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ELECTRICAL RELAY

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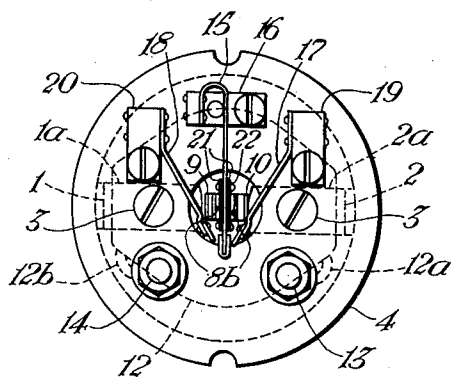


Fig. 2.

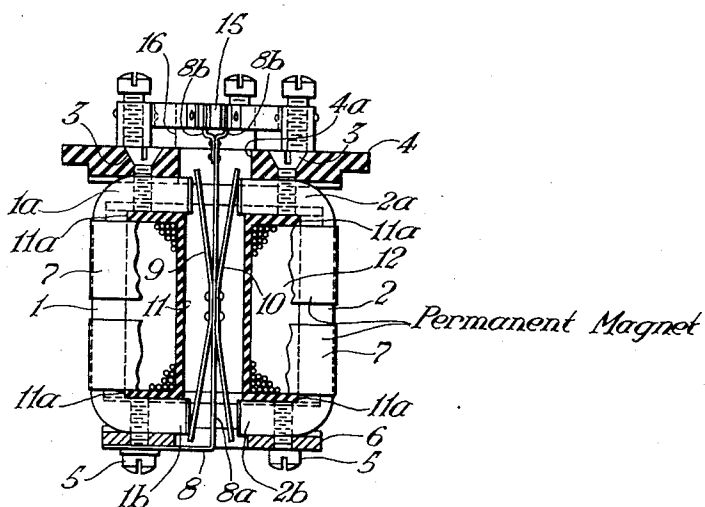


Fig. 1.

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ELECTRICAL RELAY

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5 Claims. (Cl. 200-93)

My invention relates to electrical relays, and particularly to electrical relays of the sensitive polarized type suitable for use in railway signaling systems.

In the design of compact sensitive polarized relays the problem of pivoting the armature is one of major difficulty. It is known that the greatest relay efficiency can be obtained when the armature is pivotally supported in the center so that the flux in the air gaps at both ends of the armature can do useful work. However, when the armature is pivoted in the center, it has heretofore been necessary in order to obtain full efficiency to split the energizing winding into two coils, one of which is disposed on each side of the pivots. This complicates the design, and increases the cost of manufacture, and to get away from the disadvantage of the two coil structure and at the same time eliminate the pivots, other relays have been designed with a hinge spring at the bottom, the armature in some cases acting as the spring. This latter construction, while better mechanically, is less efficient electrically.

One object of my present invention is to provide a compact sensitive polarized relay which combines the advantages of both types of relays referred to above.

Another object of my invention is to provide an improved armature construction together with an improved means for supporting the armature in relays of the type described, which construction and supporting means will enable an energizing winding wound into a single coil to be used.

A further object of my invention is to decrease the cost of manufacture and facilitate the maintenance of polarized relays of the type described.

According to my invention, the relay armature is constructed of two magnetizable strips secured to the opposite sides of a non-magnetizable spring. The spring is secured in place at one end, and the strips and spring extend with clearance through the relay winding which is in the form of a single coil. The strips are secured to the supporting spring intermediate its ends and cooperate at their opposite ends with pairs of confronting pole pieces which are polarized as by a permanent magnet, whereby when the relay is energized, the armature pivots about a point located approximately in the center of the winding. This provides a spring armature mounting with the advantages of center pivot operation, and in addition the non-magnetizable spring acts as a

pins are required. The free end of the non-magnetizable spring actuates the relay contacts. Other objects and characteristic features of my invention will become apparent as the description proceeds.

I shall describe one form of relay embodying my invention, and shall then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a view partly in elevation and partly in section showing one form of relay embodying my invention. Fig. 2 is a top plan view of the relay shown in Fig. 1.

Similar reference characters refer to similar parts in both views.

Referring to the drawing, the relay in the form here shown comprises two U-shaped yokes 1 and 2 of magnetizable material secured at their upper ends by means of screws 3 to a top plate 4 of suitable insulating material, such as a phenol condensation product, and at their lower ends by means of screws 5, to a bottom plate 6, also of suitable insulating material. The yokes 1 and 2 are disposed with their upper legs 1a and 2a, and their lower legs 1b and 2b, in spaced confronting relation, and are constantly magnetized by U-shaped permanent magnets 7 the ends of which engage the yokes at their sides.

