Oct. 21, 1941. D. E. BRANSON 2,259,514

ELECTROMAGNETIC DEVICE

Filed May 25, 1939

FIG. 1

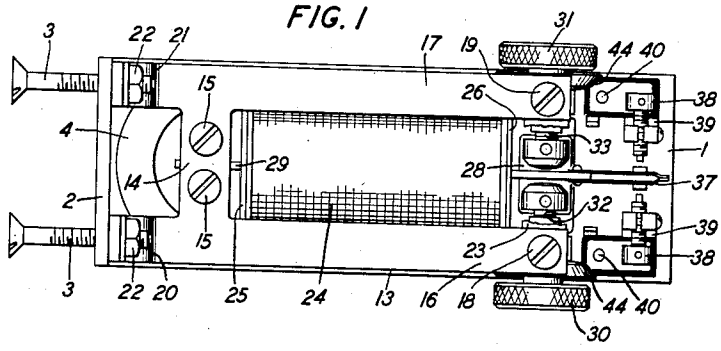


FIG. 2

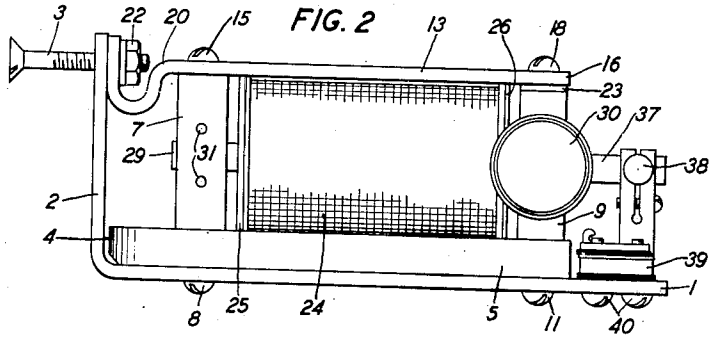


FIG. 3

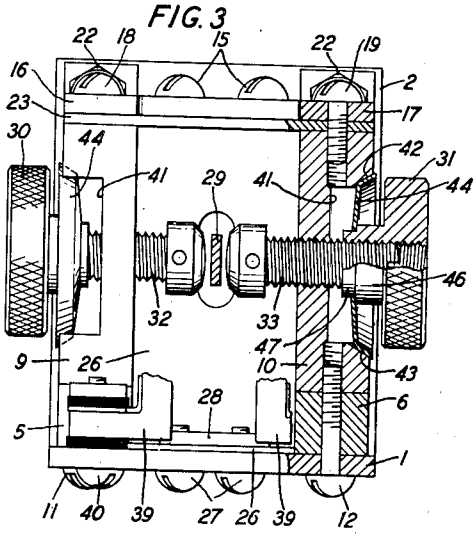
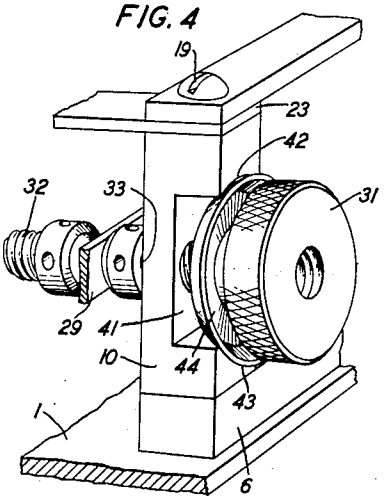


FIG. 4



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ELECTROMAGNETIC DEVICE

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2 Claims. (Cl. 175—339)

This invention relates to electromagnetic devices and in particular to a sensitive polarized relay especially suitable for use with high speed telegraph service.

With the present types of high speed relays, trouble is very often experienced with changes in the magnetic circuit of the relay due to the creepage of the pole-pieces, especially those of the screwtype. Attempts have been made to avoid these changes by providing each pole-piece with a lock nut, but it has been found that, although magnetic maladjustment due to creepage is avoided thereby, magnetic maladjustment due to tightening the lock-nut screws is brought in. Another form of relay in which an endeavor is made to avoid changes in the magnetic circuit is the so-called split pole block which consists of a split block adapted to grip the pole-piece screw. An objection to this form, however, is that any loose particles may injure the thread of the screw and cause the pole-piece screw to bind and eventually hinder its turning. Also, the latitude of adjustment is very small so that the screw is either tight or loose.

It is, therefore, the object of the present invention to provide a polarized relay of high sensitiveness that has a pair of novel pole-pieces provided with means for maintaining the adjustment of said pole-pieces in a definite and fixed position to avoid creepage and to avoid any binding of the adjusting screws.

