Dec. 10, 1957 E. S. PETERSON 2,816,190

POLARIZED ELECTROMAGNETIC RELAY

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FIG. 2

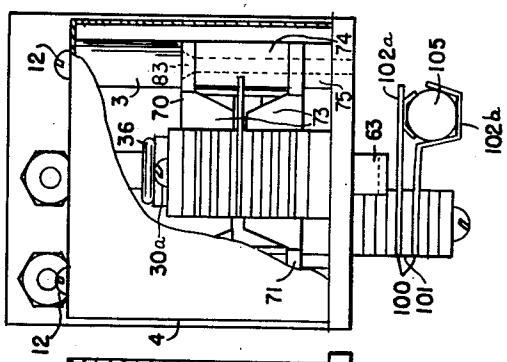


FIG. 1

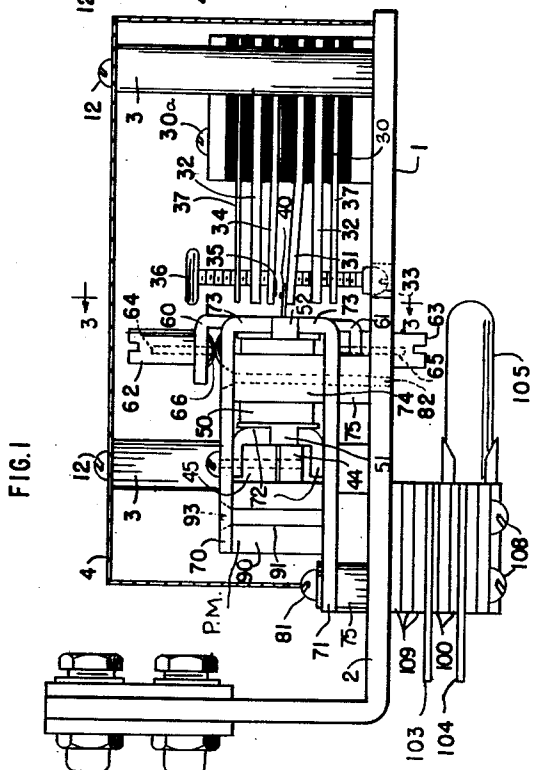


FIG. 3a

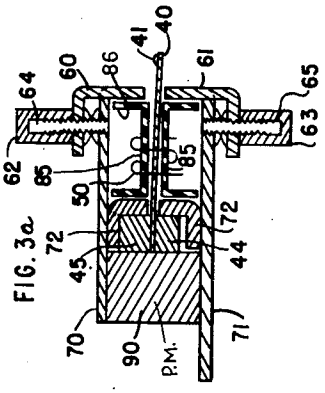
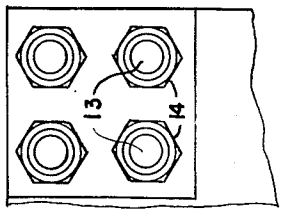