An L-shaped spring 8 of suitable non-magnetic material, such as phosphor bronze, is secured at its lower end to the bottom plate 6 by means of the screw 5 which fastens the yoke 1 to the bottom plate, and the long leg 8a of this spring extends upwardly through the air gaps formed between the confronting ends of the yokes 1 and 2 and supports an armature assembly which, as here shown, comprises two magnetizable strips 9 and 10 secured intermediate their ends to the opposite sides of the leg 8a intermediate its ends. As illustrated, the strips are riveted to the leg 8a, but it will be understood that any suitable means may be employed for fastening the strips to the leg. The upper and lower ends of the strips 9 and 10 extend between, and cooperate with, the confronting ends of the upper and lower legs of the magnetizable yokes 1 and 2 in such manner that the armature assembly is free to move between a normal extreme position in which the upper end of the strip 10 engages the end of the leg 2a of the yoke 2 and the lower end of the strip 9 engages the end of the leg 1b of the yoke 1, and a reverse extreme position in which the upper end of the strip 9 engages the end of the leg 1a of the yoke 1 and the lower end of

the strip 10 engages the end of the leg 2b of the yoke 2.

A hollow spool 11 having a coil 12 wound thereon surrounds the armature assembly with some clearance between the upper and lower legs of the yokes, and is held in the proper vertical position by engagement of the spool heads with the legs of the yokes, and in the proper horizontal position by means of notches 11a in the spool heads, which notches receive the yokes 1 and 2 at their medial portions. The leads 12a and 12b of the coil 12 are secured to terminal posts 13 and 14 mounted in the top plate 4.

The upper end of the long leg 8a of the spring 8 projects upwardly with some clearance through an opening 4a in the top plate 4, and is provided with bifurcations 8b which straddle a movable contact finger 15 intermediate its ends. The finger 15 is secured at one end to a terminal block 16 mounted on the top plate 4, and cooperates at its free end with a fixed contact finger 17 or 18 to close a normal contact 15-17 or a reverse contact 15-18 according as the armature assembly is moved to its normal or its reverse extreme position. The fixed contact fingers 17 and 18 are secured to terminal blocks 19 and 20, respectively, mounted on the top plate 4. The finger 15 at the point where it extends between the bifurcations 8b is provided with two insulating strips 21 which are fastened to the opposite sides of the finger as by rivets 22, and which serve to insulate the finger from the spring.

Assuming that the right-hand ends of the permanent magnets 7 are north poles and the opposite ends south poles, both legs of yoke 2 will become north poles while both legs of yoke 1 will become south poles. Under these conditions, flux will pass from yoke 2 to yoke 1. This flux will distribute itself in the air gaps between the confronting ends of the legs of the yokes in such a way as to allow the greatest amount of flux to flow. That is to say, when the armature assembly is swung to the normal extreme position in which it is shown in the drawing, the greatest part of the flux which passes from the yoke 2 to the yoke 1 will flow downwardly through the upper end of the armature strip 10, thence across the air gap formed between the strips 10 and 9 by the spring 8, and then downwardly through the lower end of the armature strip 9; but when the armature assembly is swung to its reverse extreme position, the greater part of the flux will then flow upwardly through the lower end of the strip 10, thence across the air gap formed between the strips 10 and 9 by the spring 9, and then upwardly through the upper end of the strip 9. It will be apparent, therefore, that both the amount and the direction of the polarizing flux which passes lengthwise through the armature depends upon the particular position of the armature with respect to the confronting ends of the legs of the yokes 1 and 2. When the armature is midway between its two extreme positions, there is no polarizing flux through the armature in the direction of its length because both ends of the armature are at the same magnetic potential, and under these conditions all of the flux which passes from the yoke 2 to the yoke 1 will pass through the confronting legs 2a and 1a, and 2b and 1b.

When the energizing coil 12 of the relay is supplied with current, the upper end of the armature assembly will become a north pole and the lower end will become a south pole, or vice versa, according as the coil is supplied with cur-

rent of reverse polarity or with current of normal polarity. Assuming that the armature assembly occupies its normal extreme position in which it is shown in the drawing and that the operating winding is supplied with current of reverse polarity, the upper end of the armature assembly will be repelled from the leg 2a of the yoke 2 and will be attracted toward the leg 1a of the yoke 2, and the lower end will be repelled from the leg 1b of the yoke 1 and will be attracted toward the leg 2b of the yoke 2. As a result, the armature will quickly move from its normal position to its reverse position and will thereby open the normal contact 15-17 of the relay and close the reverse contact 15-18. As soon as the armature reaches its reverse position, the current can then be removed from the coil 12 and the armature assembly will remain in its reverse position and will hold the reverse contact closed by virtue of the polarizing flux passing through the armature as will be readily understood.

