

Oct. 17, 1944.

O. S. FIELD

2,360,664

RELAY

Filed Aug. 3, 1940

3 Sheets-Sheet 1

FIG. 1.

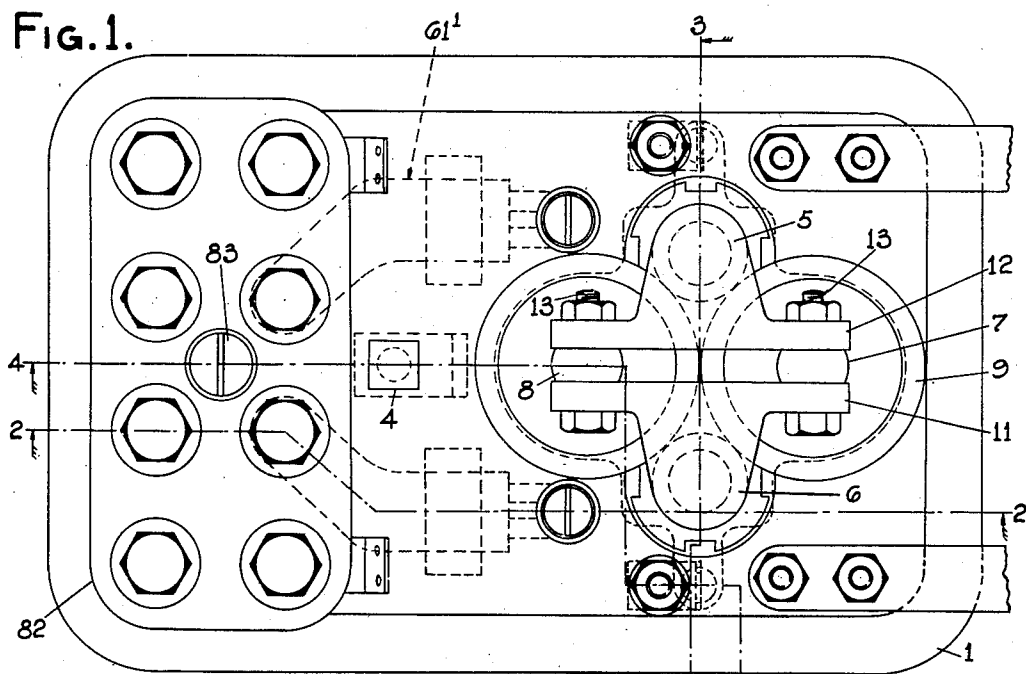
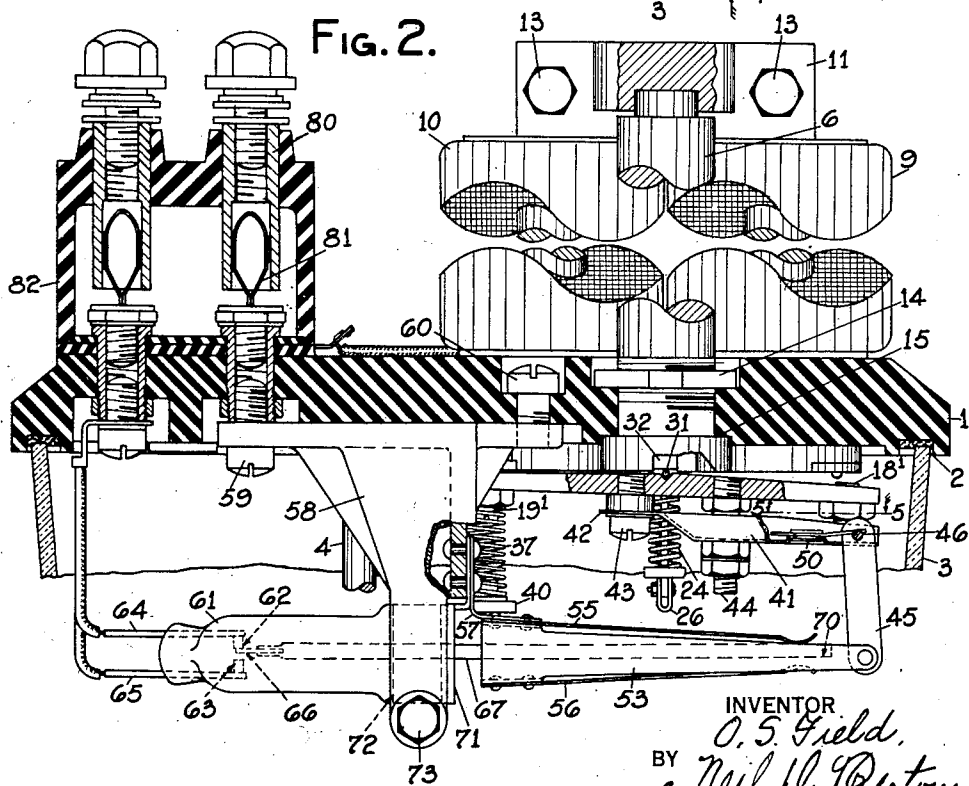


