

Jan. 4, 1944.

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2,338,566

ELECTROMAGNETIC DEVICE

Filed May 22, 1941

2 Sheets-Sheet 1

FIG. 1

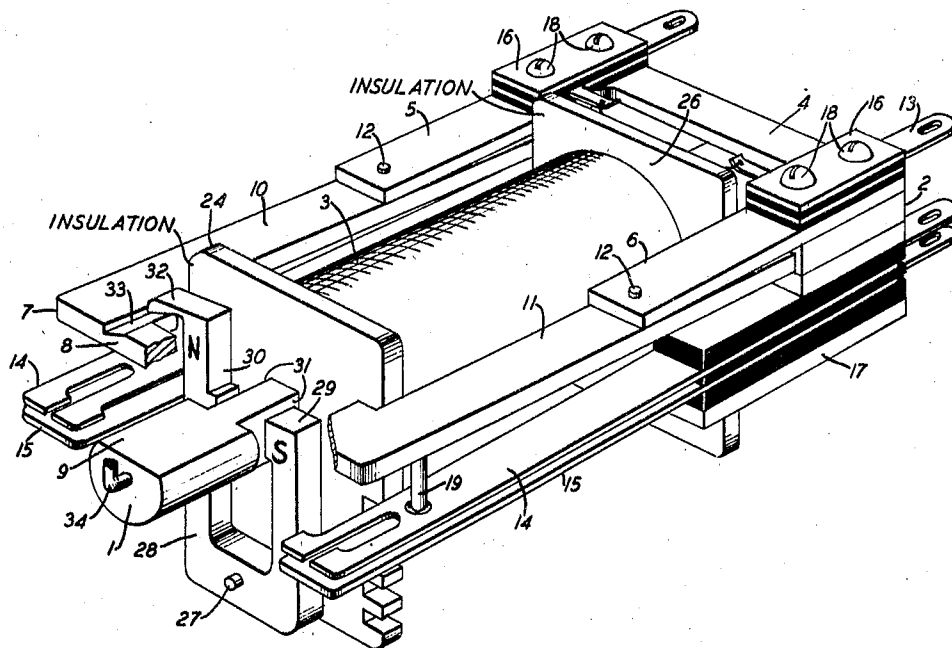
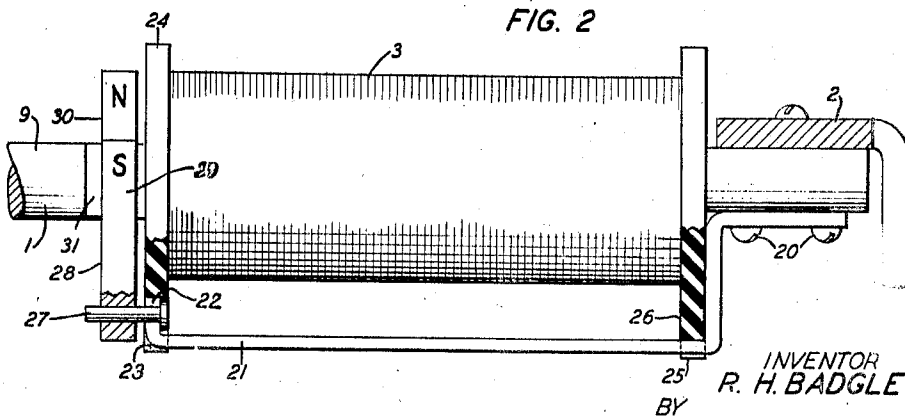


