Oct. 7, 1941. J. F. MERKEL 2,258,122

RELAY

Filed Jan. 28, 1939 2 Sheets-Sheet 1

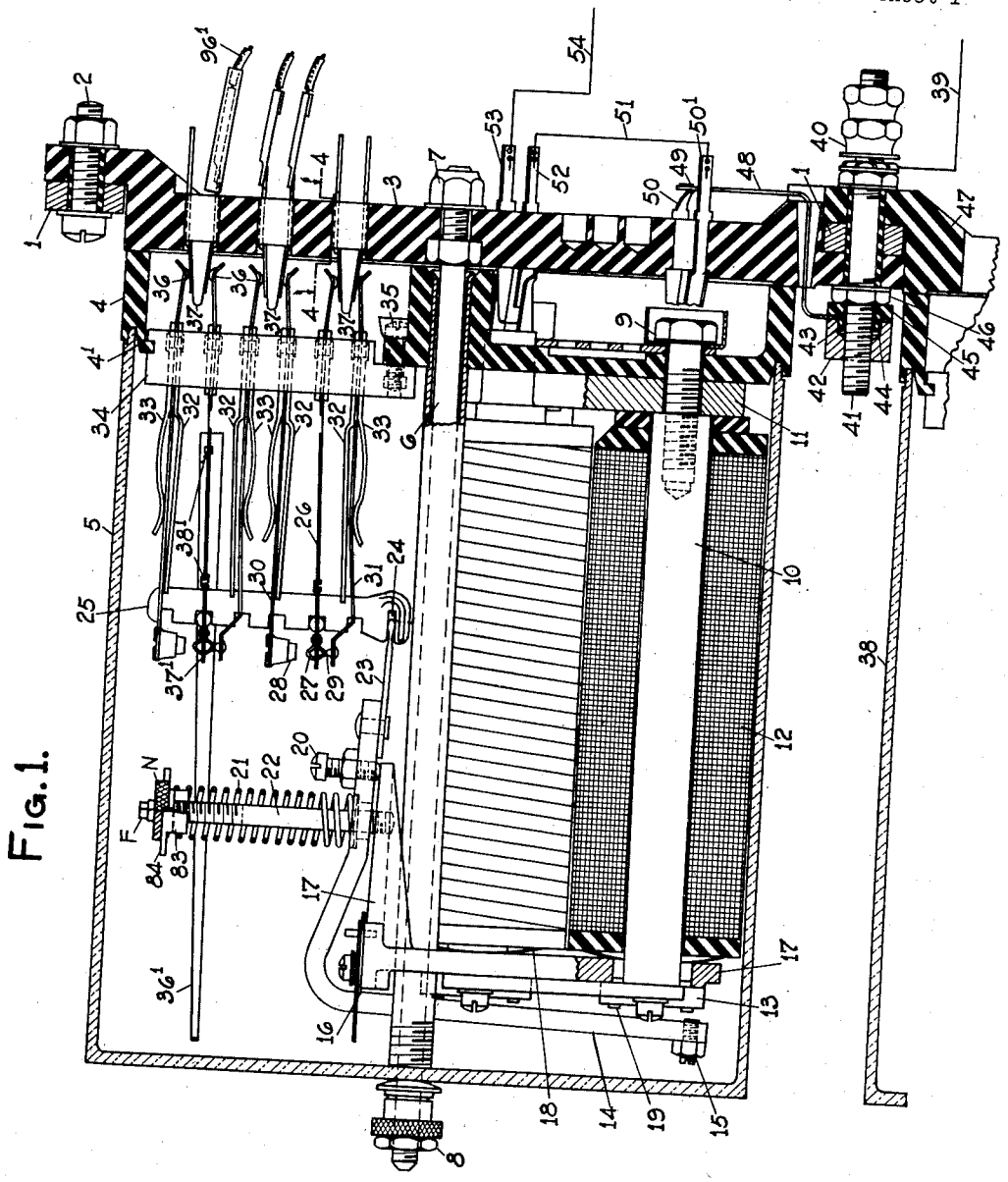

FIG. 1.