FIG. 2.



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3 Sheets-Sheet 2

FIG. 4.

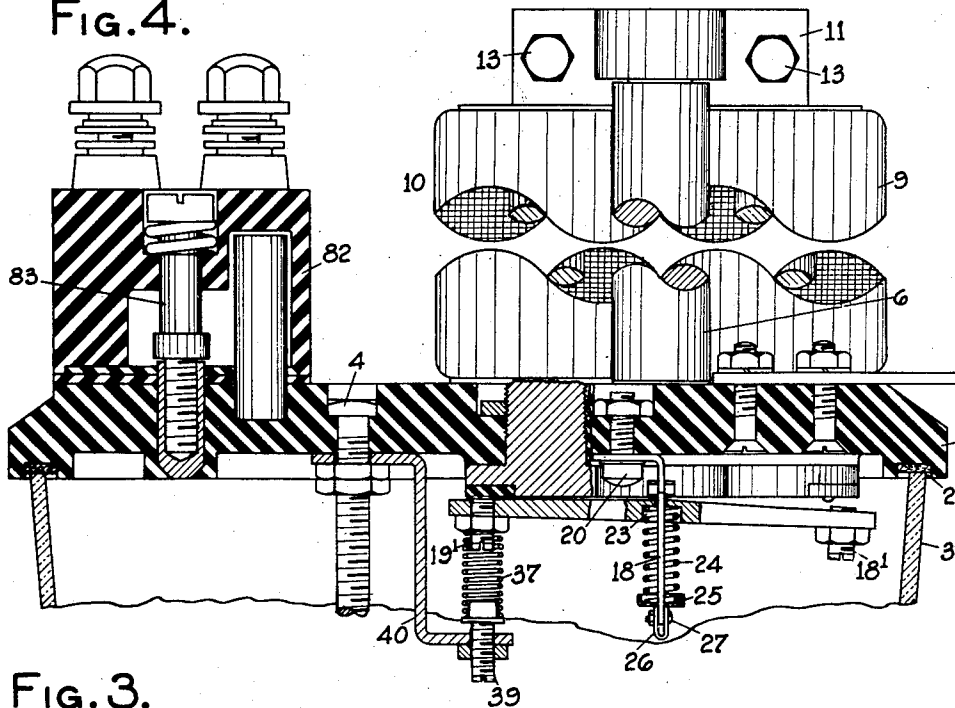


FIG. 3.

