May 11, 1948. S. N. BUCHANAN ET AL 2,441,393

LOCK PLUG RECEPTACLE

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FIG. 1.

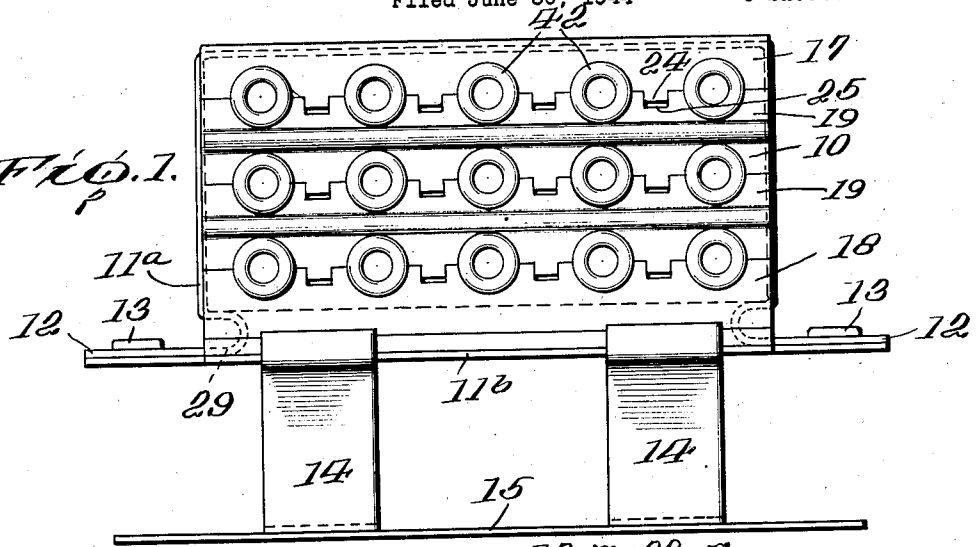


FIG. 2.

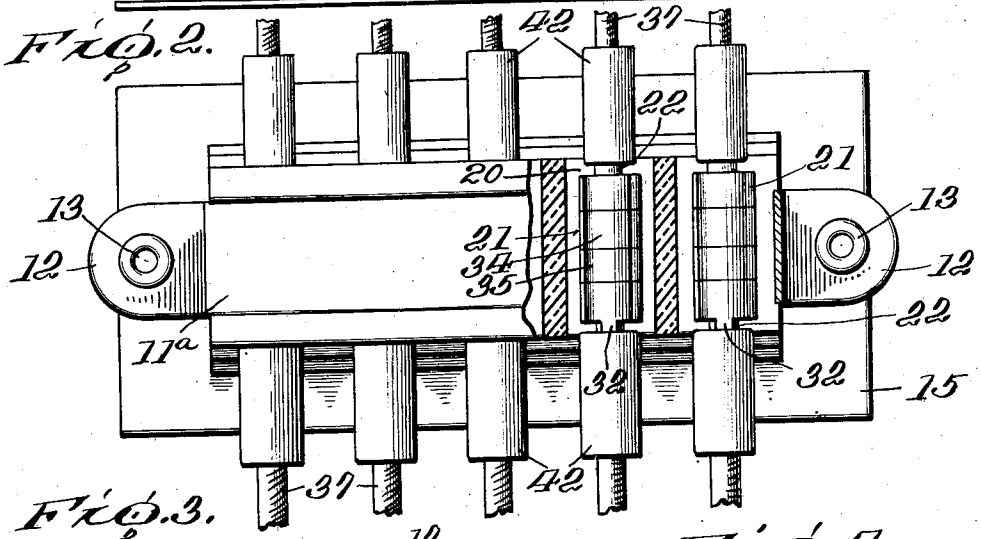


FIG. 3.

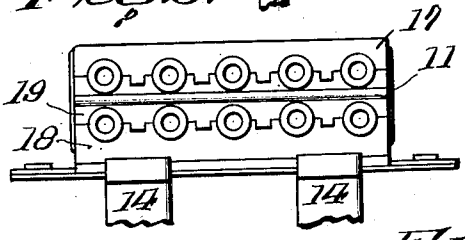


FIG. 4.

