechanisms being arranged to control the operation of the instrument to permit the insertion or withdrawal of tokens or to actuate an indicator.

As hitherto constructed rotary mechanisms of the above character comprise a stator element having a permanent magnet and an electro-magnet the poles of which are arranged around a rotor element usually consisting of a cylindrical shell of soft iron which is slotted or cut away so as to form polar projections.

When the mechanism is deenergized the rotor element takes up its normal position under the magnetic action of the permanent magnet, while when the electro-magnet is supplied with energizing current the angular direction of the resultant magnetic field is altered so as to cause the rotor to assume its other or energized position.

This construction is found in practice to possess certain disadvantages as regards rapidity of response and the magnitude of the operating and retaining torques exerted upon the rotor and the present invention has for its principal object to provide an improved construction of rotary mechanisms which shall be more effective in operation while being simple and compact in construction.

In the approved construction of the invention, the rotor element of the mechanism comprises a permanent magnet of suitable form adapted to cooperate magnetically with one or more pairs of fixed pole pieces, constituting the stator element and composed of magnetic material, which is, however, not permanently magnetized. The rotor is thus normally held in one of its operative positions owing to the rotor magnet being attracted by one of the pairs of pole pieces. The magnetic circuit of one of the pairs of pole pieces is provided with an energizing winding so as to constitute an electromagnet which, when the winding is energized, causes the rotor magnet to move the rotor into another

operative position and, according to one feature of the invention, the movement of the rotor, when the winding is energized, is arranged to be so limited that, when the winding is again deenergized, the rotor magnet will return the rotor to its normal position.

The invention is illustrated by way of example in the accompanying drawings of which Figs. 1, 2 and 3 are views in front elevation, side elevation and plan respectively of a rotary lock mechanism of the kind well known in connection with token instruments and embodying one form of the invention. Figures 4, 5 and 6 are diagrammatic views illustrating the positions assumed under different conditions by the rotor element of the lock mechanism shown in the preceding figures. Figures 7, 8 and 9 are diagrammatic views illustrating the invention as applied to a somewhat different form of rotary lock mechanism as employed for instance in the token instrument described in the specification of our co-pending application Ser. No. 466,328, Figures 10, 11 and 12 being views in front elevation, side elevation and plan respectively of the lock mechanism.

Referring now first to Figures 1 to 6 inclusive of the drawings it will be seen that the rotary lock mechanism therein shown is mounted upon a supporting lever 1 which is adapted to be raised by the initial movement of a staff or other token during the operation of removing the staff from the instrument.

The rotor element of the lock mechanism is provided in the usual manner with a hook 2 adapted to engage with a corresponding hook carried by a rock lever normally preventing the removal of the token from the instrument. When current of normal polarity or "in phase" current is supplied to the energizing coil 3 of the lock mechanism the rotor element is energized and the hook 2 carried thereby is caused to engage with the hook carried by the lock lever so that when the supporting lever 1 is raised by the token it carries with it the lock lever and thus permits the final withdrawal of the token from the instrument. When however, the ener-

gizing coil 3 is not traversed by current or the current supplied thereto is of reverse polarity or is "out of phase" the rotor element occupies its inoperative position in which the hook 2 is out of engagement with the hook on the lock lever.

The rotor element of the lock mechanism comprises a short permanent magnet 4 provided with a central boss or hub 5 which is pivotally mounted in suitable bearings 6 and carries the hook above referred to, the extremities of the magnet 4 being provided with circular pole pieces constructed of soft iron.

The stator of the lock mechanism comprises a pair of soft iron pole pieces 8 connected by a yoke 9 carrying the energizing coil 3 and mounted upon the supporting lever 1 of the mechanism.

In operation, when the energizing coil 3 is not traversed by current, the rotor will tend to assume the position shown in Figure 4 in which the permanent magnet 4 extends across the pole pieces 8 of the stator the hook 2 carried by the rotor engaging with a suitable stop not shown on the stator and being out of engagement with the hook of the lock lever.