FIG. 2



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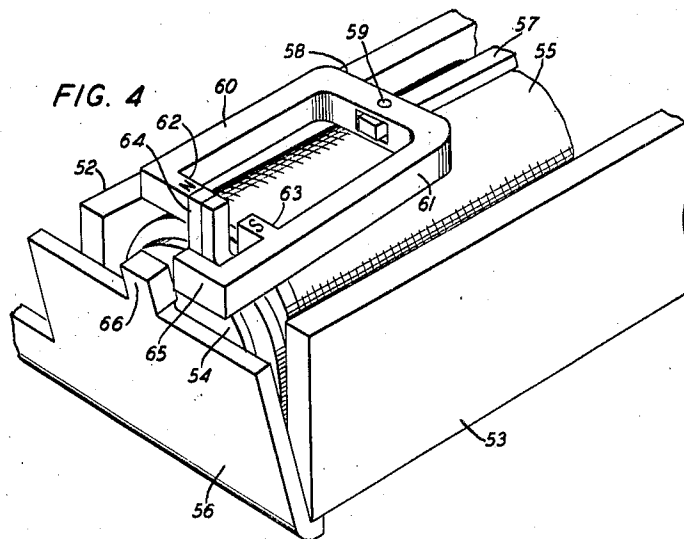
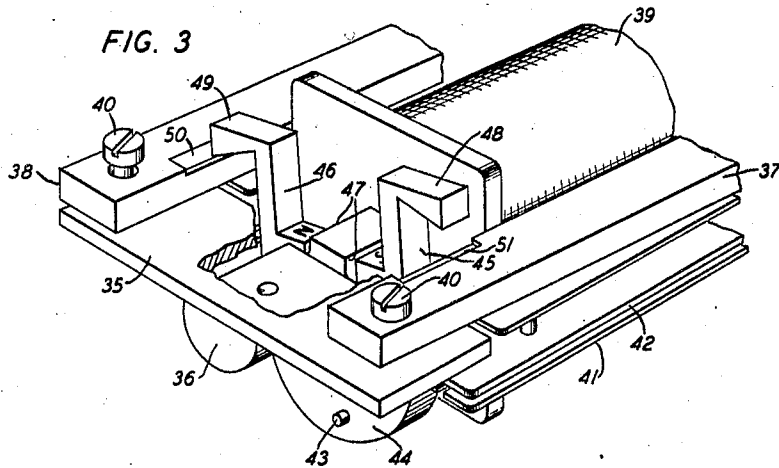
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2,338,566

ELECTROMAGNETIC DEVICE

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3 Claims. (Cl. 175—339)

This invention relates to electromagnetic devices and has for its object the provision of means of a simple character whereby the armature of an electromagnetic device may be held in its operated position without requiring the continued energization of the energizing coil of the device.

In electrical systems it is often necessary to operate an electromagnet or relay and to hold it so operated for a considerable period. For example, certain of the relays and magnets used in establishing connections in telephone systems of the dial switching type become energized when the calling subscriber initiates a call and are held in their operated condition until the conversation is terminated. This period may, therefore, be of several minutes duration. Obviously, so long as the magnet or relay remains operated, current is required to maintain its operating coil energized. In some instances the strength of the current may be reduced from an operating to a holding value after the operation of the device, but still some current is required to maintain the device operated, and this current drain while relatively slight for a single device, becomes quite a factor of operating cost in a large telephone system when a great number of such magnetic devices must be held simultaneously operated.

In accordance with the present invention, the aforementioned object is attained by the provision of a magnetic latch which is operated upon the energization of the electromagnetic device to latch the armature of such device in its operated position. The magnetic latch is so polarized that it is operable to its latching position when the winding of the device is energized by current of one polarity and when thus operated remains in its latching position after the operating current is entirely removed from the winding. Thus the device remains in an operated condition as long as desired with no current drain whatsoever. To restore the device to its normal condition, it is only necessary to send current of a reversed polarity through the winding of the device of a strength only sufficient and for an interval only long enough to restore the magnetic latch, whereupon the armature of the device will return to its normal position.

For a clearer understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 is a perspective view of a relay of a well-

known type to which a magnetic latch in accordance with the invention has been applied;

Fig. 2 is a top view of the relay of Fig. 1 with several of the parts omitted to disclose the manner in which the magnetic latch is mounted;

Fig. 3 is a perspective view of the forward end of a relay equipped with two armatures and a magnetic latch for latching either armature operated; and

Fig. 4 is a perspective view of the forward end of a cross-bar switch hold magnet, equipped with a magnetic latch in accordance with the invention.