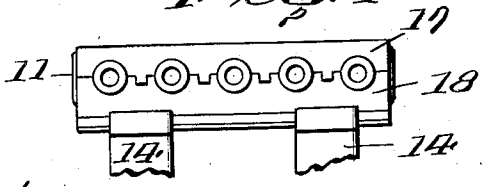
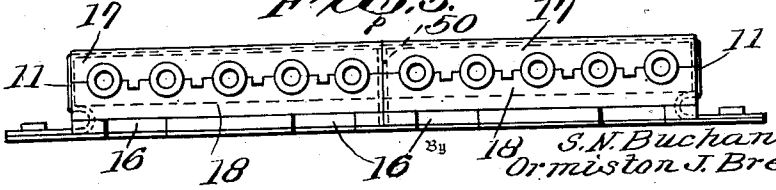


FIG. 5.



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FIG. 6.

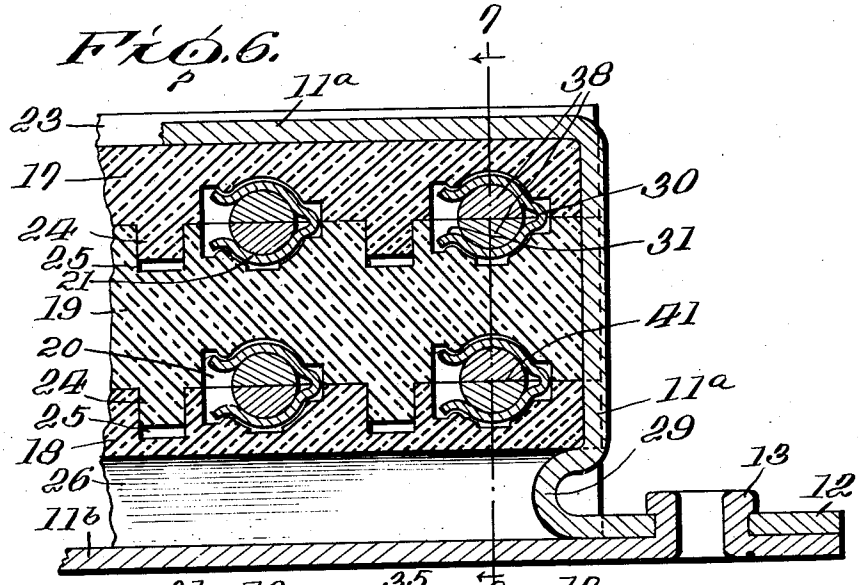


FIG. 7.

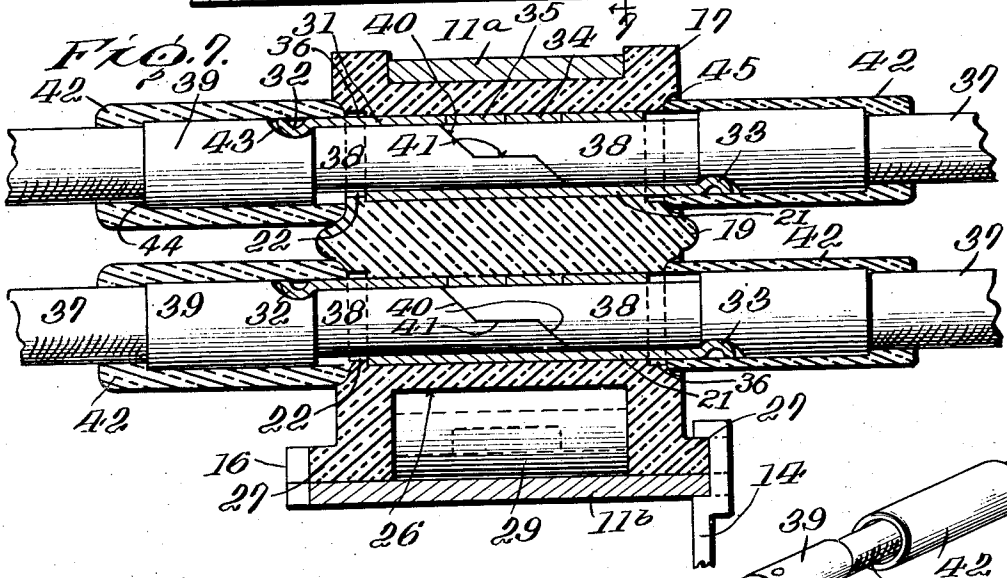
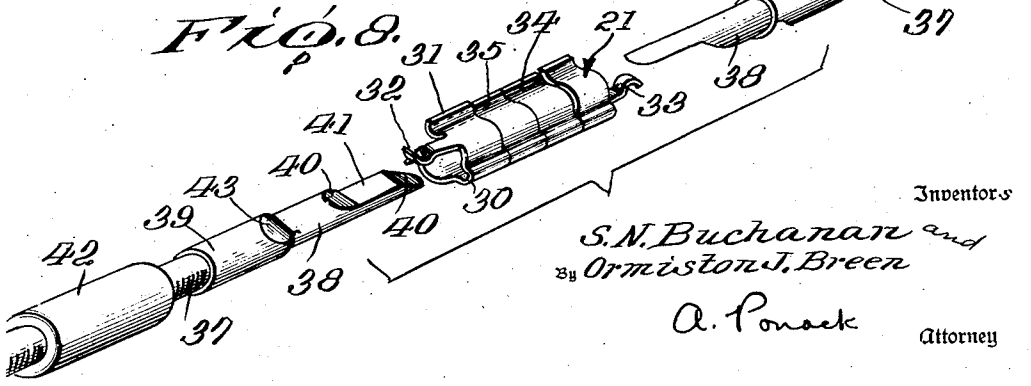