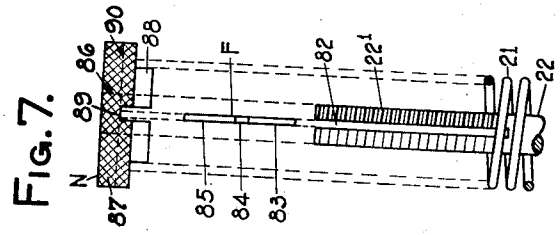

FIG. 7.

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Oct. 7, 1941. J. F. MERKEL 2,258,122

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Filed Jan. 28, 1939 2 Sheets-Sheet 2

FIG. 2.

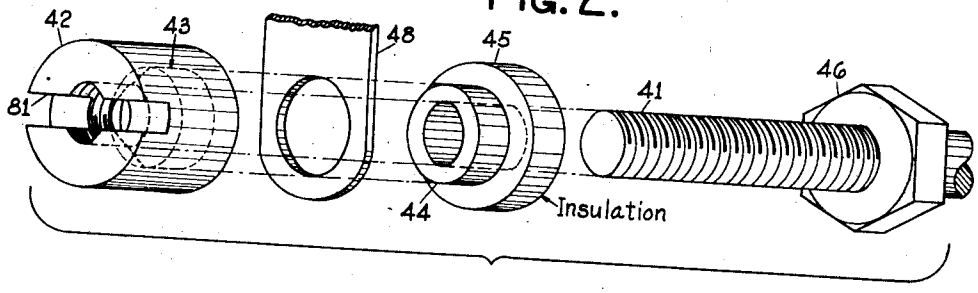


FIG. 6.

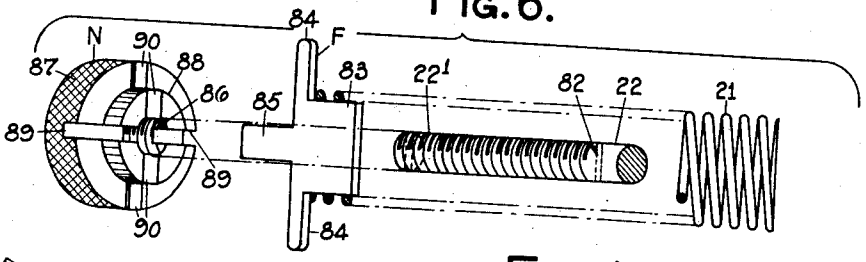


FIG. 4.

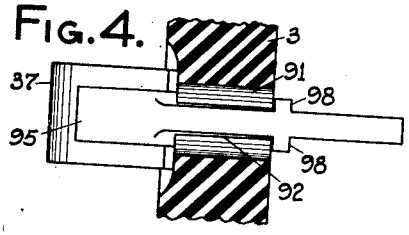
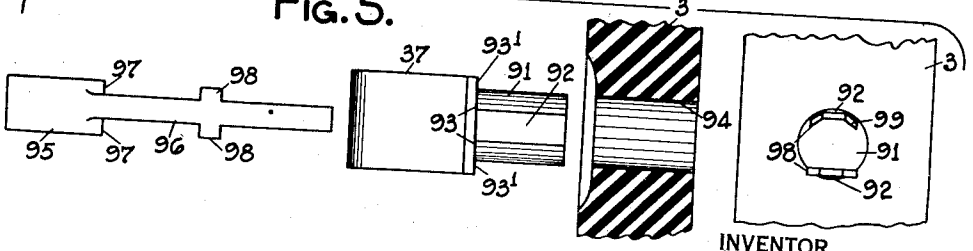


FIG. 3.

FIG. 5.