FIG. 6



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FIG. 3

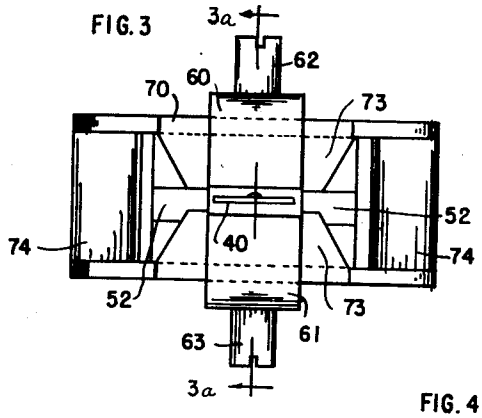


FIG. 3b

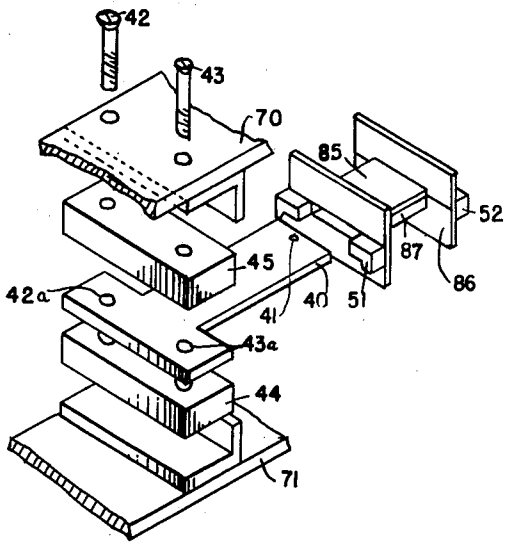


FIG. 4

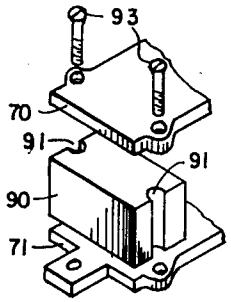
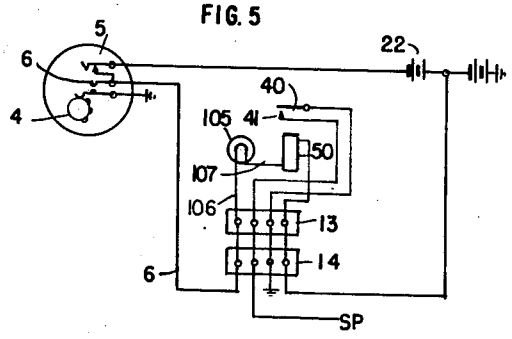


FIG. 5



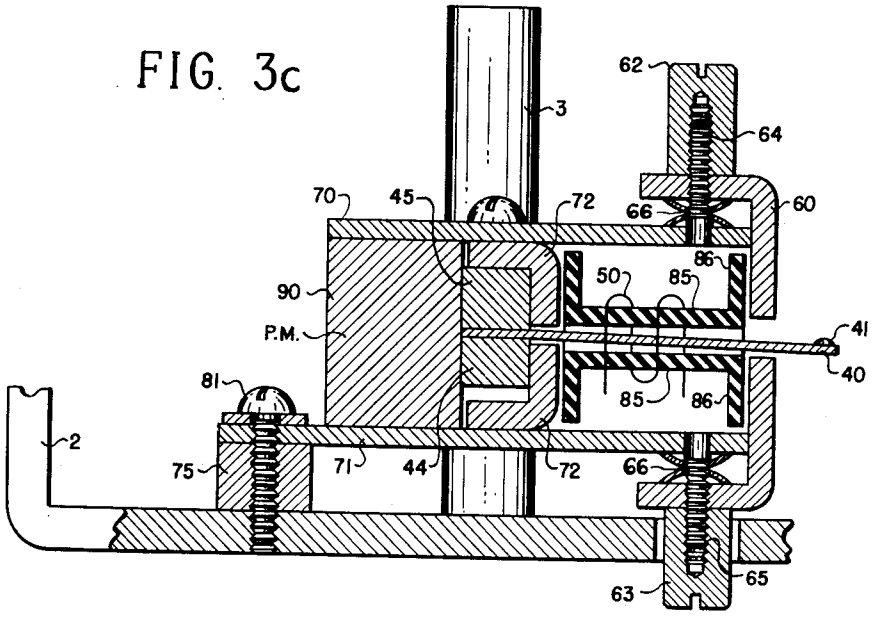
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FIG. 3c



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2,816,190

POLARIZED ELECTROMAGNETIC RELAY

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Application July 17, 1952, Serial No. 299,331

4 Claims. (Cl. 200—93)

This invention relates in general to a polarized relay and more particularly to the construction of a highly sensitive polarized electromagnetic relay. This relay was especially designed to be used in a Strowger automatic toll ticketing system. The construction used herein is somewhat similar to the sound translating device of the type disclosed in Patent Nos. 2,241,105 issued to Woodruff and Horlacher, May 6, 1951, and 2,240,576 issued to Pye May 6, 1941.

One of the objects of this invention is to provide a relay construction of the above-mentioned character which will be simple and inexpensive, compact and rugged. Another object is to provide a polarized electromagnetic relay in which the many and various disadvantages, deficiencies and defects of polarized relay construction heretofore known may be dependably and reliably overcome in a thoroughly practical, inexpensive and simple way.

Another object is to provide a polarized relay construction of high efficiency. Another object is to provide a construction of the above-mentioned character in which high sensitivity will be achieved at an efficiency heretofore unknown in electromagnetic relays. Still another object of this invention is to expedite the attainment of substantially exact magnetic ad mechanical balance and electrical symmetry of the armature in the absence of signalling currents in the signal coil.