If, when the armature assembly occupies its reverse position, the operating winding is supplied with current of normal polarity, the upper end of the armature assembly will then be repelled from the leg 1a of the yoke 1 and will be attracted toward the leg 2a of the yoke 2, while the lower end of the armature assembly will be repelled from the leg 2b of the yoke 2 and will be attracted toward the leg 1b. The armature assembly will therefore quickly move from its reverse position to its normal position and will thus open the reverse contact and close the normal contact. As soon as the armature assembly has reached its normal position, the current may be removed from the coil 12 and the armature will then remain in the position shown. If, when the armature occupies its normal position, current of normal polarity is supplied to the coil 12, or if, when the armature occupies its reverse position, current of reverse polarity is supplied to the coil 12, the armature will be held in the position which it then occupies in a manner which will be readily understood without further detailed description.

It should be particularly pointed out that with the relay constructed in the manner described when the armature assembly moves from either extreme position to the other, the spring 8 flexes in such a way that the assembly in effect pivots about a point approximately at the center of the coil 12. This provides a spring armature mounting with the advantages of center pivot operation and still permits the coil 12 to be wound on a single spool. The cost of the relay is thereby decreased and the assembly is greatly facilitated.

It should also be particularly pointed out that with the construction shown, since the flux passing lengthwise through the armature has to traverse the air gap formed between the two armature strips 9 and 10 by the phosphor bronze spring 8, this spring acts as a core pin, so that on polar stick relays no core pins are required. Additional non-magnetic spacers may be used between the armature strips 9 and 10 and the spring 8, if required.

It will thus be seen that I have provided a sensitive compact polarized relay using a minimum number of simple parts all of which are easy to machine and assemble, whereby the relay can be constructed for a minimum cost.

Although I have herein shown and described only one form of relay embodying my 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 my invention.

Having thus described my invention, what I claim is:

1. An armature assembly for a relay comprising a flexible non-magnetic spring secured at one end in a fixed position, and two magnetizable strips secured intermediate their ends to the opposite sides of said spring intermediate its ends in such positions that the longitudinal axes of said strips and said spring are substantially parallel, said spring serving as a resilient support for said assembly and also serving to provide a non-magnetic gap between said strips, and contact operating means secured to the free end of said spring.

2. A relay comprising a pair of U-shaped yokes disposed with their legs in spaced confronting relation to form air gaps, means connected with said yokes for polarizing them, a flexible spring of non-magnetic material having one end fixed and extending through said air gaps, two magnetizable strips secured to the opposite sides of said spring and having their ends disposed in said air gaps, and a coil surrounding the armature assembly formed by said strips and said spring.

3. A relay comprising a pair of U-shaped yokes disposed with their legs in spaced confronting relation to form air gaps, an armature assembly comprising a flexible spring of non-magnetic material fixed at one end and two magnetizable strips secured intermediate their ends to the opposite sides of said spring intermediate its ends and having their ends disposed in said air gaps, a spool having an energizing coil thereon surrounding said armature assembly, and a perma-

nent magnet connected with said yokes for polarizing said relay.

4. A polar relay comprising two U-shaped yokes secured with their legs in spaced confronting relation to top and bottom plates of insulating material, an L-shaped spring of non-magnetic material having one leg secured to said bottom plate and the other leg extending through the air gaps formed between the legs of said yokes and through an opening formed in said top plate, two magnetizable strips secured intermediate their ends to the opposite sides of said other leg of said spring intermediate its ends and having their ends extending into said air gaps, a coil wound on a single spool surrounding said strips and the associated leg of said spring with clearance, a permanent magnet connected with said yokes for polarizing said relay, and contacts mounted on said top plate and operated by the upper end of said other leg of said spring.

5. A polar relay comprising a pair of magnetizable yokes disposed with their legs in spaced confronting relation and connected with the opposite ends of a permanent magnet, an armature assembly comprising two magnetizable strips secured to the opposite sides of a non-magnetizable spring, means supporting one end of said spring in such a position that the ends of said strips are disposed in the air gaps formed between the legs of said yokes, and a coil surrounding the assembly formed by said strips and said springs, the parts being so proportioned that said assembly will move to a normal or a reverse position according as said coil is supplied with current of normal or reverse polarity and that in moving between its normal and reverse positions said spring will flex at a point located approximately at the center of said coil.

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