

Aug. 3, 1948.

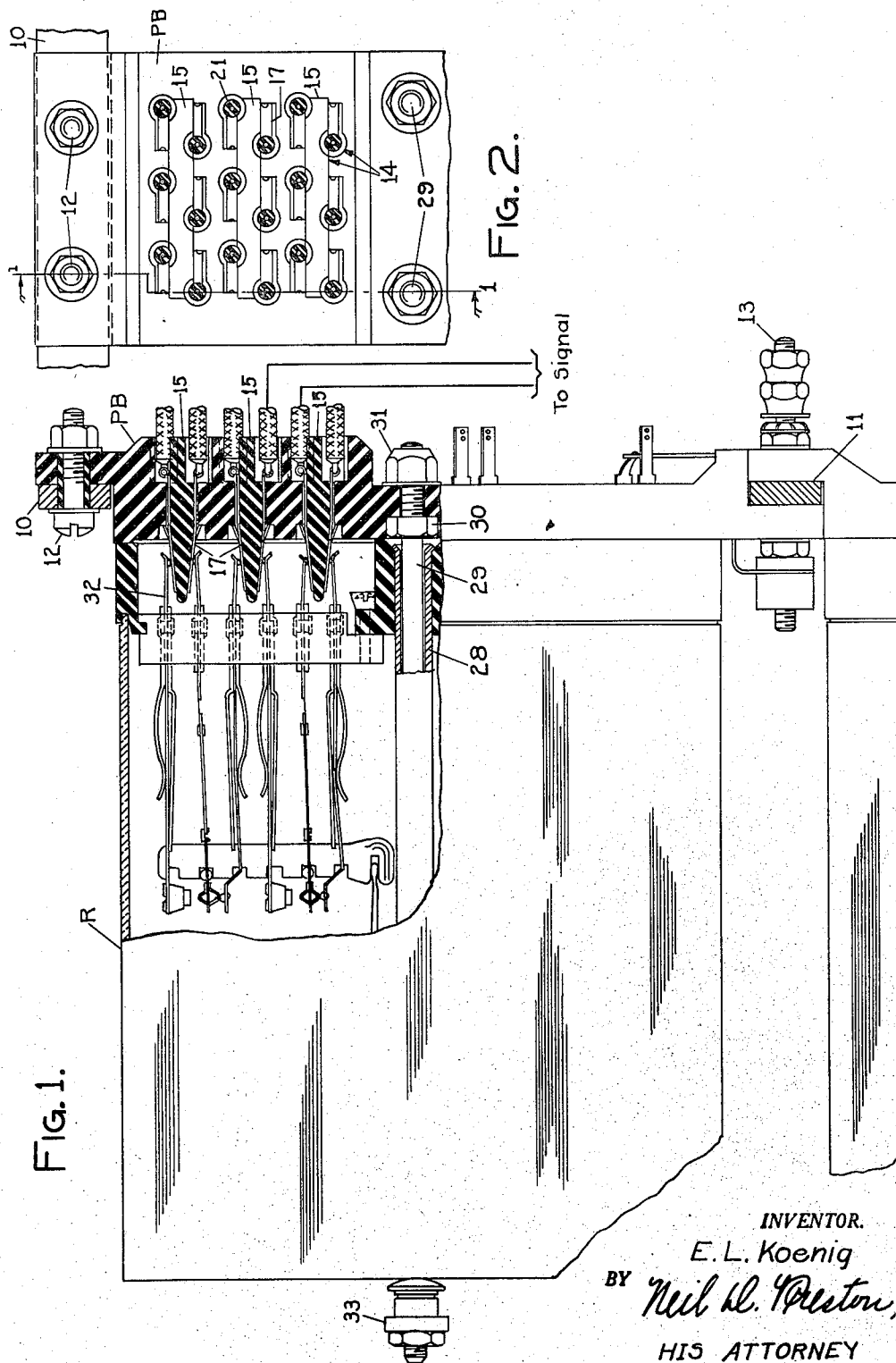
E. L. KOENIG

2,446,232

PLUG BOARD ARRANGEMENT

Filed Aug. 22, 1946

2 Sheets-Sheet 1.



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FIG. 5.