FIG. 8.



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FIG. 9.

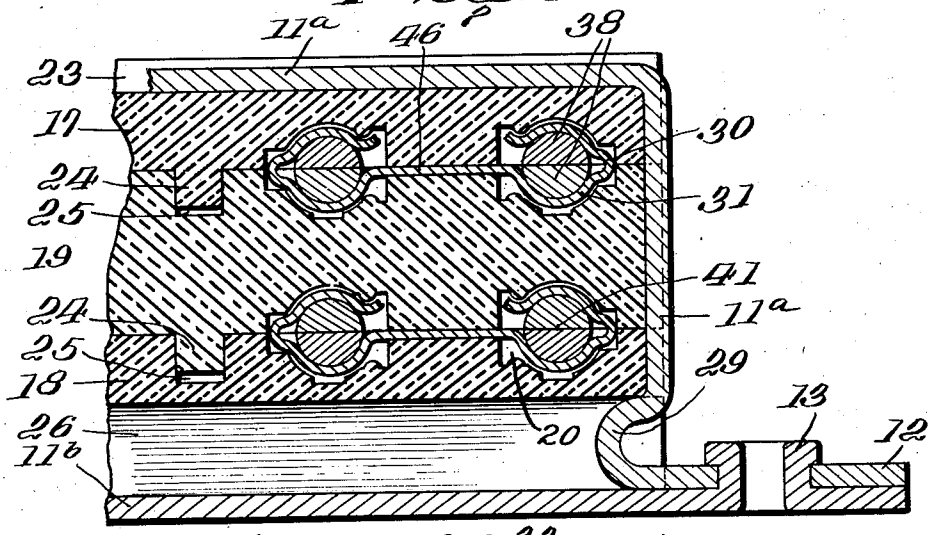


FIG. 10.

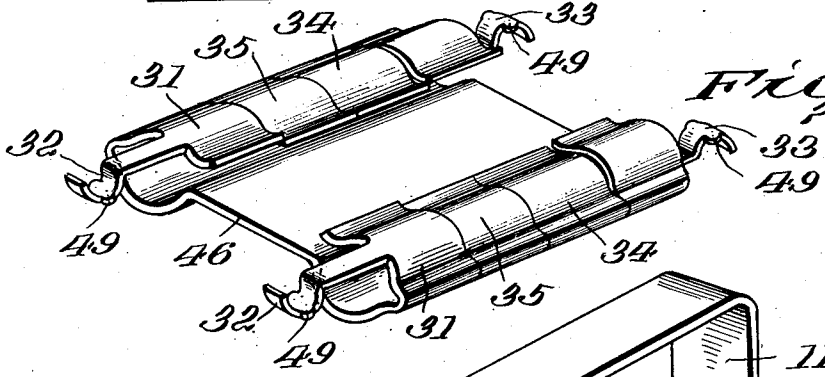
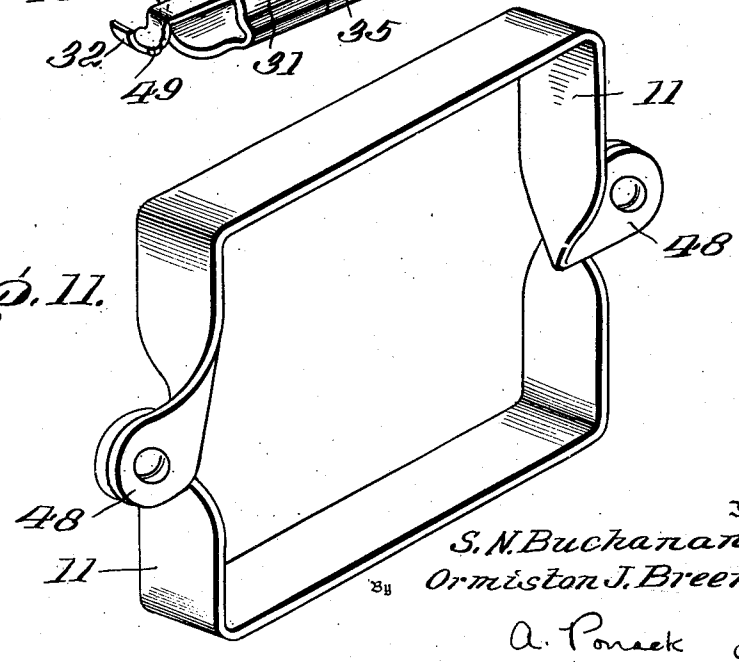