When the energizing coil 3 is traversed by "out of phase" current, the electro-magnetic flux traversing the pole pieces 8 of the stator is in such a direction as to assist the flux due to the permanent magnet 4 so that the hook on the rotor is held firmly against its stop as shown in Figure 5.

When however, the energizing coil 3 is traversed by "in phase" current the electro-magnetic flux across the stator pole pieces 8 opposes the flux due to the permanent magnet 4 with the result that the latter is moved towards a position at right angles to the axis of the stator pole pieces as shown in Figure 6 and thus causes the hook on the rotor to engage with the corresponding hook on the lock lever.

The movement of the permanent magnet 4, when the energized coil is traversed by "in-phase" current, is arranged to be so limited that, when the coil 3 is deenergized, the magnet 4 is again attracted by the pole pieces 8 so as to return the rotor to its original position and release the hook 2.

Referring now to Figures 7 to 12 inclusive the invention is illustrated as applied to a lock mechanism in which the rotor is required to assume three different positions corresponding to "no current", "in phase" current and "out of phase" current in the energizing coil. The rotor is in this case provided with a forked member 10 adapted when in the position shown in Figures 7 and 10 to engage with a rotatable disc 11 provided with projections 12 and thereby prevent the rotation of the disc 11 in either direction. The lock mechanism is adapted for use in connection

with the control of permissive working of a token instrument. The stator comprises two pairs of pole pieces 13, 14 arranged at right angles to one another around the rotor. Each pair of pole pieces is provided with a yoke and the yoke 15 of the pair of pole pieces 13 carries the energizing coil 3. The other pair of pole pieces 14 and its yoke 16 serves to complete the magnetic circuit of the permanent magnet 4 on the rotor so that the latter is maintained in its "no current" position shown in Figure 7 when the energizing coil 3 is deenergized. When however, current of "in phase" or "out of phase" is supplied to the energizing coil 3 the corresponding pole pieces 13 are magnetized in one direction or the other and the permanent magnet 4 of the rotor is correspondingly attracted so as to move the rotor in one direction or the other to the position shown in Figure 8 or Figure 9 thus permitting the rotation of the disc 11 in one direction or the other through a limited range of movement.

It will be observed that, when the rotor of the mechanism occupies either of the energized positions, shown in Figs. 8 and 9, the pole pieces, carried by the permanent magnet 4, are still under the influence of the stator pole pieces 14, owing to the limited range of movement, so that, when the winding 3 is deenergized, the rotor will return to the position shown in Figs. 7 and 10.

The invention is evidently not limited to the particular applications or constructions above described and illustrated which may be varied in many respects without exceeding the scope of the invention.

Having now described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. In a rotary electromagnetic mechanism, the combination of a rotor element, comprising a permanent magnet not provided with an energizing coil, a stator element, comprising at least one pair of fixed pole pieces, and an energizing winding for the magnetic circuit of one of said pairs of pole pieces.

2. In a rotary electromagnetic mechanism, the combination of a rotor element, comprising a permanent magnet, a stator element, comprising two pairs of fixed pole pieces, an energizing winding for the magnetic circuit of one of said pairs of pole pieces, and a yoke composed of magnetizable material for the other pair of pole pieces.

3. In a rotary electromagnetic mechanism, the combination of a rotor element, comprising a permanent magnet, a stator element, comprising a plurality of pairs of fixed pole pieces, an energizing winding for the magnetic circuit of one of said pairs of pole pieces, and means for limiting the movement of said rotor element when said winding is energized.

4. In a rotary electromagnetic mechanism,

the combination of a rotor element, comprising a permanent magnet, a stator element, comprising two pairs of fixed pole pieces, an energizing winding for the magnetic circuit of one of said pairs of pole pieces, a
5 forked member operated by said rotor element, and a rotatable locking member controlled by said forked member.

In testimony whereof we have hereunto set
10 our hands.

WALTER SYDNEY ROBERTS.
JOSEPH HALLAM BURTON.

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