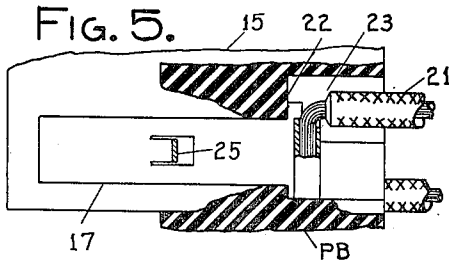


FIG. 6.

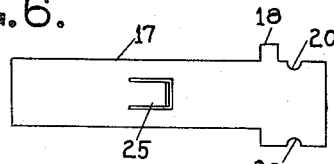


FIG. 7.

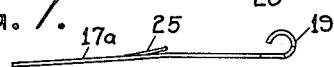


FIG. 3.

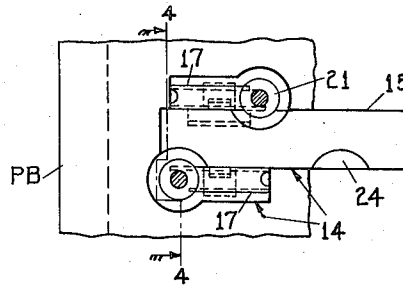


FIG. 4.

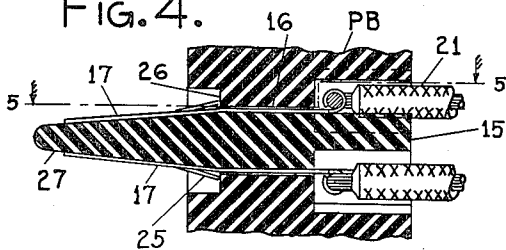


FIG. 11.

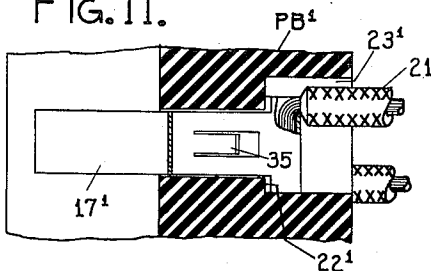


FIG. 12.

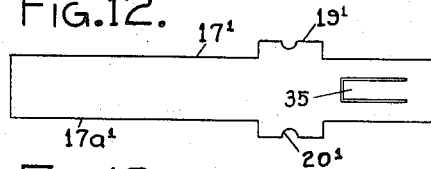


FIG. 13.

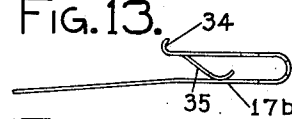


FIG. 10.

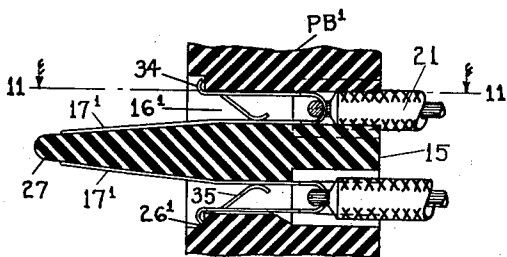


FIG. 9.

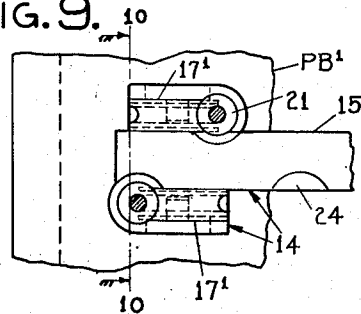
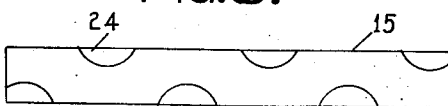


FIG. 8.