To accomplish this object a feature of the invention is to be found in the use of a spring washer attached to a threaded nut having a conical or bevelled edge on the washer that mates with a similar-shaped seat in the pole block. The locking washer may be turned to give the desired holding force and, by so choosing the angle of bevel at the rim of the washer, the holding torque may be made much greater than the available torque for turning the locking collar through the turning the pole screw.

Still other features will be brought out more clearly in the following specification and in the accompanying drawing, in which:

Fig. 1 shows a top plan view of the relay;

Fig. 2 shows a side elevational view of the relay;

Fig. 3 shows an enlarged front elevational view of the relay with the contact screws omitted and the right pole screw partly cut away to show the relation between the threaded portion of the pole-piece and the adjusting nut and washer; and

Fig. 4 is a perspective view of the right pole-piece of the relay showing the details of the adjusting screw and washer cooperating therewith.

Referring to the drawing, an L-shaped base or mounting plate 1 is provided for mounting and supporting the relay structure, the short vertical arm 2 of which may be secured to the usual mounting rack by bolts 3 extending through holes near the upper edge of the arm 2 thereof. Supported on the upper face of the horizontal portion of plate 1 is a U-shaped permanent magnet 4 having its poles 5 and 6 extending toward the forward end of the plate. Positioned on the horizontal portion of the plate near its rear end and within the permanent magnet 4 is an upwardly extending heel-piece 7 of magnetic material secured to the plate 1 by screws 8. Positioned on and extending upwardly from the poles 5 and 6 of the magnet 4 are two pole-screw blocks 9 and 10 of magnetic material which are held in position by screws 11 and 12 that extend through holes in the plate and in poles 5 and 6, and are secured into threaded holes in the lower ends of the blocks. The screws 11 and 12, besides holding in position the pole screw blocks 9 and 10, serve also to clamp the permanent magnet to the plate 1. Each pole block is rectangularly grooved on its outer side as shown at 41, and arcuately bevelled to form upper and lower seats 42 and 43 which are engaged by a washer 44 as more particularly described hereinafter.

The return pole-piece 13 is of magnetic material and is substantially H-shaped, its cross-bar member 14 being secured by screws 15 to the upper end of the heel-piece 7 and its forward or long arms 16 and 17 being secured by brass screws 18 and 19 to the upper ends of the pole-screw blocks 9 and 10, respectively. The rear or short arms 20 and 21 of said return pole-piece are bent downwardly and then upwardly, as most clearly shown in Fig. 2, with their upwardly extending ends forming feet which rest against the inner surface of the vertical arm 2 of the plate 1 and are provided with holes through which the relay mounting bolts 3 extend. Thus, when the relay structure is mounted on the relay rack and the nuts 22 on the bolts 3 are tightened, the rear arms of the return pole-pieces, due to the slight resiliency of their bent portions, become firmly seated against the vertical arm 2 of the plate 1 and the entire relay structure is clamped firmly on the relay rack. The forward ends of the arms 16 and 17 of the return pole-piece 13 are magnetically separated from the upper ends of the pole-screw blocks 9 and 10 by an interposed shim 23 of non-magnetic material of suitable thickness to provide fixed air-gaps between the forward arms of the return pole-piece and the pole-screw blocks. By this construction a very rigid magnetic structure is provided.

Mounted on the plate 1 between the heel-piece 7 and the pole-screw blocks 5 and 6 is an operating coil 24 having a spool sleeve extending axially therethrough. The coil is supported at its rear

end by an L-shaped bracket 25, one arm of which is secured in the usual manner to the end of the coil spool and the other arm of which is clamped by the screws 6 between the plate 1 and the bottom of the heel-piece 7. The coil is supported at its forward end by a similar L-shaped bracket 26, one arm of which is secured to the forward end of the coil spool and the other arm to the plate 1 by screws 27 which extend through the plate and through the bracket into threaded holes in the clamping plate 28.

The armature 29 is clamped at its rear end in a notch in the heel-piece 7 by a T-shaped clamping member (not shown) which is secured to the side of the heel-piece by screws 31, and extends freely through the axial sleeve of the coil spool for vibration in a plane parallel to the plate 1. The free end of the armature is movable between the inner ends of pole screws 32 and 33 which are provided with fine threads and are threaded through the pole-screw blocks 9 and 10. Each pole screw 32 and 33 threads into an adjusting nut 30 and 31, respectively, and each of said adjusting nuts has hub 46 having a reduced portion 47 on which is rigidly secured a spring disk or washer 44. The disk and nut may, of course, be of one-piece construction or may be separate elements assembled upon the relay as shown.