FIG. 11.



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2,441,393

LOCK PLUG RECEPTACLE

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Application June 30, 1944, Serial No. 542,994

4 Claims. (Cl. 173—328)

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The present invention relates to a lock plug receptacle and to connector and plug constructions therefor.

Desiderata in a device for use in interconnecting a plurality of wires are among others, maximum compactness of arrangement, ease of assembly and disassembly, possibility of connecting and disconnecting any wire without disturbing the arrangement of any other wire, freedom from exposed "live" parts, flexibility in arrangement of the component parts to suit available space, ease of associating small units into larger units, safeguarding or locking of plugged-in wires against undesired disconnection, etc.

It is a primary object of the present invention to provide a relationship of parts in a lock plug receptacle whereby the above-enumerated desiderata are realized.

A further object of the present invention is the embodiment of connector elements, particularly adapted for use in the aforementioned lock plug receptacle and including novel characteristics which contribute to the realization of the desiderata above set forth.

On the accompanying sheets of drawing,

Fig. 1 is a front elevational view of an assembly according to the present invention;

Fig. 2 is a top plan view of the assembly of Fig. 1, a part being broken away in order to better illustrate internal relationships;

Fig. 3 is a front elevational view of a second form of assembly, the essential difference from that of Fig. 1 residing in the fact that there are two tiers of connectors instead of three, as in Fig. 1;

Fig. 4 is a front elevational view of an assembly involving but one horizontal tier of connectors;

Fig. 5 is a front elevational view of still another type of assembly within the purview of the invention, the essential difference from the assembly of Fig. 3 being that the two rows of tiers are arranged in extension of each other rather than in superposition;

Fig. 6 is a fragmentary longitudinal sectional view through the assembly according to Fig. 3;

Fig. 7 is a sectional view taken along line 7—7 of Fig. 6;

Fig. 8 is a perspective view of a connector per se according to the invention, and of the wire ends to be interconnected thereby;

Fig. 9 is a view similar to that of Fig. 6 but showing a modified form of connector;

Fig. 10 is a perspective view of the connector per se according to Fig. 9;

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Fig. 11 is a perspective view of a modified arrangement of block retaining straps.

Referring first to Fig. 1, reference numeral 10 designates in toto a three-tiered lock plug receptacle, the constructional details of which will hereinafter be set forth. Reference numeral 11 designates a metallic retaining strap which, as hereinafter described, encompasses the plug receptacle 10 and retains the component parts thereof in place. Strap 11 is preferably two-part in character and comprises, on the one hand, a substantially U-shaped part 11*a* which terminates in outwardly directed flanges 12, and on the other hand, a cross-piece 11*b* extending across and interconnecting the said flanges. Corresponding openings 13 are provided in flanges 12 and cross-piece 11*b*, the edges of the openings in the latter being peened over the edges of the openings in the former in eyelet fashion, whereby the strap parts are securely fastened together but means is provided for the reception of a screw or the like for attaching the assembly to a supporting base. In the embodiment shown in Fig. 1, the plug receptacle 10 is shown associated with spring retaining members 14 upstanding from the bottom 15 of a receptacle box. The spring retaining members 14 may fit into corresponding notches 16 provided in the plug receptacle 10.