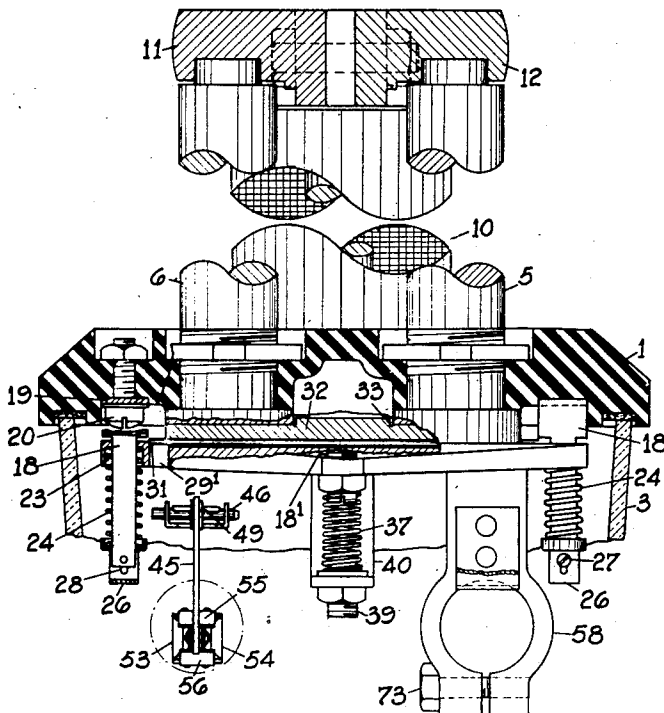
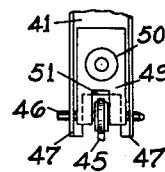


FIG. 5.



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3 Sheets-Sheet 3

FIG. 8.

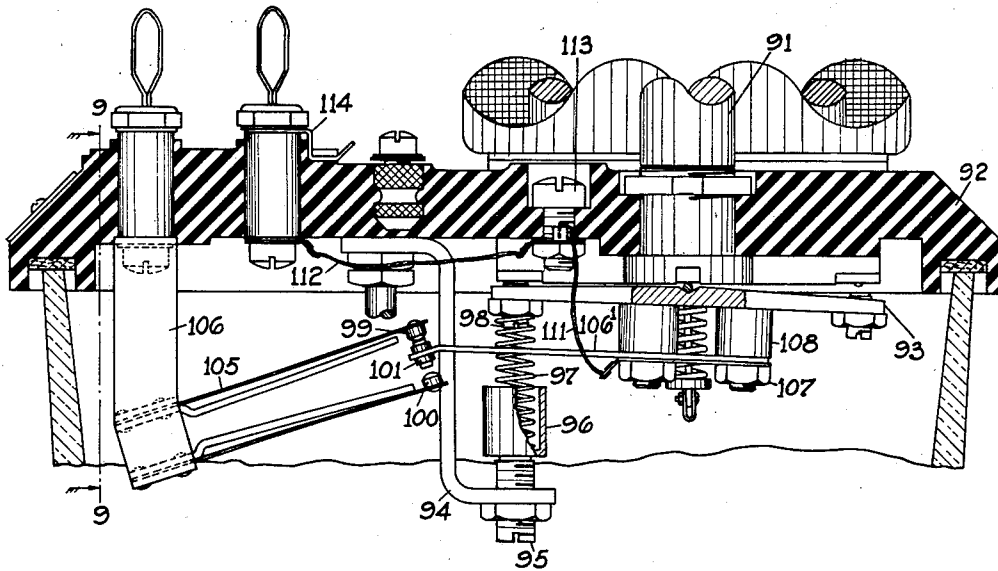


FIG. 9.

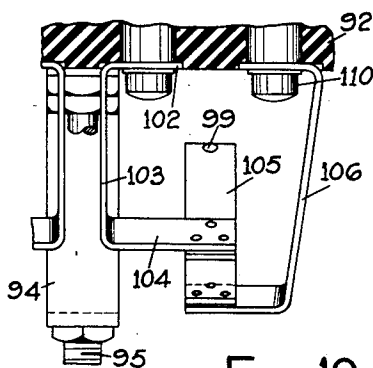


FIG. 6.