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2,258,122

RELAY

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Application January 28, 1939, Serial No. 253,383

8 Claims. (Cl. 175—298)

This invention relates, in general, to improvements in relays, and has more particular reference to improvements in the so called "Type-B", line of relays, for use more particularly in connection with railway operation.

The type of relays to which the present invention relates, is the plug-in type, whereby the relay external connections can be made and broken by merely plugging the relay into a panel board, or withdrawing it therefrom. Furthermore, these relays are made relatively light and compact, in order to conserve space, and accordingly, when mounted on the supporting panel, the relays are placed relatively closely together to thereby leave very little space between the relays as they project forwardly from the panel.

One object of the present invention is to provide a convenient and readily accessible means for making and breaking the energizing circuits for the relays whereby to facilitate checking the operating characteristics of the relays and testing the integrity of the energizing circuits. More specifically, means are provided for reaching from the front of the relay support rack, in between the adjacent relays, to break and make the energizing circuits at the support panel. In this connection, means are also provided for facilitating connecting measuring instruments, such as ammeters, into the energizing circuit.

A further object of the present invention is to provide an improved means for mounting the plug members on the support panel.

A further object of the present invention is to provide an improved adjusting means for varying the resilient bias on the relay armature.

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, one form which the invention can assume.

In the drawings:

Fig. 1 is a side sectional elevation, with parts shown in elevation, of a complete relay embodying the present invention.

Fig. 2 is a detail exploded view of a part of the energizing circuit breaking means.

Fig. 3 is a side view, with parts broken away, and parts shown in section, of the circuit breaking tool and testing device.

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

Fig. 5 is an exploded view of the means for holding the plug members in the support panel.

Fig. 6 is a perspective, exploded, view, of the armature biasing means.

Fig. 7 is an exploded view of the armature biasing means.

Referring now to the drawings, and first to Fig. 1, there is here shown a relay support means for supporting a large number of relays within a confined space. The support means comprises spaced parallel horizontal bars 1, to which are connected, by bolts 2, supporting panels 3, of insulating material. Carried by the panels 3 are relays, one of which is shown in Fig. 1.

The relay essentially comprises an insulating base member 4, which bears against the panel 3, a housing 5, which is preferably made of transparent material such as any usual or desired thermal plastic substance, which fits into an annular groove 4¹ in the base 4. The housing 5, and the base 4, are held together, and are held onto the panel 3, by means of long through bolts 6 which are clamped to the panel 3, by nuts 7, and carry on their outer ends, holding nuts 8.

Carried by base member 4, by means of screws 9, are two cores 10, magnetically interconnected by a back strap 11, and each carries a winding 12. At the outer end of each core 10, is a pole shoe 13, which cooperates in the usual manner with an armature 14, carrying a residual pin 15, and pivoted at 16, to a fixed member 17. The fixed member 17 is held between the pole shoes 13, and the ends of the spools carrying the windings 12, by means of leaf springs 18, stationary member 17 being fastened to the pole shoes 13 by means of screws or the like 19.

The pivoted armature 14, carries an adjustable stop screw 20, for determining its retracted position, and this armature is biased to its retracted, or deenergized, position, by means of a spring 21, carried on a threaded rod 22, which, at its lower end, is screwed into the fixed member 17. The means for adjusting the tension of spring 21 constitutes one of the features of the present invention, and will be described in detail, below.

The armature carries an operating member 23, which is received in a slot 24, in a contact operator 25, for moving the contact operator, and with it the movable contact fingers 26, which have contact points 27, cooperating with fixed front contact points 28, and fixed back contact points 29, carried respectively by fixed front and back contact fingers 30 and 31. Each front and back contact finger has a usual stop plate 32, and pressure plate 33. The contact fingers are carried by a block of insulating material 34,

which in turn is connected, as at 35, to the relay base member 4.

Each contact finger extends to the rear of the carrying block and terminates in an outwardly bent portion 36, whereby adjacent pairs of contact fingers constitute a socket member, to receive a plug member carried by the panel 3, such as the plug member 37.