The plug receptacles 10 are preferably built up of a plurality of superposed component parts which comprise at least a top member 17 and a bottom member 18 as shown in Figs. 4 and 5. With this relationship of parts, but one row of connectors or plugs is possible. In order to provide additional rows of connectors or plugs, intermediate elements 19 are interposed between the top 17 and the bottom 18. Thus, in Fig. 6, the interposition of one intermediate member 19 makes it possible to have two rows of connectors or plugs. The three-tiered arrangement of Fig. 1 involves a top 17, a bottom 18, and two intermediately superposed members 19. It is evident that substantially any desired number of connections may be realized by superposing a corresponding number of parts. While the embodiment of Fig. 1 shows five plugs in each horizontal row, it is manifest that this number may be varied as desired. Or else a plurality of receptacles may be arranged side by side after the manner shown in Fig. 5.

The intermediate elements 19, which like the parts 17 and 18 are made of suitable insulating, i. e., electrically non-conducting material, are of a special construction.

The upper surface of each element 19 is pro-

vided with a plurality (five, according to the illustrated embodiments) of connector-receiving recesses, which are preferably arranged in equally spaced relationship and severally extend substantially across the width of the element 19, the precise extent being such as to freely accommodate a connector proper 21. The recesses are delineated by upstanding end walls 22 which retain the connectors 21 against undesired displacement longitudinally thereof.

The lower surface of each element 19 is provided with a corresponding plurality of connector-receiving recesses 20, and these as shown are severally in alinement with the previously described recesses 20.

The ends of each element 19 are rabbeted, i. e., provided with a rectangular groove for the reception of the adjacent portions of strap 11*a*, the depth and lateral extent of the said grooves being preferably adapted to the dimensions of the strap.

The lower surface of the top member 17 is formed exactly as the aforedescribed lower surface of member 19. The ends of the member 17 are rabbeted to provide grooves which are continuations of the grooves in the ends of the adjacent member 19. This groove 23 (Fig. 6) also extends across the top of member 17 for the reception of the corresponding top portion of strap 11*a*.

Intermediate each pair of recesses 20, the top member 17 is provided with an integral depending projection 24 which fits into a corresponding recess 25 formed in the top of the adjacent member 19, as shown in Fig. 6.

The upper surface of the bottom member 18 is formed exactly as the aforedescribed upper surface of intermediate member 19. The ends of the member 18 are rabbeted to provide grooves which are continuations of the grooves in the ends of the adjacent member 19. These grooves receive the adjacent portions of strap 11*a*. Intermediate each pair of recesses 20, the bottom member 18 is provided with a recess 25 for the reception of the corresponding projections 24 which depend integrally from the bottom of the adjacent intermediate member 19.

The bottom member 18 has essentially the cross-sectional configuration shown in Fig. 7, i. e., it has a substantially centrally arranged longitudinally extending recess 26 on the underside thereof. Member 18 is also provided with lower outwardly projecting flanges 27 as shown.

Strap member 11*a* is provided with inwardly offset loops 29 which, as shown more particularly in Fig. 6, extend into the recess 26 and into close underlying engagement with the bottom of member 18.

Upon superposition of the described parts in the indicated manner, each juxtaposed pair of recesses 20 will in effect define a housing for a connector 21.

The connectors 21 are of the cross-section best shown in Fig. 6. The connector is essentially U-shaped in configuration and when associated with the other parts assumes a recumbent or relatively horizontal position. The connector is made of electrically conductive spring metal and has a longitudinally extending rib 30 along the loop or bottom of the U (see Fig. 8), whereby enhanced springiness is imparted to the connector. The several legs of the U terminate in outward flares 31. The intermediate portion of each leg of the U is preferably arcuate in essential correspondence with the surface of the wires to be interconnected.

Projecting from one leg of the U at one end of the connector 21 is a springy retainer lug 32 and from the other leg of the U at the other end thereof is a similar springy retainer lug 33 (Fig. 8) for a purpose hereinafter described. One leg of the U, the upper one in Fig. 8, is slotted to provide spring tongues 34, 35 of enhanced spring tendency.

The interior of each recess 20 is configured to correspond essentially to the configuration of the connector portion to be housed therein. The downwardly opening recesses 20 are therefore in the nature of mirror images of the upwardly opening recesses 20. As to size, the recesses are very slightly larger than the connectors, sufficiently so to provide a clearance or play of about 0.010" around the connector.