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PLUG BOARD ARRANGEMENT

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3 Claims. (Cl. 173—328)

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This invention relates to plug couplers for electrical devices and it more particularly pertains to a plug board having detachable contacts for use in detachably supporting electroresponsive devices.

In a relay and plug board arrangement of the general character disclosed in the patent to J. F. Merkel, Patent No. 2,258,122 dated October 7, 1941, the contact strips of the plug board are permanently secured in the plug board and thus considerable skill and care is required to attach and solder the wires to the plug board contact strips without burning or otherwise damaging the wires on adjacent contact strips.

An object of the present invention is to improve the method of wiring of the plug board by the use of detachable contact strips that can be suitably secured to the ends of wires before the insertion of the contact strips into their respective slots of the plug board. In this manner the wires can be attached to the plug board contact strips at the most convenient stage in the assembly of the apparatus, such, for example, as immediately after the forming of the wiring harness, without the danger of damaging wires on adjacent contact strips.

Another object of the present invention is to provide a detachable contact strip for the plug board that is self locking upon its insertion from the rear of the board, but that can be manually released from the front of the plug board.

Another object of the present invention is to provide a detachable contact strip for the plug board which is self locking upon its insertion from the rear of the plug board, but that can be manually released from the rear of the plug board to thereby allow the changing or removal of the relay contacts without requiring the removal of the relay.

Another object of the present invention is to limit the flexing of each wire at the point of its connection to a plug board contact strip and protect it against short circuiting with other wires by providing individual recesses in the plug board for such connections, the use of such recesses being made possible because of the provision for attaching the wires to the contact strips before the insertion of the contact strips into their respective slots in the plug board.

Other objects, purposes, and characteristic features of the present invention will be in part obvious from the accompanying drawings and in part pointed out as the description of the invention progresses.

In describing the invention in detail, reference will be made to the accompanying drawings in

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which parts having similar features and functions are designated in the several illustrations by like reference characters, and in which:

Fig. 1 is an elevational view of a relay coupled to its plug board and shown partially in cross section as taken along the line I—I of Fig. 2 and viewed in the direction of the arrows;

Fig. 2 is a back view of the upper portion of the plug board assembly to which the contacts of the relay shown in Fig. 1 are coupled;

Fig. 3 is an enlarged back view of a typical plug board connection;

Fig. 4 is a sectional elevational view of a typical plug and contact strip organization taken along the section line 4—4 of Fig. 3 and viewed in the direction of the arrows;

Fig. 5 is a plan view of a typical plug and contact strip organization taken along the section line 5—5 of Fig. 4 and viewed in the direction of the arrows;

Fig. 6 is a plan view of a typical plug board contact strip during a stage in its development;

Fig. 7 is an elevational view of a typical plug board contact strip;

Fig. 8 is a back view of a plug which is used to provide support for the plug board contact strips;

Fig. 9 is an enlarged back view of a typical modified plug and contact strip organization;

Fig. 10 is a sectional elevational view of the plug and contact strip organization illustrated in Fig. 9 as taken along the section line 10—10 of Fig. 9 and viewed in the direction of the arrows;

Fig. 11 is a plan view of the typical modified plug and contact strip organization shown in Fig. 10, taken along the section line 11—11 and viewed in the direction of the arrows;

Fig. 12 is a plan view showing one of the contact strips of Fig. 10 during a stage in its development; and,

Fig. 13 is an elevational view of one of the contact strips employed in the plug and contact organization of Fig. 10.

With reference to Fig. 1, a relay R is shown as being plug coupled to the plug board PB. The plug board PB is formed of insulating material and it is suitably secured to stationary supports 10 and 11 as by the screw 12 at the top of the plug board, and by the binding post 13 at the bottom of the plug board. The binding post 13 is insulated from the support 11 in a suitable manner such as is disclosed specifically, for example, in the above mentioned patent to J. F. Merkel.