Referring first to Fig. 1, a relay is disclosed therein of the type disclosed in Patent No. 2,178,656, granted November 7, 1939, to P. W. Swenson to which the magnetic latch in accordance with the invention has been applied. In general this relay comprises a core 1 secured at its rear end to a heel-piece 2 by which the relay may be supported on an apparatus rack, a coil 3 supported on the core 1, an armature hinge bracket 4 secured to the rear end of the core and having its two arms 5 and 6 extending forwardly on either side of the coil 3, a U-shaped armature 7 having a forward cross-reach 8 extending over the forward end of the core 1 and cooperating with the pole face 9 of such core and having rearwardly extending arms 10 and 11 pivoted to the forward ends of the arms 5 and 6 of the hinge bracket 4 by the pivot pins 12, and two spring pile-ups secured to the opposite ends, respectively, of the heel-piece 2. Each spring pile-up comprises a coil terminal lug 13 and a plurality of contact springs, in the case illustrated, a single armature spring 14 and a stationary spring 15 mating with it. The springs of each pile-up are clamped to the heel-piece 2 between the clamping plates 16 and 17 by the screws 18 and are insulated from such clamping plates, from the heel-piece and from each other by interposed strips of insulating material. The armature springs 14 are operable by the armature through operating studs 19 of insulating material, ring-staked at one end to the armature spring and having their other ends engaged against the arms 10 and 11 of the armature. The usual armature backstop screw 34 and backstop nut (not shown) are provided.

Secured to the rear end of the core 1 as by screws 20 is a forwardly extending member 21, disclosed best in Fig. 2, having its forward end upturned at 22 and seated in a notch 23 in the front spoolhead 24 and engaged near its rear end

in a notch 25 in the rear spoolhead 26. Pivoted on the pin 27 extending through the upturned end 22 of the support 21 and positioned adjacent to the forward face of the spoolhead 24 is a U-shaped latch member 28 of permanently magnetized material, the two arms 29 and 30 of which are positioned on either side of the forward end of the core 1 and the pole faces of which arms cooperate with flattened pole-faces 31 of the core. The arm 30 is provided with an upwardly and outwardly extending latch portion 32 which is engageable in a notch 33 in the outer face of the armature to lock the armature in its attracted position.

It will be assumed that in the normal operation of the relay, current is applied through the coil 3 in such a direction as to make the forward end of the core a north pole. The armature 7 will in the usual manner be attracted toward the pole face 9 of the core 1 and will through the studs 19 operate the springs of the associated pile-ups. At the same time, however, the pole-piece arm 29 of the permanent magnet latch 28, which has been assumed to be polarized as a south pole, will be attracted toward the adjacent pole face 31 of the core 1 and the pole-piece arm 30 of the permanent magnet latch, polarized as a north pole, will be repelled from the core thereby swinging the magnet 28 about the pivot pin 27 to move the latch extension 32 of the arm 30 over the outer surface of the armature and into the notch 33 therein. If current is now removed from the coil 3, the pole-piece arm 29 will still remain attracted to the end of the core due to the permanent magnetization of the magnet 28 thereby holding the latch 32 in the notch 33 of the armature 7 and thereby preventing the release of the armature 7. The relay armature is thus maintained in its operated position.

To release the relay armature, current of a reversed polarity is momentarily applied to the coil 3 whereupon the forward end of the core is now made a south pole thereby repelling the arm 29 of the magnet 28 therefrom and attracting the arm 30 of the magnet thereto to remove the latch 32 from the notch 33 of the armature 7 whereby the armature releases as soon as the current ceases to flow through the coil 3. The reversed current may be of much less strength than the initial operating current.

Fig. 3 shows the invention applied to a relay of the general type disclosed in the Patent No. 2,254,037, granted to H. C. Harrison, on August 26, 1941. This relay is structurally similar to the relay disclosed in Fig. 1 except that a crosspiece 35 is secured to the forward end of the core 36 and two separate armatures 37 and 38 are provided, one on either side of the coil 39, the forward ends of which cooperate with the ends of the crosspiece 35. The backstop screws 40 are provided for limiting the releasing movement of the armatures and for adjusting the air-gaps between the armatures and the face of the crosspiece 35 and each armature is effective upon its attraction to operate springs such as 41 and 42 of an associated pile-up.