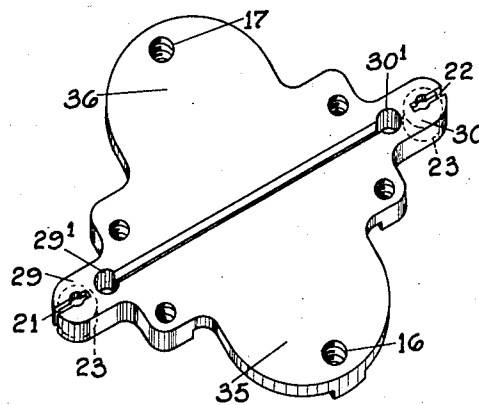


FIG. 10.

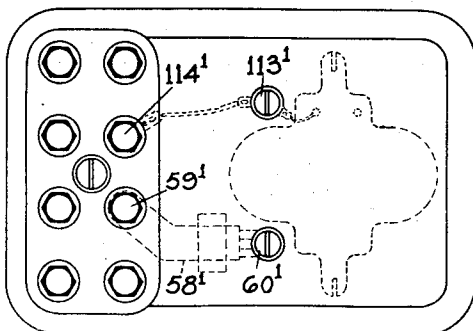
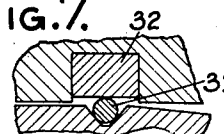


FIG.7.



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UNITED STATES PATENT OFFICE

2,360,664

RELAY

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8 Claims. (Cl. 175—345)

This invention relates in general to electrical relays, and has more particular reference to a polarized, two-position relay, particularly adapted for use in connection with railway operation, and the like.

In the operation of coded track circuits and the like, in railway practice, it is most desirable to employ relays which are sensitive and certain in operation, and still are rugged in design so as to be long lived, and also to be economical in power consumption.

With a view to providing an improved relay of this type, the following invention involves a relay having various new and improved features.

One feature of the present invention is an improved and novel supporting means for the armature employed in the relay.

A further feature of the present invention is an improved and practically frictionless pivoting means for the armature.

A further object of the invention is to provide means in the form of an evacuated or gas filled tube for enclosing the contacts, whereby to largely eliminate sparking and arcing, and thus reduce to a minimum the wear and pitting of contact points.

A further object of the invention is to provide novel means for connecting the armature to the contact fingers.

A further object is to provide a relay permitting readily interchangeable contact finger assemblies.

Further objects, purposes and characteristic features of this invention will appear as the description progresses, reference being made to the accompanying drawings showing, solely by way of example, and in no manner whatsoever in a limiting sense, three forms which the invention can assume. In the drawings:

Fig. 1 is a top plan view of a relay constructed in accordance with the present invention.

Fig. 2 is a sectional view with parts shown in elevation, on line 2—2 of Fig. 1, viewed in the direction of the arrows.

Fig. 3 is a sectional view with parts shown in elevation on line 3—3 of Fig. 1, viewed in the direction of the arrows.

Fig. 4 is a sectional view on line 4—4 of Fig. 1, viewed in the direction of the arrows.

Fig. 5 is a sectional view on line 5—5 of Fig. 2, viewed in the direction of the arrows.

Fig. 6 is a perspective view of the armature employed in the relay of the previous figures.

Fig. 7 is a fragmentary sectional view of the armature pivot.

Fig. 8 is a fragmentary sectional elevation of a second form of the invention.

Fig. 9 is a fragmentary sectional view on line 9—9 of Fig. 8, viewed in the direction of the arrow.

Fig. 10 is a top plan view of a third form of the invention.

Referring now to the drawings, and first to the Figs. 1—6, illustrating the first form of invention, it can be seen that the relay comprises a usual top plate 1, of suitable insulating material, having a groove 2 around its periphery, and in its lower face, for receiving a transparent casing 3, held in place by any suitable means such as a through bolt 4.