The plug members, together with their means for holding them in the panel 3, constitute a feature of the present invention, and will be described in considerable detail, below.

In order that it can be readily ascertained whether the relay armature is in its attracted or retracted position, a pointer 36^1 is employed, which is connected to the contact finger moving parts, as, for example, to the contact finger 37^1, as at the points 38^1, the pointer 36^1 coacting with any suitable reference mark (not shown), on the front face of the housing 5, for example.

Below the relay just described, and having the casing 5, is shown a fragmentary portion of an adjacent relay, having a casing 38, from which it can be seen that the space between the two casings is very narrow. For energizing the windings of each relay there is a lead-in wire, such as 39, fastened to a binding post 40. The binding post, at its inner end 41, carries a conducting threaded nut 42, which has an inner cup shaped depression 43 for receiving the cup-like portion 44 of an insulating washer, having a flange 45 and being backed up by the clamp nut 46, which latter helps to clamp the panel 3 and the lower panel 47, to the adjacent support bar 1. Clamped between the conducting nut 42, and the insulating washer flange 45, is a conducting member 48, of relatively stiff material, in the form of a ribbon, with its upper end connected, at 49, to a lead-in connection 50 going to the winding 12. The lead-out connection 50^1 from winding 12 is connected, by a wire 51, to a lead-in connection 52, with the lead-out connection 53 connected to a wire 54, which is connected to a source of energy.

With the construction just described, it can be readily appreciated that the circuit for energizing the relay windings passes from the binding post 40, through the threaded bolt 41, the nut 42, the ribbon 48, etc., and since the ribbon 48 is retained out of electrical connection with the bolt 41, by means of the cupped portion 44 of the insulating washer, upon turning the conducting nut 42 toward the end of the threaded stem, the connection to the winding is broken, it being borne in mind that the ribbon 48 is relatively stiff and assumes a normal biased position pressing against the flange 45 of the insulating washer.

It is clear that with this arrangement of connection to the operating coils of the relay, a long handled socket wrench can be reached in between the casings 5 and 38, and the nut 42 can be turned to readily break and make the circuit. As an added refinement, and for added facility in testing the energizing circuit, a special wrench tool has been provided, which is shown in detail in Fig. 3.

Referring now to Fig. 3, a portion of the lead-in circuit for the operating windings of the relay has been shown by dashed lines, whereby to more clearly illustrate the cooperation of this construction with the operating wrench.

This special tool or wrench of Fig. 3, is comprised by a hollow conducting tube 55, of steel or the like, carrying, at one end, two lugs 56, and a sweated-on enlarged portion 57 of conducting material such as steel. A cup member 58 of insulating material, is slid onto the tube from the other end, and is biased against the portion 57 by a spring 59, bearing against a collar 60, connected by a screw 61, or the like, to the tube 55. Carried by the insulating cup 58, is a ring 62 of conducting material, while at the other end of tube 55, there is fastened an operating handle 63, by means of a pin 64, or the like.

Received within the tube 55, is a rod 65, carrying a ring 66 fixed thereto as by a pin 67, for affording a stop against which bears a stop 68, fixed to the hollow tube 55, by means of a screw or the like 69. A biasing spring 70 is received on the rod 65, and bears at its inner end against the stop 68, while at its outer end it bears against an operating handle 71, threaded onto the rod 65, and held in place by a lock nut 72.

On the inner end of rod 65, is threaded a socket member 73, which is in turn threaded to receive the threaded end of the binding post stem 41, as will be described below in greater detail. Carried on tube 55 is a conducting member 73^1, which is biased by a spring 59, against the end of the cup 58, and attached to this conductor member 73^1, and to the conducting member 62, are two lead wires 74 and 75 respectively. These wires terminate in connecting members 76 and 77, which can be connected to the terminals 78 and 79 of a meter M, which can be an ammeter, for example, and included in the meter circuit is a switch 80, which can be manually operated to connect the meter into a circuit including the lead wires 74 and 75, or to open the circuit.