Another object is to provide a relay of highly stable operation for use in a Strowger automatic toll ticketing system wherein line conditions are constantly varying.

A feature of the invention is a protective device to prevent injury to the coil through which signalling currents pass.

Another feature of this invention is the provision of an electromagnetic construction which will faithfully reproduce rapid changes in signalling current.

Other features of the invention are the construction whereby contacts are always made at the same point, and the overflexing of the armature is prevented.

Still another feature of this invention is a relay construction which is such as to enable adjustment of its sensitivity.

Other objects and features will become obvious on further reading of the following.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts as will be exemplified in the structure to be hereinafter described in the remainder of the application and which will be indicated in the following claims.

In the accompanying drawings is shown by way of illustration one of the various embodiments of my invention:

Fig. 1 is a plan view only partially showing the cover for the assembly.

Fig. 2 is a side elevation.

Fig. 3 is a view of the armature, coil and magnet assembly along the line 3—3 in Fig. 1.

Fig. 3*a* is a view taken along line 3*a*—3*a* of Fig. 3.

Fig. 3*b* shows the manner in which the armature is

fastened and the construction of the coil body. Fig. 3*c* is an enlarged view of Fig. 3*a* taken along the line 3*a*—3*a* showing the details of the arrangement more clearly.

Fig. 4 shows the manner in which the magnet and heel pieces are joined.

Fig. 5 shows a typical Strowger automatic toll ticketing circuit in which this relay will operate.

Fig. 6 is a left side elevation of the structure illustrating the four jacks.

As conducive to a clearer and more ready understanding of certain features of my invention, it might at this point be noted that the winding here used is of a low resistance type generally used in sound power receivers where small currents are usually relied upon.

The pole pieces used are adjustable by means of separate nuts and tensed steel springs for each pole piece. These pole pieces may provide for greater or less sensitivity by adjustment of the nuts so that undesirably small signal currents will have no effect on the armature. Allegheny electric metal is used for the pole pieces and heel pieces.

Spring contacts are provided and are adjustable by means of a separate screw exerting pressure upon the back of each spring, one spring being provided as a rest and the other as a contact. This method of adjustment enables the armature and the spring to contact each other at the same point on their surfaces.

The armature is anchored at one end at a point in the center and just above the permanent magnet; this point being some distance from the points of contact between the armature and the spring thus preventing overflexing of the armature and at the same time provide a large degree of movement at one end.

A lamp is provided in series with the coil winding to prevent burning out of the coil if the current becomes too large.

The invention and the above noted and other features thereof will be understood more clearly and fully from the following detailed description.

Referring first to Fig. 1 there is generally indicated at Fig. 1 the L-shaped carrying plate **1** at the right end of which is the contact assembly **30**. Carrying plate **1** has on its horizontal face **2** a pair of lugs 3 at each corner having their centers threaded. A cover 4 is adapted to be placed on these lugs **3** and held in place there by means of screws **12**. This cover serves to enclose the permanent magnet, armature, coil and contact assembly. The contact assembly is fastened to the carrying plate by means of screws **30***a*. The contact assembly consists of resting spring **31** against which armature 40 rests when signalling currents are not passing through coil **50**. Resting spring **31** is tensed against and adjusted by means of adjusting screw **33** which is threaded through adjusting plate **32** and guide plate **37**. Contact spring **34** carries a curved contact point **35** adapted to make contact with a similar contact point **41** on armature **40**. Contact spring **34** is tensed against and adjusted by means of adjusting screw **36** threaded through guide plate **37** and adjusting plate **32**. Thus adjustment may be made without turning contact points **35** and **41** out of alignment.