Carried by the top plate 1 is a core structure comprising two permanently magnetized cores 5 and 6 in spaced opposed relation to each other. In quadrature with the permanently magnetized cores are two spaced cores 7 and 8 carrying energizing windings 9 and 10. The cores are held in place at their upper ends by back straps 11 and 12 clamped onto cores 7 and 8 by means of bolts or the like 13, and receiving the upper reduced ends of cores 5 and 6 in sockets provided therefor. The four cores are held to the top plate by nuts 14, carried on the lower threaded ends of the cores, and clamping the pole shoes, as 15, of the cores against the lower face of the top plate.

The armature of the relay is of a general diamond shape, as shown in Fig. 6, and carries two drilled holes 16 and 17, for receiving residual pins 18¹ and 19¹. This armature is supported adjacent the pole shoes 15 of the permanent magnets by means of support brackets, as can be seen to advantage in Fig. 4. Each bracket, such as 18 of Fig. 4, has an over-turned upper end 19, clamped to the under face of the top plate by a bolt 20. In cross section the bracket is wide and thin so as to be receivable in slots 21 and 22 in the armature.

The armature, at each slot, is bored as at 23, to form a cup receiving portion for a spring 24 of a helical form. This spring 24 is sleeved on the support bracket and bears at its other end against a cup 25, slidable on the bracket, and held against downward movement by a U-shaped clip 26, adjustably held in position on the bracket by a bolt 27, which clip can be slid for adjustment, by way of a slot 28 in the U-shaped clip. In this way, the tension of the supporting spring 24 can be readily adjusted.

As seen in Fig. 6, the opposite corners 29 and 30 of the armature are slotted as described above,

and the armature is supported at these two points by resilient means as described just above, whereby to press the armature upwardly against the pole shoes of the two spaced permanent magnetic cores.

The armature is drilled inwardly of the two slots 21 and 22, but in line therewith, as at 29¹ and 30¹, and the armature is grooved between these two drilled holes with a V form groove to form a V-shaped channel to receive a bearing member. This member, which is cylindrical in cross section and in general is in the form of a needle 31, is of a length to have its ends bear against the outer sides of the two drilled holes 29¹ and 30¹, as to be clearly seen in Fig. 3.

A bearing bar 32, of special hardened material, is carried by the pole shoes of the permanent magnet cores, and is held in place against end-wise movement by its shoulders 33, bearing against the inner side faces of the pole shoes.

The needle bearing member 31 is of a size, and is so received in the V-shaped slot, as to project slightly beyond the flat face of the armature, and thus to contact with the bearing bar 32. In this manner, the armature can rock on its bearing and bring either of its other ends 35 and 36 against a pole shoe of the electro-magnetic cores, respectively, while the needle 31 stays substantially unmoved in its V-slotted receiving member.

The upper ends of slots 21 and 22 are positioned in a horizontal plane substantially level with the top element of the needle bearing member 31 whereby to practically obviate any tendency of the needle to slide or shift bodily on the bearing bar 32. Furthermore, with the spring support employed for pressing the armature toward the pole shoes, vibrations are compensated for, and shocks and jars can produce no chattering of the bearing and consequently, wear, due to this cause, is completely eliminated.

In practice, the springs supporting the armature, can exert a pressure of at least 16 pounds, without causing measurable bearing friction.

The armature is biased by elastic means to assume a normal biased position, as shown in Fig. 4. This biasing means comprises a spring 37 of a helical form, having one end received on the stud 19¹, positionable in the threaded hole 17 of the armature, and the other end on a stud 39 adjustably carried by a bracket 40, fastened to the top plate by the through bolt 4, which holds the transparent housing in position. It can be seen that the armature can rock on its pivot against the bias of spring 37 to bring the residual pin 18¹ against the pole shoe of the adjacent electro-magnet.