In operation, when it is desired to check the operation of the relay, the tool, as shown in Fig. 3, can be reached in from the front of the relay rack, and in between the housings 5 and 38, so as to screw the socket member 73 onto the threaded end 41 of the binding post. This forces the lugs 56, in a resilient manner, against the front end of nut 42. By turning tube 55, by means of its handle 63, lugs 56 will snap into the operating slots 81, in nut 42, whereby this nut can be turned on its stem to break the electrical connection to the operating winding. Thus, by a slight turn on the handle 63 in one direction, or the other, the circuit can be broken and completed, so that an operator at the front of the relay rack can control the circuit and watch the relay operation at the same time, in a most convenient and satisfactory manner.

In breaking the energizing circuit to the windings of the relay, a gap is opened in the circuit between the ribbon conductor 48, and the conducting nut 42. It will be observed that with the tool in position to control the circuit, the projecting end of the conducting ring 62 bears against the ribbon 48, while the rod 65 is in electrical connection with the threaded end 41 of the binding post. Since the conducting member 73^1 is in electrical connection with rod 65, it follows that the gap which has been opened between the ribbon 48 and the nut 42 has been, in effect, transferred to the lead wires 74 and 75, whereby it is merely necessary to connect these wires to the meter M, to connect the meter in the relay energizing circuit, and disconnect it therefrom, at will, by means of the hand operated switch 80. Thus, not only the relay operation can be readily observed by an operator who is at the same time controlling the energizing circuit, but the electrical values of the circuit,

such as the current flow, can be readily measured by inserting a meter, or the like, between the leads **74** and **75**.

Referring now more particularly to Figs. 6 and 7, there is here shown the improved means for adjusting spring **21**, which, as can be seen from Fig. 1, biases the armature **14** to its de-energized, or released, position. This spring **21** is sleeved on the rod **22** which, at its upper end, is threaded as at **22¹**, and is slotted longitudinally as at **82**, from its outer end to a considerable distance inwardly. This slot **82** receives a follower F, which is a flat plate-like member having a lower portion **83** of a width to be received within the spring **21**, with diametrically opposed extending arms **84**, which extend beyond the spring **21** and bear against the upper end thereof. The follower F is completed by an upper portion **85**, which is of a size to be received in the threaded central bore **86**, in adjusting nut N, the bore **86** being threadable onto the end of the rod **22¹**. Nut N has an outer knurled portion **87** and a reduced inner portion **88**, of a size to be received within the spring **21**, the nut being slotted by two transverse slots **89** and **90** positioned preferably at 90° from each other so as to receive the arms **84**, of follower F, in either of two positions.

With the arrangement as described just above, when it is desired to vary the tension of the spring **21**, as, for example, to increase it, it is necessary merely to push the follower F in its slot in the threaded stem, to compress the spring, and then to turn nut N on the threaded stem to the proper position and permit the follower F to be urged by the spring **21** toward the nut to cause the arms **84** to enter one of the slots **89** or **90**. In this manner, all parts are locked in adjusted position and the adjustment cannot be accidentally changed. This follows, since the threaded stem **22** is in fixed position, the follower is locked to the stem by the slot in the stem, and the nut is locked to the stem by the follower. It is obvious, of course, in order to decrease the tension of the spring, that the nut can be eased off, and the same general procedure followed.

It should be noted that the locking of all of the parts has been accomplished without the need for a wrench, or other tool, for producing high degrees of friction between parts, and also so that a subsequent adjustment can be made by hand without the use of any special tools, as a wrench.

Referring now to Figs. 4 and 5, wherein is shown the manner in which the plug members **37** are inserted into, and connected to, panel **3**, there is here shown the plug member proper **37**, of insulating material having a shank **91** which is generally circular in cross-section and is furnished with diametrically positioned relatively shallow grooves **92**, and an enlarged head whereby to provide stop shoulders **93**. Thus, the plug member can be inserted through the opening **94**, in panel member **3**, from the front, with the depth of insertion limited by shoulders **93¹**.