Armature **40** is clamped at one end adjacent the center of magnet **90** between blocks **44** and **45** by screws **42** and **43** extending through heelpiece **70** through block **45** through holes **42***a* and **43***a* respectively in the armature **40** and threaded into block **44**. Armature **40** passes through the center of coil **50** and between pole pieces **60** and **61**. Pole pieces **60** and **61** are detachably held on heelpieces **70** and **71** and are adjusted by means of nuts **62** and **63** on screws **64** and **65** fastened to heelpieces **70** and **71** respectively. Springs **66** are placed between pole pieces **60** and **61** and the back of

heelpieces 70 and 71 to tension the pole pieces away from the heelpieces. A magnetic circuit is thus formed by permanent magnet 90, heelpieces 70 and 71 and pole pieces 60 and 61. The density of the magnetic flux passing between pole piece 60 to 61 is affected by currents passing through coil 50 to in turn attract or repel the armature 40 according to the strength of said currents and the distances the pole pieces are from said armature 40. Therefore the effect these signalling currents have upon the armature 40 is determined by pole pieces 60 and 61 being adjusted to have more effect or less effect on armature 40 as desired so that if armature 40 is overly sensitive to changes of magnetic flux, pole pieces 60 and 61 then may be backed away from the armature 40 under the influence of springs 66 by loosening nuts 62 and 63 until the desired sensitivity is effected. Body portions 73 at the right end of each heelpiece and extending toward each other form respective recesses which serve as a guide for pole pieces 60 and 61 respectively.

As will be noted in Figs. 1 and 2 heelpieces 70 and 71 are fastened to carrying plate 1 by means of screws 81, 82, 83 and spacers 74 and 75. Spacers 74 are for the purpose of securing the same distance between heelpieces 70 and 71 at their ends nearest the spring contact assembly as is effected at their lower end by permanent magnet 90. Each heelpiece has a body portion 72 formed at right angles to the heelpiece and passing between the left end of the coil winding 50 and blocks 44 and 45 respectively, as shown in Fig. 3*a*. It will be noted that the permanent magnet 90 is slotted at each end 91 to accommodate heelpiece fastening screws 93 which secure heelpieces 70 and 71 to each other.

Centrally apertured coil winding 50 is assembled with armature 40 passing through its center. Lugs 52 and 51 extending from the right and left center of the phenolic spool heads 86 of the coil respectively rest between body portions 72 and 73 respectively of each heelpiece. This coil is shown in Fig. 3*a* and Fig. 3*b* and is of the type disclosed in the afore-mentioned patents. It consists of two complimentary longitudinally extending body sections 85 of insulating material and laterally extending spool heads 86 carried on the opposite ends of said body. The body includes side walls 87 arranged in aligned openings in said spool heads 86. Body portion 73 has an angular face as shown in Fig. 3 adapted to fit a correspondingly shaped face on phenolic lug 52 so that its assembled position will be stable. The coil winding 50 is longitudinally wound on body sections 85. The distance between body portions 72 and 73 of the heelpieces is so dimensioned as to fit snugly against the phenolic spool heads 86 of the coil in their assembled position.

A typical Strowger automatic toll ticketing circuit in which this relay might be used is shown in Fig. 5. It will be noted that spring 5 is a typical telephone dial spring while spotter identification cam 4 is adapted to close identification contact 6 to ground only when the regular dial spring 5 is closed and that the current to be used for operating the relay in this circuit might be very weak due to losses in the different lines. Armature 40 is centered between the pole pieces as the attraction of each pole piece for the armature when adjusted is the same. When the telephone is not in operation, rest spring 31 rests against armature 40 by adjustment of screw 33. When the phone is in operation current passing through the coil 50 from negative side of the spotter battery 22 through dial spring 5 through coil 50 to positive battery serves to force armature 40 more strongly against resting spring 31. When identification contact 6 is closed to ground the current through the coil 50 is reversed and armature 40 is forced against contact spring 34 to close a circuit to the spotter.

The lamp holder assembly shown in Figs. 1 and 2 consists of 2 plates 100 separated by an insulator 101.

Each of the plates has an extending body portion 102*a* and 102*b* as shown in Fig. 2 formed to clamp lamp 105 between them. Each of the plates is in contact with a separate spring terminal 103 and 104 to which are attached leads 106 and 107. These spring terminals are separated from ground on the carrying plate 1 by insulators 109. This entire assembly is fastened to carrying plate 1 by screws 108. The lamp 105 is wired in series with coil winding 50 as shown in Fig. 5 and is so chosen as to prevent the burning out of coil winding 50 if carrying an excess of current.

The base portion of carrying plate 1 as shown in Figs. 1 and 6 has attached thereto male plugs 13. These are adapted to fit into base carrying female plugs 14 to which are attached various leads as shown in Fig. 5. To each of the male plugs 13 extending above the base of carrying plate 1 is extended a corresponding lead to each of the various parts of the relay as shown in Fig. 5.