As is shown in Figs. 1 and 2, the plug board PB provides space for nine pairs of contact strips, although it is to be understood that a greater or

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lesser number of pairs of contact strips can be provided in accordance with the requirements of practice. The pairs of contact strips are arranged in three vertical rows of three pairs of contact strips each, each row being formed by a substantially rectangular slot 14 in the plug board PB in which is pressed, or otherwise suitably secured, a substantially rectangular plug 15 which is more clearly illustrated in Fig. 8.

Recesses 16 (see Figs. 4 and 5) are formed in the plug board PB above and below the plug 15 having a width slightly greater than the width of the contact strips 17 to form slots, in cooperation with the plug 15, through which the respective upper and lower contact strips 17 may be inserted.

Each contact strip 17 is formed preferably of low resistance resilient material, it being blanked out in the form shown in Fig. 6, with the ear or detent 18 protruding from the upper right hand corner as a limit to the extent of insertion of the contact strip 17 into the plug board PB from the back of the board. A transverse sleeve 19 in which the wire connection to the contact strip 17 is suitably secured, as by soldering, is formed at the right hand end of the contact strip 17, the semi-circular notches 20 being formed in the ends of the sleeve to conform to the circular form of the wire. Although only one wire is shown in each sleeve 19, it is to be understood that two wires could as well be connected, such wires being preferably inserted from the opposite ends of the sleeve 19.

After a wire, such as the wire 21, is secured to a contact strip 17, such contact strip is inserted in a slot 16 from the back of a plug board PB to a point where the ear 18 rests against the shoulder 22 within the cavity 23 which is formed of a size and shape as illustrated in Figs. 3, 4, and 5 to receive and house the sleeve 19 and a portion of the insulation at the end of the wire 21. Semi circular cavities 24 of the plug 15 (see Fig. 8) cooperate in forming a cylindrical cavity slightly greater in diameter than the diameter of the insulated wire 21.

The contact strip 17 is pierced in a U shaped manner near its center, and an ear is formed upwardly to form a spring detent 25 as is shown in Figs. 6 and 7 at a point to allow the detent 25 to snap back of the shoulder 26 of the plug board PB when the contact strip 17 is fully inserted in the slot 16 from the rear of the plug board PB.

The spring detent 25 is depressed in an obvious manner as the contact strip 17 is inserted in the slot 16.

The left hand portion 17a of the contact strip 17 is formed downwardly at a slight angle (see Fig. 7) to conform to the slope of the wedge shaped portion 27 of the plug 15 that protrudes from the left hand, or front side, of the plug board PB as viewed in Figs. 1 and 4.

It has been pointed out that the wire 21, for example, is necessarily attached to a contact strip 17 prior to the insertion of such contact strip into a slot 16 in the plug board PB. When the contact strip 17 is fully inserted from the back of the plug board PB it is locked in position by the springing of the detent 25 back of the shoulder 26. When the contact strips 17 are fully inserted as shown in Fig. 4, they are of sufficient length to extend outwardly from the front of the plug board PB to within a short distance of the front or left-hand end of the plug 15 to provide adequate contact surface to engage

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with the relay contact strips upon the coupling of the relay R to the plug board PB.

It will be noted that when the relay R is coupled to the plug board PB, the sleeve 28 of that relay slides over the rod 29 which is suitably secured to the plug board PB as by the nuts 30 and 31. The resilient contact tips 32 of the relay R slide along the plug board contact strips 17 which are supported in position by the wedge 27 of the plug 15, and when the relay R is fully coupled to the plug board PB, the contact tips 32 of the relay R bear with sufficient pressure against the plug board contact strips 17 to insure a dependable low resistance connection. The relay R is held in its full plug coupled position by the nut 33.

In order to fully appreciate the utility of the removable contact strips as provided by the present invention, some understanding must be had of the manner in which the relays are used in practice. Among other advantages of using plug coupled relays is the facility of readily changing a relay at times when the contacts fail, or at times when circuit changes are made to modify, or add to, a signalling system that is already in service.