The end walls of the recesses 20 (Fig. 7) are notched as at 36 for the reception of the respective lugs 32 and 33. It is manifest that the notches 36 will all be on one side in the case of the several downwardly opening recesses 20 and will all be on the other side in the case of the several upwardly opening recesses 20. The result is that the connectors can be inserted in place in one relative position only, as illustrated in Fig. 6.

Assembly of the plug receptacle and connectors is thus readily effected. First, a bottom piece is laid in place. Then the several connectors are placed in the several upwardly opening recesses. Then, a top piece or an intermediate piece, as the case may be is superposed, until the desired number of rows of connectors are realized. The final piece to be laid in place is of course always a top piece. The retaining straps 11 are then snapped into place and bound together, and the assembled device is then fastened onto a support with the aid of screws or the like, or else the clamping support arrangement of Fig. 1 is used. The device is then ready to be associated with wires or the like to be interconnected.

The wires or the like 37 to be interconnected terminate in solid metallic electrically conductive plug ends 38, the latter being associated with the respective wires in any suitable and/or conventional manner, preferably at the socket portions 39. The plug ends are of stepped configuration as best apparent from Figs. 7 and 8 and comprise a pair of spaced oblique surfaces 40 arranged at an angle of about 40° with the horizontal (as shown in Fig. 7), the two oblique surfaces being interconnected by a substantially horizontally extending surface 41. The respective plug ends are intended to be inserted or plugged into a connector 21 from opposite sides of the receptacle 10 and are intended to complementarily overlap as best shown in Fig. 7. The overlapping portion X (Fig. 7) is substantially coextensive with the lateral extent of the springy tongues 34, 35, the pressure of which enhances the desired intimate contact between the overlapped plug ends. The wires 37 are of course in electrical connection with the plug ends 38, and thus the wires plugged in from the opposite sides of the connector 21 are electrically interconnected.

In order to lock the parts in interconnected relation against undesired disconnection, there is mounted on each wire posteriorly of the plug end 38 a sleeve 42 of insulating material. Each plug end is also provided with a notch or recess 43 for the reception of the corresponding lug or detent 32 or 33, the latter slipping into place

in the said notch or recess as the end 38 is plugged into place. After the latter step has been effected, the sleeve 42 is moved thereover into the position shown in Fig. 7, and this results in a positive locking of the plug end in place. It is impossible to disconnect the plug end while the sleeve 42 is disposed in encompassing relation about a notch-engaged detent 32 or 33. On the other hand, after slipping the sleeve 42 back to the position shown in Fig. 8, the corresponding plug end 38 may be dissociated from, i. e., pulled out of the connector 21 without in any way disturbing or deranging the plug end 38 which is plugged in from the opposite side.

It may be noted that the parts are so arranged that sleeve 42 may not slip off the wire end, such detachment being prevented by the shoulder 44 which engages the end of socket 39 of the plug end 38. The parts 17, 18 and 19 are preferably slightly undercut, as at 45 (Fig. 7) for reception of the inner end of sleeve 42. The result is that with all the parts in place, as shown in Fig. 7, the assembly presents what may be termed a "dead front" on each side, i. e., no "live" parts are exposed. This completely insulated aspect may be further enhanced, if desired, by spraying a sealing coating of insulating material such as lacquer over the device after assembly.

A feature of the invention is that the socket 39 may be associated with a variety of sizes of wire by merely correspondingly dimensioning the socket bore which serves to receive the wire end. Association of the socket and wire end may be effected, for example, with the aid of any conventional crimping tool. The size of the plug end 38 remains constant, regardless of differences in wire size. In this way, the assembly is adapted to interconnect various wire sizes without the necessity of varying the size of the connector 21.

A further feature of the arrangement is that sleeves 42, insofar as they pertain to wires of one and the same electrical circuit, may be correspondingly colored or otherwise identified, thus providing permanent circuit markers and facilitating the tracing of the circuits.

An important aspect of the invention is that maintenance of the desired intimate contact between the interengaged plug ends 38 is assured, on the one hand, by the detents 32, 33 and the engagement thereof with their respective detent-receiving notches and, on the other hand, by the action of the resilient tongues 34, 35. The relative independence of these tongues with respect to the connector body 21 assures close contact, by a force acting transversely of the plug ends and regardless of the possible presence of irregularities, such as high spots or the like, on the exterior of the said ends.