The invention described herein utilizes a well known magnetic sound translating device as described in the afore-mentioned patents including a coil responsive to voice frequencies and low currents. It is to be noted that several improvements and changes are made to adapt the translating device to serve the purpose herein contemplated. The armature is now clamped at the end instead of pivoted in the center. Adjustable pole pieces, adjustable contact springs and other features described herein are added.

Although a specific embodiment of my invention has been shown and described, it will be understood that it is but illustrative and that various modifications may be made without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. In an electromagnetic device, a pair of parallel magnetizable plates having a permanent magnet positioned therebetween and adjacent one end of each plate, a pair of spaced apart tongues on the other end of each plate, each pair of tongues extending at a right angle to its respective plate and toward the other plate, each pair of spaced apart tongues defining a space therebetween, pole pieces individually positioned in the space between each pair of tongues and extending toward each other thereby forming an air gap, a centrally apertured coil positioned between said plates and adjacent said pole pieces, a bobbin for carrying said coil and having positioning elements, said elements extending between the opposing tongues of each pair to thereby retain said bobbin and coil securely in position, an armature passing through said coil aperture and in said air gap, said magnet, plates, pole pieces and air gap forming a magnetic circuit having a certain flux density, and means for adjusting said pole pieces for reducing or enlarging the size of said air gap for preventing said armature operation unless said coil is energized by current of a predetermined magnitude.

2. In a device as claimed in claim 1, an adjustable contact assembly comprising a pair of manually adjustable screws, a rest spring for preventing movement of the armature in one direction, said rest spring tensioned against one of said screws, and a contact spring having a protuberance thereon, said contact spring tensioned against the other screw, a similar protuberance on said armature in axial alignment with said first protuberance for contact with said other protuberance, separate threaded apertured guide plates adapted to receive each of said screws, said screws thereby individually movable for adjusting the individually associated contact spring closer relative to said armature and for adjusting the position of said armature in said air gap whereby said protuberances are in constant axial alignment despite eccentricities in said screw structure so that the position of said armature in said air gap may be varied for the purpose of varying the effect of the magnetic field thereupon without affecting the alignment thereof with said contact spring.

3. A polarized relay of the class wherein an armature

is supported between magnetizable plates attached to a permanent magnet at one end of said plates and is surrounded by a coil winding positioned between said plates, the improvement comprising an L-shaped pole piece for each plate, positioning means secured near the other end of each plate and extending through one leg of each pole piece for maintaining the other leg of each pole piece at right angles to and in continuous engagement with the other end of its respective plate, said other leg of each pole piece forming an air gap through which said armature passes, a tensioned member located between the said one leg of each pole piece and its respective plate and normally applying a force against said one leg of each pole piece to securely hold said other leg of each pole piece in engagement with the other end of its respective plate, adjustable means cooperating with said positioning means and operated in one direction to increase the tension in said member and to cause the said other leg of each pole piece to move towards said armature while maintaining continuous engagement with said other end of its respective plate for adjusting said air gap, and said tensioned member applying a force to move said other leg of each pole piece away from said armature while maintaining continuous engagement with said other end of its respective plate for adjusting said air gap when said adjustable means is operated in the opposite direction.

4. A polarized relay of the class having a pair of magnetizable plates with a permanent magnet therebetween, an armature surrounded by a coil located between said magnetizable plates, the improvement comprising an L-shaped pole piece for each plate, a threaded stud attached to each plate and extending through one leg of its respective pole piece for maintaining the other leg of each pole piece at right angles to and in continuous engagement with an end of its respective plate, a nut for each stud cooperating with one leg of each pole piece whereby the other leg of each pole piece is forced toward said armature while maintaining engagement with the end of its respective plate when its associated nut is tightened on its associated stud, and a tensed member for each pole piece carried on each stud between said one leg of each pole piece and its associated plate for forcing the other leg of each pole piece away from said armature while maintaining engagement with the end of its respective plate when its associated nut is loosened, each tensed member and its associated nut thereby cooperating to permit adjustment of said pole pieces relative to said armature to vary the air gap therebetween accordingly and to maintain said other legs of said pole pieces securely in engagement with said ends of said plates when adjusted.

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