To facilitate future additions of equipment, relays are generally provided with spare contacts, and, according to the present invention, wiring connections can be readily made to spare relay contact strips by the insertion of spare contacts 17 after they have been secured to control wires in a manner fully described above; such additions being made without requiring the removal of the relay concerned, or without the danger of damaging wires on adjacent contact strips on that plug board.

If it is required in modification work, or for other reasons, to shift a wire connection from one plug connection to another, it is necessary to remove the relay involved and compress the detent 25 past the edge of the shoulder 26 to allow the contact strip 17 to be slipped through the slot 16 and removed from the back of the plug board PB. Such contact strip 17 can then be inserted in another slot 16 or have other wires attached thereto and reinserted in the same slot as required.

If a pair of relay contacts such as those shown in Fig. 1 for controlling a signal are damaged and there are spare contacts available on that relay, the signal control wires can be readily moved to connect the spare contacts by simply removing the relay to allow the depression of the detents 25 of the contact strips 17 associated with the relay contacts that are damaged, and then shifting such contact strips 17 to the positions in the plug board PB associated with the spare relay contacts.

If it is desirable in practice to provide the plug board contact strips to be removable from the back of the plug board so that the contact strips can be changed without requiring the removal of the relay, as in shifting a wire from connections to one relay contact to another, a contact strip arrangement can be employed such as is shown in Figs. 9, 10, 11, 12 and 13.

As is shown in Fig. 9 a deeper opening is formed in a plug board PB¹ than is shown for the plug board PB to allow a deeper slot 16¹ for the contact strip 17¹ so that a suitable tool such as the blade of a small screw driver can be inserted over the top of the contact strip 17¹ to release the lock of the contact strip and allow its removal from the back of the plug board PB¹.

The contact strip 17¹ assumes the form shown

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in Fig. 12 when it is blanked out during its development, the broadened portion 19¹ a little to the right of the center forming a semi-circular sleeve when the contact strip is completely formed as shown in Fig. 13 with notches 20¹ provided at the ends of the sleeve to conform to the circular form of a wire when it is suitably secured to the contact strip 17¹ as by soldering.

The right hand end of the contact strip 17¹ has a hook 34 formed thereon which extends upwardly when the semi-circular wire connection sleeve is formed in a U-shaped manner as shown in Fig. 13. The contact strip 17¹ tends to maintain its form as shown in Fig. 13 because of its resiliency, and an additional spring support 35 is provided for urging the hook 34 to its upper position. Such spring 35 can be formed as shown in Figs. 12 and 13 where a U-shaped cut is made in the contact strip 17¹ when it is stamped out, and the inner portion of the U forms a supporting spring 35 when the forming of the contact strip is completed as shown in Fig. 13, with the spring 35 being formed downwardly to bear against the lower portion of the contact strip 17¹ at the point 17b. The left hand portion 17a¹ of the contact strip 17¹ is formed downwardly at a slight angle as shown in Fig. 13 to conform to the taper of the wedge shaped portion 27 of the plug 15.

Because of the hook 34 being curved slightly to the right, it locks securely behind the shoulder 26¹, which is similarly shaped, and this particular shape of the hook 34 facilitates the compression of the spring 35 of that contact strip upon the insertion of the contact strip into the slot 16¹, from the back of the plug board PB¹.

It will be noted that the extra breadth of the sleeve 19¹ serves as a limit to the extent of the insertion of the contact strip 17¹ from the back of the plug board PB¹ when it engages the shoulder 22¹ of the plug board PB¹, sufficient depth of insertion being allowed to provide that the hook 34 can slip back of the shoulder 26¹.

It will be readily apparent from structure described for the contact strip 17¹ in the plug board PB¹ that the wedging of a suitable tool such as the blade of a small screw driver between the contact strip 17¹ and the upper side of the slot 16¹ from the back of the plug board is effective to draw the hook 34 away from the shoulder 26¹, and thereby allow that contact strip to be removed from the back of the plug board by pulling lightly on the wire attached to that contact strip without requiring the removal of the relay. The contact strip 17¹ when removed can of course be inserted in a different slot or different wires can be attached to that contact strip for its reinsertion in the same slot in accordance with requirements of practice.