The size and configuration of the strap 11 vary according to the size and configuration of the plug receptacle. In the arrangement according to Fig. 5 the strap will, of course, be relatively elongated. A spline 50 is preferably inserted in the central juxtaposed rabbeted grooves to assure alinement of the tiers which, as shown, are arranged in extension of each other.

Coming now to the modification shown in Figs. 9 and 10, this is primarily adapted to situations where a plurality of outgoing wires are desired to be "tapped off" from a single incoming wire.

As shown in Fig. 10, the connector 46 is in effect a duplex form of the connector shown in Fig. 8. As in the latter, spring detents 32 and 33 are provided, but there are two on each side

instead of one. In addition, two sets of springy togues 34, 35 are provided. The spring detents 32 and 33 may, according to this embodiment, be provided with lateral extensions 49 forming an essentially rectilinear cross-piece across the respective detent. These extensions are received in the corresponding detent-receiving notches. The ends of the extensions come into frictional engagement with the interior surface of the sleeves 42, thereby assuring retention of the latter in locking position against undesired displacement from such position. In other respects the device is essentially the same as in Fig. 8.

Fig. 9 corresponds to Fig. 6, with corresponding parts bearing corresponding reference numerals but being configured to conform to the changed configuration of the connector 46. In other respects, the relationships of the parts and the operation of the device are essentially the same as in the first-described embodiment.

Referring, finally, to Fig. 11, the plug receptacle corresponds essentially with the aforedescribed construction. However, the strap 11 of the previously disclosed embodiments is replaced by a modified strap construction 47, the essential characteristic of which is the disposition of the ears 48 in relatively vertical rather than horizontal relation. This type of assembly is particularly suitable for use in a partition (wall, bulkhead, etc.) so that wires on one side of the plug receptacle are plugged in from one room while the wires on the other side are manipulated from another room. This arrangement emphasizes the independence of each plug from the plug with which it may be associated, i. e., the possibility of connecting and disconnecting any wire without in any way disturbing any other wire.

It will be apparent from the foregoing that the present invention provides a device whereby the objects introductorily enumerated are realized.

Having thus disclosed the invention, what is claimed is:

1. A device of the character described comprising a compact assembly of a plurality of wire end plug connectors, wire end plugs therein, a spring detent extending from each end of each connector, each said wire end plug having a notch for the reception of one said detent, means for locking each of said plugs in its corresponding receptacle against undesired removal therefrom, said locking means being severally releasable and said plug ends being severally dissociable from said connectors without disturbing any other locking means and plug end, said locking means comprising a sleeve member mounted on said wire and movable into encompassing relationship with said notch and spring detent therein, whereby dissociation of said wire end plug and connector is possible only when said sleeve is out of said encompassing relationship.

2. A device of the character described comprising a compact assembly of a plurality of wire end plug connectors, wire end plugs therein, a spring detent extending from each end of each connector, each said wire end plug having a notch for the reception of one said detent, means for locking each of said plugs in its corresponding receptacle against undesired removal therefrom, said locking means being severally releasable and said plug ends being severally dissociable from said connectors without disturbing any other locking means and plug end, said

locking means comprising a sleeve member mounted on said wire and movable into encompassing relationship with said notch and spring detent therein, whereby dissociation of said wire end plug and connector is possible only when said sleeve is out of said encompassing relationship, and means on each said detent for frictionally engaging the interior surface of its corresponding sleeve member.

3. A device of the character described comprising a plurality of superposed tiers of insulating material defining a plurality of rows of recesses therein, a wire connector received in each said recess, a spring detent extending from each end of each said connector, each said connector being entirely housed in said recess with only said detents projecting therefrom, a wire end in each connector at each end thereof, each wire end being notched to receive said detent, and a sleeve of insulating material arranged about each associated notch and detent, whereby each said connector and wire end are locked together and no electrically conductive part is exposed.

4. A device of the character described comprising a compact assembly of a plurality of wire end plug connectors, wire end plugs therein, a spring detent extending from one end of each connector, each said wire end plug having a notch for the reception of one said detent, means for locking each of said plugs in its corresponding receptacle against undesired removal therefrom, said locking means being severally releasable and said plug ends being severally dissociable from said connectors without disturbing other locking means and plug ends, said locking means comprising a sleeve member

mounted on said wire and movable into encompassing relationship with said notch and spring detent therein, whereby dissociation of wire end plug and connector is possible only when said sleeve is out of said encompassing relationship.

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