The magnetic core and coil structure is in general of the same type as disclosed in the Field Patent 1,749,331, granted March 4, 1930. The coils on the electro-magnets are connected in series so as to make one pole shoe a north pole and the other a south pole, or vice versa, depending upon the polarity of energization. The two permanent magnets are poled in the same direction, as, for example, the lower end of each can be a south pole, whereby to make the armature in general a south pole. Thus, the permanent magnetic flux finds a return path through one or the other of the electro-magnetic cores, depending upon the direction of energization of the windings. The armature has one end attracted and the other repelled, or vice versa, depending upon the direction of energization of the electro-magnetic windings, whereby to cause

it to either remain in its biased position, as shown in Fig. 4, or to move to its other position against the bias. Thus, this relay assumes its position, as shown in Fig. 4, both when the windings are deenergized and when they are energized with one polarity, and moves to the other position when energized with current of the other polarity. This is a desirable feature inasmuch as in the case where the relay is employed in connection with track circuits for following a code or the like, it will not respond to current from an adjacent block if, as usual, the polarity of alternate blocks be reversed.

The armature carries a contact finger operator 15 in the form of a channel-shaped finger 41, having a flat portion 42, at one end, fastened by a screw or the like 43, to the armature. An adjusting screw 44 is carried by the armature and passes through the base of the channeled portion of the finger for securely maintaining the finger against any turning movement. An operating link 45 is carried at its upper end by the operator by means of a pin 46 passing through the opposite sides 47 of the channeled portion of the finger, and through the upper end of the link. This pin is cylindrical in form but has a flattened portion 48 for receiving a holding leaf spring member 49, fastened at 50, to the base of the channeled portion of the finger. Thus, to assemble the link 45 and the contact finger 41, it is merely necessary to pass the end of the link through the end slot 51 in the finger, then insert the cylindrical pin 46 and hold it in place by rotating it until the flattened portion is in position to receive the free end of holding spring 49.

The lower end of the operating link 45 is connected to a boot-like member having two outwardly flaring side strips 53 and 54 to the outer ends of which are fastened upper and lower spring members 55 and 56. This boot-like member is carried by a bracket 57 which in turn is connected to a main bracket 58, fastened by bolts or the like 59 and 60, to the top plate.

In this first form of invention, the contacts to be made and broken are carried in a tube unit, comprising a tube 61, which is hermetically sealed and can either be evacuated or gas filled at low pressure with some inert gas. This tube carries a front fixed contact 62 and a back fixed contact 63, connected to lead-in wires 64 and 65 which are sealed into the end of the tube.

There is a movable contact member 66 which is normally in contact with the front fixed contact 62 and is connected to an operating rod 67, which passes out through the tube and is received in the operating boot, so as to have its outer end 70 bearing against the upper spring 55 when the relay armature assumes its biased deenergized position. The end of the tube through which the operating rod 67 passes is sealed by a flexible diaphragm 71 of suitable conducting material such as metal, and this end of the tube has a metal or other conducting material ferrule 72 which is received in the bracket 58 and clamped therein by a bolt 73.

It can be seen from the above description that when the relay is energized with the proper polarity of current to cause it to operate its armature to its other extreme position, link 45 moves the operating boot and causes the lower spring 56 to press on the end 70 of the operating rod and by slightly deforming the diaphragm 71, the front contact breaks and the back contact makes. In the event the polarity of energizing current is

the opposite of the desired one, the magnetic attraction merely aids the biasing spring, and the armature does not move from its normal biased deenergized position.

The parts described above are duplicated in this relay, as can be seen in Fig. 1. For example, the armature is connected to two tubes, held by brackets, as shown in dotted lines in Fig. 1, with two operating links, etc., the second bracket, referred to only generally, and immediately above, being designated as 61¹. The lead-in wires for the various connections are connected to socket members 80, of a quick detachable plug coupler. The socket members 80 cooperate with plug members 81, which are carried by the top plate, and the socket casing member 82 can be held in position on the top plate by bolt means 83, whereby the plug and socket connections can be readily made and broken.