The relay is provided with a support (not shown) similar to the support 21 of Fig. 2 on the pin 43 of which a latch member 44 of permanently magnetized material is pivoted, the pole-piece arms 45 and 46 of which are positioned on either side of the forward end of the core 36 and the pole faces of which cooperate with the flattened pole faces 47 of the core. Each arm is provided with an outwardly extending latch portion, the latch por-

tion 48 of arm 45 being adapted to be positioned over the armature 37 when such armature has been attracted to the crosspiece 35 and the latch portion 49 of the arm 46 being adapted to be positioned over the armature 38 when such armature has been attracted to the crosspiece 35. Normally one or the other of the armatures is latched in its operated position.

If it be assumed that current is applied through the relay coil 39 in such a direction as to render the forward end of the core 36 and the ends of the crosspiece 35 a north pole, both of the armatures 37 and 38 will become attracted to operate their associated pile-ups and the pole-piece arm 45 of the latch member 44 will be attracted into engagement with the adjacent pole face 47 of the core. At the same time, the pole-piece arm 46 of the member 44 will be repelled from the adjacent pole face of the core. Thus movement of the armature 44 about the pivot pin 43 will result in the movement of the latch extension 49 of the arm 46 over the outer face of the armature 38 and into the notch 50 therein, whereby when the coil 39 later becomes deenergized, the latch 49 will hold the armature 38 in its operated position. The armature 37 will, however, release to its normal position against the head of the associated backstop screw 40. To release the armature 38, it is necessary to apply current of the opposite polarity to the coil 39 whereupon both armatures will be attracted and the latch member 44 will be swung in the opposite direction about its pivot pin 43 to remove the latch 49 from over the armature 38 and to move the latch 48 over the armature 37. Armature 38 will thereupon restore as soon as the reverse current is removed but armature 37 will be latched operated.

Had the initial operating current been of the opposite polarity whereby the end of the core 36 was made a south pole, then both armatures 37 and 38 would have been attracted as before, but the latch member 44 would have been swung in such a direction as to move the latch 48 of the arm 45 over the armature 37 into engagement with the notch 51 therein, since with the core 36 made a south pole, the pole-piece arm 46 would have been attracted toward the core and the pole-piece arm 45 would have been repelled therefrom. When thereafter the energizing current was removed from the coil 39, the armature 38 would have restored but the armature 37 would have been held by the latch 48 in its operated position. To release the operated armature 37, it is then necessary to apply current of a polarity opposite to the polarity of the current by which the armature was operated, thereby reoperating both armatures. Upon the removal of the reverse current, armature 37 releases but armature 38 is latched operated.

It will, of course, be apparent that if the relay of Fig. 3 is provided with a permanent magnet associated with the crosspiece 35, as disclosed in the application of Harrison hereinbefore referred to, and the latches 48 and 49 are so proportioned that with either armature released the member 44 may be moved to unlatch the other armature, then the two armatures 37 and 38 would be selectively operated and latched upon the energization of the coil 39 by current of opposite polarities and the latched armature would be released by the application of a current of reversed polarity to the coil of sufficient strength to operate the magnetic latch member but of insufficient strength to attract an armature of the relay.

The invention is also applicable to a magnet, such for example as a hold magnet of a cross-bar type switch of the type disclosed in Patent 2,021,329, granted November 19, 1935, to Mr. J. N. Reynolds. A portion of such a hold magnet with a magnetic latching member in accordance with the present invention applied thereto is illustrated in Fig. 4. The hold magnet comprises a U-shaped pole-piece yoke, only the forward ends of the parallel arms 52 and 53 of which are disclosed, a core 54 secured at its rear end to the base of the yoke and having its forward end disposed in substantially the plane of the forward pole-piece ends of the arms 52 and 53, a coil 55 upon the core 54 and an armature 56 suitably pivoted for cooperation with the ends of the arms 52 and 53 and with the end of the core 54.