Having described particular plug board contact organizations having detachable contact strips as specific embodiment of the present invention, it is desired to be understood that these forms are selected to facilitate in the disclosure of the invention rather than to limit the number of forms which the invention may assume, and it is to be further understood that various adaptations, alterations and modifications may be applied to the specific forms shown to meet the requirements of practice, without in any manner departing from the spirit or scope of the present invention except as limited by the impending claims.

What I claim is:

1. In a plug coupler of the character described for detachably supporting an electro-responsive device providing quickly detachable electrical

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connections for a plurality of pairs of contact tips on the device, a plug board of insulating material having openings therein opposite said pairs of contact tips, a plug of insulating material secured within each of said openings, said plug having a tapered end protruding from the front of said plug board for spacing said contact tips of each pair, and said plug cooperating with said plug board to form slots extending through said plug board substantially opposite said contact tips, contact strips formed for the attachment of wires at one end thereof, said contact strips being insertable in the respective slots from the back of said plug board after the attachment of wires thereto to an extent that the other end of the strips makes electrical connection with the contact tips of said device, said contact strips being supported at the point of contact with said tips by the protruding portion of the plugs, and said contact strips having formed therein spring detents adapted to be compressible upon insertion of the contact strips in their respective slots from the back of the plug board, and adapted to lock said contact strips against backward movement when they are fully inserted from the back of the plug board, whereby the respective contact strips are individually insertable from the back of the plug board subsequent to the attachment of wires thereto and automatically locked in their inserted positions, irrespective of whether or not said device is coupled to the front of the plug board at the time of insertion.

2. In a plug coupler providing quickly detachable electrical connections for a plurality of pairs of spring contact tips of an electro-responsive device, a plug board of insulating material having openings opposite said pairs of contact tips, a plug of insulating material secured in each of said openings having a tapered portion extending from the front of the plug board to space the spring contact tips of a pair, said plug cooperating with the plug board to form slots extending through said plug board substantially opposite said contact tips, said slots being formed with abutments and with enlarged openings at the back of the plug board, contact strips formed for the attachment of wires at one end insertable with wires attached through the respective slots from the back of the plug board to an extent to make electrical connections at the other end with the respective contact tips and to an extent to cause the wire connections to the contact strips to enter said enlarged openings, said contact strips having spring detents formed therein so as to engage with said abutments in the respective slots when the contact strips are fully inserted from the back of the plug board, whereby the respective contact strips are individually insertable from the back of the plug board subsequent to the attachment of wires thereto to a position locked against backward movement by engagement of the detents behind the abutment and whereby the respective contact strips when fully inserted have their wire connections enclosed in the portions of the slots at the back of the plug board.

3. In a plug coupler for detachably supporting an electro-responsive device on the front of a plug board to provide quickly detachable electrical connections for a plurality of pairs of spring contact tips arranged in rows on said device, a plug board having openings opposite said pairs of contact tips, a plug of insulating material secured in each of said openings having a tapered portion protruding from the front of the plug board to space the spring contact tips of a pair,

said plug cooperating with said plug board to form slots extending through said plug board substantially opposite said contact tips, each slot having a locking abutment formed therein, contact strips formed for the attachment of wires at one end insertable with wires attached through said slots from the back of the plug board to an extent to make electrical connections at the other end with the respective contact tips, and locking means for locking said contact strips in their fully inserted positions comprising spring detents secured to said contact strips engaging said abutments formed in the slots, said detents being accessible for compression from the back of the plug board to release the locking of the respective contact strips, whereby said contact strips with wires attached are respectively insertable to a locked position and removable by manual release of the locking from the back of the plug

board, irrespective of whether or not a device is coupled to the front of the plug board.

EMIL L. KOENIG.

REFERENCES CITED

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