The circuit connection for the movable contact finger 66 includes the operating rod 67, the diaphragm 71, the ferrule 72, the bracket 58, and the plug member 81. As shown in Fig. 1, there are eight external connecting posts, two of which are employed for the energizing circuit for the operating coils, and three of which are used for each of the tube members, each of which latter has a front contact, a back contact, and a movable contact.

Referring now to Figs. 8 and 9, there is here shown a slightly modified form of the invention, wherein the core and coil structure 91 is carried by the top plate 92 in the same manner as described above. Also, the armature 93, with its bearing, is the same as described above.

The biasing means in this form of invention is slightly different from what was described above in that the bracket 94, carried from the top plate, has a stud 95, which is adjustable in the bracket and carries a cup 96 for receiving a biasing spring 97, which has its upper end received on a stud 98.

Also, in this form of invention, the contacts are not enclosed in a sealed tube. These contacts comprise front and back contacts 99 and 100, and a movable contact 101 connected as by wires 111 and 112, to posts 113 and 114. The fixed contacts, such as contact 99, are carried by brackets from the top plate. The contact 99 is carried by a bracket having a horizontal portion 102, clamped against the inner face of the top plate, and the bracket then is turned at right angles to form a vertical portion 103. It is then turned inwardly to form a horizontal portion 104, and is then turned forwardly, toward the armature, to form a contact finger carrying portion 105. The back contact 100 is carried by a bracket 106 which is of the same general form as the bracket just described, but is reversed in a right and left hand sense, and is held in place by a bolt 110.

The armature operates the movable contact finger 101 by means of an operating member 106¹, carried by studs and separators 107 and 108, from the lower face of the armature.

As in the form of relay first described, this relay has a second set of front, back and movable contact fingers positioned on the other side of the relay and connected to the other side of the armature, but since it is the same arrangement as shown in plan in Fig. 1, it appears unnecessary to further illustrate or describe.

In Fig. 10 is shown a modified form of relay in that one of the sets of front, back and movable contacts is enclosed in a tube, as in Fig. 2,

and the other set is open, as in Fig. 8. It can be noted that the top plate, armature, etc., are so formed as to permit readily assembling the relay with open, or closed, contacts, as desired.

For example, to change from the double enclosed arrangement of Fig. 2, it is merely necessary to substitute the brackets 103 and 106 of Fig. 9, for the tube 61 of Fig. 2, and connect the movable contact to the external binding post, by the wires 111 and 112 of Fig. 8, after first removing the tube carrying bracket 58 of Fig. 2, and by substituting the parts connected to the armature in Fig. 8, for the corresponding parts in Fig. 2. In Fig. 10 is shown a relay of this kind, with the bracket 58¹ held to the top plate by bolts 59¹ and 60¹, and with the wire connections for the front point of the open contact connected to the posts 113¹ and 114¹.

As can be appreciated from the above, the various features involved in this relay make for a more rugged, dependable and economical relay than has heretofore been available. The suspension of the armature by spring means from the lower face of the top plate makes for reduced friction upon movement of the armature. Furthermore, the needle bearing constitutes a very simple and rugged type of bearing which can be very readily replaced when necessary and which produces little wear on the various parts with which it is in contact.

Also, the arrangement of contact members within an evacuated tube largely prevents arcing and burning of the contact points and the construction of the relay is such that a new set of sealed-in contacts can be readily installed, due to the means 73 for clamping the tube in place and to the operating boot into which the operating rod 67 can be readily and accurately inserted.

It is to be understood that various modifications can be made without departing from the invention as described above. For instance, the number of contact fingers operating by a single armature, can be varied in accordance with desires and requirements. Likewise, it is contemplated that should a three-position polar relay be desired, the armature can be biased to a neutral position in which no contacts are made, and from which the armature can be operated magnetically to make up either a front, or back, contact, depending upon the polarity of the energizing current.

The above rather specific description of several forms of the present invention is given solely by way of example, and is not intended in any manner whatsoever in a limiting sense. It is to be understood that various modifications, adaptations and alterations may, from time to time, be applied to meet the requirements of practice without in any manner departing from the spirit or scope of the invention except as limited by the appended claims.