Carried by plug member **37**, are two contact members, which are identical, and each of which comprises a head portion **95**, connected to a relatively narrow body portion **96**, to thereby afford stop shoulders **97**, the body portion **96** extending a considerable distance and intermediate its ends having transverse ears **98**.

Before the plug member is inserted into the receiving aperture in the panel, each plug member receives two contact members, with the body portion **96**, between the shoulders **97** and the ears **98**, received in the grooves **92**, the ears **98** being bent downwardly as shown at **99**, whereby to bring the entire body rearward of the shoulders **97**, of the contact piece, within the perimeter of the shank **91** of the plug member, so that the plug member can be inserted through its aperture. After its insertion, the ears **98** are bent to again lie in the same plane as the body of the contact member, whereby to lock the entire assembly in position, the shoulders **97** of each contact piece not only bearing against the front face of the panel **3**, when in assembled position, but also bearing against shoulders **93** on the plug member.

In this manner, the plug member and the contact member are both prevented, by their shoulders **93¹** and **97**, respectively, from being pushed through panel **3** from the front, and are prevented from being withdrawn from the panel in a forward direction, by means of the shoulders **97** of the contact members and the ears **98** of the same members. To the end of the body portions, **96**, are connected the lead-in wires **96¹**, as by soldering or otherwise connecting them thereto.

With the various improvements as described above, it is obvious that a relay has been produced which has several very distinct advantages over what has heretofore been known.

To summarize, the relays can be mounted in close proximity to each other, on a plug board, with all of the lead-in wires connectable to and disconnectable from, the relay, by merely plugging the relay in and pulling it out; with a convenient means available for testing the relay by opening the energizing circuit and bringing the circuit to the front of the relays whereby to conveniently measure the constants of the circuit by a meter, for example.

Furthermore, a securely locked adjusting means for a biasing spring for the armature has been provided, which has no binding parts, and which, for its manipulation, requires no special tools or equipment, other than the hand.

Again, there has been provided a ready and simple and economical means for fastening the plugs of a plug coupler, together with the contact members they carry, in openings in a panel board so that the parts are secured in place against accidental displacement.

The above rather specific description of one form of the present invention, has been given solely by way of example, and is not intended, in any manner whatsoever, in a limiting sense. It should be understood that this application is intended to cover all such modifications, adaptations and variations as may prove desirable or expedient, except insofar as they are specifically excluded by a reasonable interpretation of the appended claims.

Having described my invention, I now claim:

1. In a relay plug board for mounting plug-in type relays, a plug board, an opening in the board, a plug of insulating material having a shank snugly receivable in the opening and an enlarged head forming a shoulder with the body and bearing against the face of the board when the shank is fully inserted, a longitudinal groove in the shank, a shoulder at the forward end of the groove, a conducting contactor having a body receivable in the groove and an enlarged head forming a shoulder with the body that bears

against the groove shoulder when the contactor body is in the plug groove, and an ear extending laterally from the body of the contactor and spaced from the enlarged head a distance substantially equal to the thickness of the plug board.

2. In a relay plug board for mounting plug-in type relays, a plug board, an opening in the board, a plug of insulating material having a shank snugly receivable in the opening and an enlarged head forming a shoulder with the body and bearing against the board when the shank is fully inserted, a longitudinal groove in the shank, a shoulder at the forward end of the groove, a conducting contactor having a body receivable in the groove and an enlarged head forming a shoulder with the body that bears against the groove shoulder when the contactor body is in the plug groove, and an ear extending laterally from the body of the contactor and spaced from the enlarged head a distance substantially equal to the thickness of the plug board, whereby the ear can be bent out of the plane of the body to permit its insertion, with the plug shank, through the board, and then bent back into the plane of the body to thus lock both plug and contactor in assembled position.