Suitably secured to the rear end of the pole-piece yoke is a forwardly extending arm 57 to the forward end of which a U-shaped magnetic latch member 58 is pivoted by the pivot pin 59. The forwardly extending arms 60 and 61 of the member 58 have inturned pole-pieces 62 and 63 which cooperate with an auxiliary pole-piece 64 secured to the forward end of the core 54. The arm 61 of the member 58 extends forwardly beyond the pole-piece 63 thereof and is provided upon its end with a latch 65 for engagement outside of extension 66 formed upon the outer edge of the armature 56. In the operation of the magnet, it will be assumed that coil 55 is energized with an operating current of such a polarity that the auxiliary pole-piece 64 is made a north pole. The armature 56 will be attracted to the pole-pieces of the yoke and of the core 54 and with the auxiliary pole-piece 64 made a north pole, the south pole-piece 63 of the member 58 will be attracted thereto and the north pole-piece 62 of the member 58 will be repelled therefrom, thereby swinging the member 58 about the pivot 59 to move the latch 65 behind the armature extension 66. If now the coil 55 is entirely deenergized, the member 58 will remain in its operated position and will by its latch 65 hold the armature 56 from releasing. Thereafter if current of a reversed polarity is applied to the coil 55 for a short interval, the auxiliary pole-piece 64 will be so polarized as to become a south pole thereby attracting the north pole-piece 62 of the member 58 and repelling the south pole-piece 63 to swing the member 58 in such a direction as to remove the latch 65 from behind the armature extension 66 whereby upon the deenergization of the coil 55, the armature 56 is permitted to release.

It is to be noted that the reversed current required to unlock any one of the magnetic devices need be only of sufficient potential to effect the operation of the permanent magnet latching member and may, therefore, be insufficient to operate the main armature or armatures of the device. It will be apparent that while the invention has been illustrated as applied to electromagnetic devices of well-known types, it is

readily applicable to any type of magnetic device.

What is claimed is:

1. In an electromagnetic device, a core, an operating coil on said core, an armature attractable to said core and a latch member for locking said armature in its attracted position, said member comprising a U-shaped magnet pivotally mounted with its pole-pieces positioned on opposite sides of said core, one of said pole-pieces having the end thereof extended at right angles to form a latch engageable against said armature, when said armature is in its attracted position, upon the attraction of one of said pole-pieces to said core in response to the energization of said coil by current of one polarity and the other of said pole-pieces being attractable to said core to remove said latch from said armature upon the energization of said coil by current of the opposite polarity.

2. In an electromagnetic device, a core, an operating coil on said core, an armature attractable to said core, an auxiliary pole-piece on said core and a latch member for locking said armature in its attracted position, said member comprising a U-shaped magnet pivotally mounted with its pole-pieces positioned on opposite sides of said auxiliary pole-piece, one of said pole-pieces having the end thereof extended at right angles to form a latch engageable against the outer face of said armature, when said armature is in its attracted position, upon the attraction of one of said pole-pieces to said auxiliary pole-piece in response to the energization of said coil by current of one polarity and the other of said pole-pieces being attractable to said auxiliary pole-piece to remove said latch from said armature upon the energization of said coil by current of the opposite polarity.

3. In an electromagnetic device, a core, an operating coil on said core, two armatures attractable to said core and a latch member for locking either armature in its attracted position, said member comprising a U-shaped magnet pivotally mounted with its pole-pieces positioned on opposite sides of said core, one of said pole-pieces having the end thereof extended at right angles to form a latch engageable over one of said armatures when said armatures are in their attracted positions, upon the attraction of the other of said pole-pieces to said core in response to the energization of said coil by current of one polarity, the other of said pole-pieces having the end thereof extended at right angles to form a latch engageable over the other of said armatures, when said armatures are in their attracted positions, upon the attraction of said one pole-piece to said core in response to the energization of said coil by current of the opposite polarity, and said member being operable to unlatch either latched armature in response to the energization of said coil by current of a polarity opposite to the polarity by which the latched armature was initially attracted.

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