What I claim is:

1. In relays, in combination, a top plate, a flat plate-like armature, two opposed, open ended, edge slots in the armature, a support arm for each slot anchored to the top plate and each passing through its slot and projecting beyond the armature, an adjustable stop on the projecting end of each arm, and a coil spring sleeved on each arm between one face of the armature and the associated adjustable stop.

2. In relays, in combination, a top plate, a flat plate-like armature, opposed, spaced, open ended, edge slots in the armature, a support arm for each slot anchored to the top plate and passing

through its slot and projecting beyond the armature, an adjustable stop on the projecting end of each arm, a coil spring sleeved on each arm between a face of the armature and the associated adjustable stop, and an elongated rocker bearing between the armature and the top plate and in line with the said edge slots.

3. In relays, in combination, a top plate, a plane plate-like armature, opposed, spaced, open ended, edge slots in the armature, a support arm for each slot anchored to the top plate and passing through its slot and projecting beyond the armature, an adjustable stop on the projecting end of each arm, a coil spring sleeved on each arm between a face of the armature and the associated adjustable stop, an elongated V sectioned closed ended slot in the face of the armature facing the top plate and in line with the said edge slots, and an elongated cylindrical hardened rod in the slot and projecting therefrom throughout its length to contact, on one of its elements, with the top plate.

4. In a relay, in combination, a plane support, an extending flat plate-like armature, a pivot between the armature and support comprising, an elongated groove in the armature intermediate opposite ends of the armature, a hardened cylindrical rod loosely received in the groove and projecting therefrom throughout its length and facing the support, and elastic means positioned in line with the rod and biasing the armature toward the support to thus press the rod against the support with the armature rockingly spaced from the support.

5. In a relay, in combination, a plane support, an extending flat plate-like armature, a pivot between the armature and support comprising, an elongated groove in the armature intermediate opposite ends of the armature, a hardened cylindrical rod loosely received in the groove and projecting therefrom throughout its length and facing the support, elastic means positioned to exert force in the line of the rod and biasing the armature toward the support to thus press the rod against the support with the armature rockingly spaced from the support and means at one end of the armature biasing the armature toward the support.

6. In a relay, in combination, a plane support, an extending flat plate-like armature, a pivot be-

tween the armature and support comprising, an elongated V sectioned, closed ended groove in the armature intermediate opposite ends of the armature, a hardened cylindrical rod loosely received in the groove and projecting therefrom throughout its length and facing the support, and elastic means positioned to exert effort in the line of the rod and biasing the armature toward the support to thus press the rod against the support with the armature rockingly spaced from the support.

7. In an electromagnetic relay structure, a tiltable flat plate-like armature, a support member having an elongated hardened plane surface, a bearing between said armature and said support member comprising, an elongated groove in one face of said armature extending along its pivotal axis for the greater part of the distance between its opposite edges, a hardened cylindrical rod loose in said groove and having a diameter to bring its surface outside of the surface of the armature, means limiting endwise movement of said rod, and spring means acting adjacent each end of said groove in line therewith for pressing said armature toward said support member to provide for rocking motion of the armature with respect to said support member by a rolling contact of said rod on the hardened plane surface of said support member.

8. In an electromagnetic relay structure, a flat plate-like armature adapted to cooperate with the electromagnet of the relay structure, a support member having an elongated hardened plane surface, a bearing between the armature and the support member comprising a hardened cylindrical rod loose in an elongated groove in the armature on that side facing said support member, said rod having such a diameter that its upper surface is slightly raised out of the groove beyond the surface of the armature, support arms extending from said support member and passing loosely through holes in said armature in line with said groove and adjacent its ends, and spring means on said support arms for pressing said armature toward said support member along the pivotal axis of said armature, thereby permitting a rocking motion of said armature with respect to said support member without tending to bias said armature in either direction.

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