3. In a relay plug board for mounting plug-in type relays, a plug board, an opening in the board, a plug of insulating material having a shank snugly receivable in the opening and an enlarged head forming a shoulder with the body and bearing against the board when the shank is fully inserted, a longitudinal groove in diametrically opposed faces in the shank, a shoulder at the forward end of each groove, a conducting contactor having a body receivable in each groove and an enlarged head forming a shoulder with the body that bears against the groove shoulder when the contactor body is in the plug groove, and an ear extending laterally from the body of each contactor and spaced from the enlarged head a distance substantially equal to the thickness of the plug board.

4. In a relay, in combination, a relay operating coil, a circuit for energizing the coil and including, in series, a plug, a socket receiving the plug, a binding post, a conducting threaded stem on the post, a conducting nut on the stem, a ribbon conductor connected at one end to the plug and an insulating washer on the stem, the other end of the ribbon conductor being clamped between the nut and the washer and out of contact with the stem.

5. In a relay, in combination, a relay operating coil, a circuit for energizing the coil and including, in series, a plug, a socket receiving the plug, a binding post, a conducting threaded stem on the post, a conducting nut on the stem, a ribbon conductor connected at one end to the plug, an insulating washer on the stem, the other end of the ribbon conductor being clamped between the nut and the washer and out of contact with the stem, the ribbon conductor being made of relatively stiff material and biased against the washer, whereby movement of the nut along the stem away from, and against, the ribbon conductor, respectively breaks and makes the circuit to the relay coil.

6. In combination, a plurality of plug-in type relays, a relay rack formed by a plurality of support panels, bolts clamping adjacent panels together, plugs in the panels for receiving relays closely spaced from each other and extending forwardly of the rack, each relay having an operating coil, a circuit for energizing the coil and including, in series, a plug, a socket receiving the plug, and a binding post constituted by one of the said bolts, a conducting threaded stem on the post, a conducting nut on the stem, and a ribbon conductor connected at one end to the plug, an insulating washer on the stem, the other end of the ribbon conductor being clamped between the nut and the washer and out of contact with the stem, and a socket wrench for the conducting nut having a handle longer than the distance the relays project from the rack.

7. In combination, a plurality of plug-in type relays, a relay rack formed by a plurality of support panels, bolts clamping adjacent panels together, plugs in the panels for receiving relays closely spaced from each other and extending forwardly of the rack, each relay having an operating coil, a circuit for energizing the coil and including, in series, a plug, a socket receiving the plug, and a binding post constituted by one of the said bolts, a conducting threaded stem on the post, a conducting nut on the stem, a ribbon conductor connected at one end to the plug, an insulating washer on the stem, the other end of the ribbon conductor being clamped between the nut and the washer and out of contact with the stem, a socket wrench for the conducting nut having a handle longer than the distance the relays project from the rack, and two electrically insulated, conducting elements on the wrench positioned to contact with the ribbon and the threaded stem when the wrench is applied to the conducting nut, and lead wires, respectively connected to the said elements.

8. In combination, a plurality of plug-in type relays, a relay rack formed by a plurality of support panels, a bolt clamping adjacent panels together, plugs in the panels for receiving relays closely spaced from each other and extending forwardly of the rack, each relay having an operating coil, a circuit for energizing the coil and including, in series, a plug, a socket receiving the plug, and a binding post constituted by one of the said bolts, a conducting threaded stem on the post, a conducting nut on the stem, a ribbon conductor connected at one end to the plug, an insulating washer on the stem, the other end of the ribbon conductor being clamped between the nut and the washer and out of contact with the stem, and a socket wrench for the conducting nut having a length greater than the distance the relays project from the rack and two electrically insulated, conducting elements on the wrench positioned to connect with the ribbon and the threaded stem when the wrench is applied to the conducting nut, lead wires, respectively connected to the said elements, whereby to permit ready access to the circuit without moving the plug-in relay or going to the rear of the relay rack.

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