The disk 44 is of any suitable resilient non-magnetic material and is provided with a conical rim whose angular bevel is so determined with respect to the angle of bevel of the pole-piece arcuate seats 42 and 43, as to provide the disk with a snug fit in said two arcuate seats.

The required degree or amount of clamping of the pole-pieces 32 and 33 may be secured by turning the adjusting nuts 30 and 31, and the clamping of the pole-pieces thus obtained is maintained by the disks which exert a lengthwise pull on the pole screws 32 and 33. This pull serves two purposes, one to hold the pole screws in alignment and the other to exert sufficient friction so that the pole screws will not need to be further clamped or locked after the proper adjustment is obtained. The amount of this friction is adjustable within a certain range depending upon how tightly the spring disks are set. This adjustment may be made by turning the nuts 30 and 31 by hand.

In order to permit a relatively loose fit of the pole screws 32 and 33 in the threads of locking nuts 30 and 31, respectively, it is essential that the instant centers of the disks 44 relative to the pole blocks be as near as possible to the instant center of the locking nuts relative to the pole screws. If this condition is satisfied, then any rocking or skewing of the locking nut will not cause the pole screw to be moved out of axial alignment appreciably. This is desirable in order to preserve the axial adjustment of the pole-piece without the necessity of providing tight fits that might produce magnetic distortion of the magnetic circuit or in binding of the nuts to the pole screws. The cross-sectional areas of the pole-screw blocks 9 and 10 are such as to afford low reluctance paths therethrough, thus increasing the magnetic efficiency of the relay.

The extreme forward end of the armature is provided with contact carrying springs 37 riveted thereto which cooperate with adjustable contact screws 38 threaded through the upper bifurcated ends of terminal posts 39 which are insulatedly secured to the forward end of the plate 1 by screws 40.

The permanent magnet 4 has sufficient magnetic strength so that the pull exerted thereby upon the armature 29 is practically sufficient to counteract the stiffness of the armature which is, therefore, substantially in equilibrium. The polarizing flux through the magnetic circuit extends from one pole 5 of the permanent magnet to the pole-screw block 9 where it divides into two paths, one across the fixed air-gap through the non-magnetic shim 23, through the forward arm 16, cross-bar 14 and forward arm 17 of the return pole-piece 13, across the other fixed air-gap through the non-magnetic shim 23 and through the pole-screw block 10 to the other pole 6 of the permanent magnet and over a second path from the pole-screw block 9 into the pole screw 32, across the working air-gaps and the free end of the armature to pole screw 33 and thence through the pole-screw block 10 to the other pole 6 of the permanent magnet. It will be apparent that both the amount and the direction of the polarizing flux through the armature depend upon the position of the free end of the armature in the working air-gaps. When the armature is exactly midway between the pole screws, there is no polarizing flux through the armature in the direction of its length since it connects two points of equal magnetic potential, but as it moves toward one pole-piece the polarizing flux flows through the armature in one direction, whereas when it moves toward the opposite pole screw, the polarizing flux reverses and flows through the armature in the opposite direction.

The paths of the operating flux generated by current traversing the coil 24 pass out the forward end of the armature 29, across the two working air-gaps in parallel into the pole screws 32 and 33, pole-screw blocks 9 and 10, across the fixed air-gaps through the shim 23, thence through the forward arms 16 and 17 and cross-member 14 of the return pole-piece 13 and through the heel-piece 7 to the rear end of the armature, or in the reverse sequence if the current in the coil 24 is in the opposite direction.

While I have described my invention and the means for utilizing the same in connection with its specific application to a polarized relay, it is to be understood that various other applications and embodiments thereof may be made by those skilled in the art without departing from the spirit of the invention as defined within the scope of the appended claims.

What is claimed is:

1. A clamping device for the pole screw of a relay comprising in combination a threaded pole block having a bevelled recess in its face, a pole screw threaded through said block and a threaded nut registering with said screw, said nut having a concentric spring disk with a bevelled rim adapted to fit into said bevelled recess, the instant center of the bevel of the rim of said disk relative to the pole block being substantially near the instant center of the nut relative to said pole screw.

2. A pole-piece for an electromagnetic device comprising a pole-block having an outer conical seat, an adjustable screw extending therethrough, a nut on said screw, and a thin sheet metal circular disk fixedly secured to said nut, said disk having at its periphery a continuous narrow conical rim and acting as a spring to yieldingly engage its rim with the conical seat of said pole-block.

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