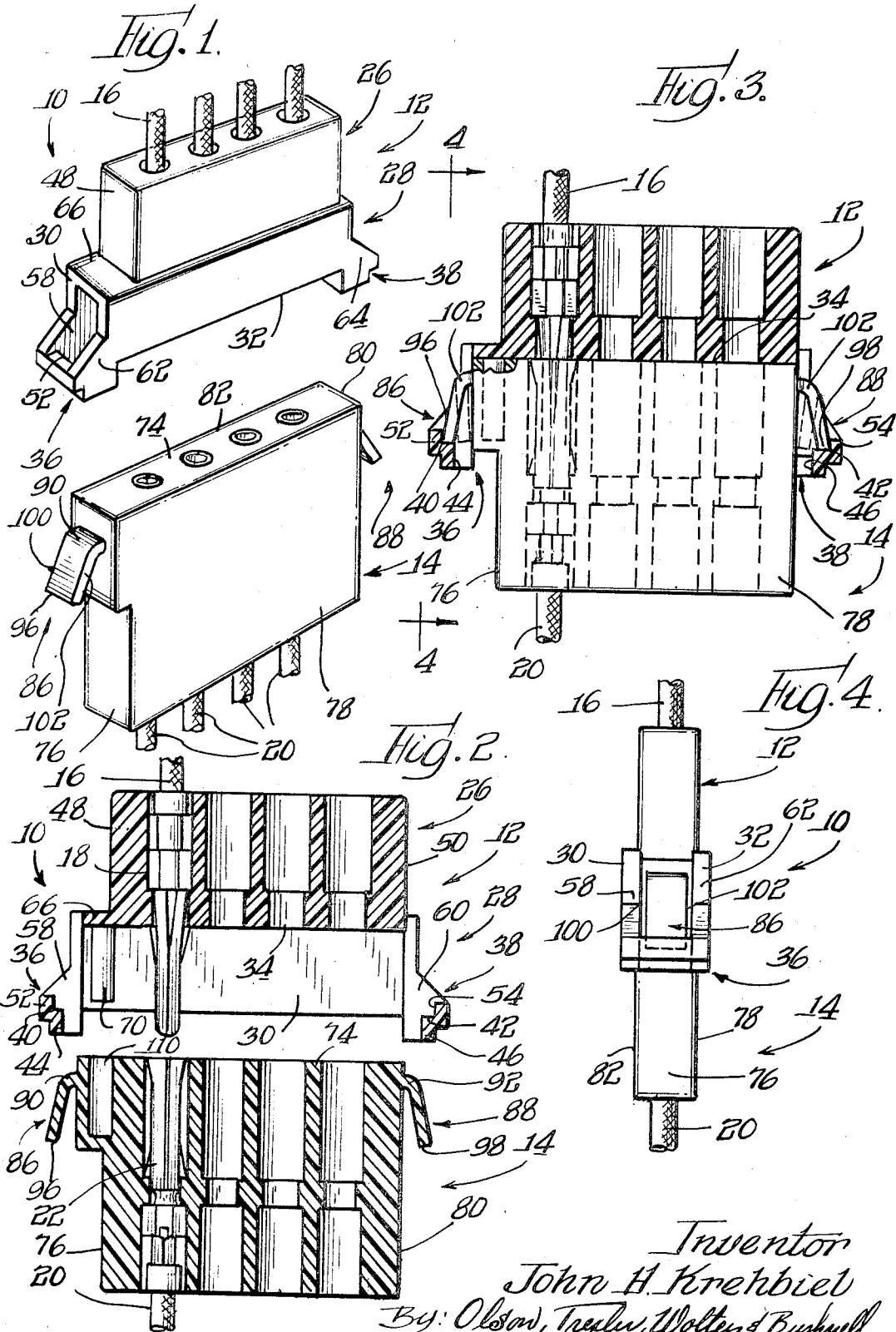


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SEPARABLE ELECTRICAL CONNECTOR HAVING REARWARDLY
DIRECTED LATCH FINGERS
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SEPARABLE ELECTRICAL CONNECTOR HAVING REARWARDLY DIRECTED LATCH FINGERS

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ABSTRACT OF THE DISCLOSURE

A two-piece molded plastic, separable connector; the plug has, adjacent its entering face, a pair of rearwardly and outwardly directed integral flexible latch members which are cammed inwardly upon assembly with the receptacle, and snap out into latch recess means of the receptacle for semi-permanent assembly of the plug and receptacle.

This invention relates generally to an electrical connector and more particularly to an electrical connector having a selectively releasable latch means for interconnecting a plug and receptacle portion of a connector.

Electrical connectors are commonly utilized for interconnecting two groups of wires, rather than separately joining together individual pairs of wires. The prior art electrical connectors commonly include a plug having terminals connected to a first group of wires and a receptacle having terminals connected to a second group of wires. The two groups of wires are electrically interconnected by inserting the plug portion of the connector into the receptacle portion of the connector. A latch means is usually provided for preventing the plug from being accidentally pulled out of the receptacle.

The latch is generally released by pressing a lug, manually or with a tool, out of engagement with a recess. Once the lug has been forced out of engagement with the recess, the plug and receptacle portion of the connector can be separated. When the plug is reinserted into the receptacle, the lug will again engage the recess to securely latch the two electrical components together.

The generally satisfactory service provided by these prior art electrical connector latches is shown by the widespread industrial usage of the latches. However, the prior art connector latches have proven to be somewhat unsatisfactory, due to the difficulty in disengaging the latch lug from the associated latching recess. This difficulty is multiplied when one of the connector elements is mounted in or behind a control panel where access to the latch lug is limited.

Therefore, it is an object of this invention to provide improved connector structure having a readily engageable and disengageable latch structure for securely interconnecting the mating parts of the connector.

Another object of this invention is to provide a satisfactory electrical connector having a latch structure which can be released by depressing readily accessible levers mounted on the connector.

Another object of this invention is to provide an electrical connector having a latch structure which can be released by depressing an easily accessible lever mounted on the connector.

Another object of this invention is to provide an improved electrical connector of two-piece construction which is simple in design and structure, economical to manufacture, highly practicable in use, and which is readily connected and disconnected for rapid assembly and disassembly of electrical components.

These and other objects and features of the invention

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will be more apparent upon a reading taken in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a connector for interconnecting two groups of wires shown with a plug element separated from a receptacle element for purposes of clarity of illustration;

FIG. 2 is a sectional view illustrating the construction of the receptacle and plug elements of FIG. 1, with the plug and receptacle elements being shown in substantially the same spaced-apart relationship as in FIG. 1;

FIG. 3 is a partial sectional view illustrating the relationship between the plug and receptacle elements of the connector of FIG. 1 when the elements are interconnected; and

FIG. 4 is an elevational view, taken along the line 4-4 of FIG. 3, further illustrating the relationship of the plug and receptacle elements when they are interconnected.

Referring now to FIG. 1, taken in conjunction with FIG. 2, it will be seen that the electrical connector 10 includes a receptacle 12 and a plug 14 which are molded of a suitable elastomeric material such as nylon. A first group of wires 16 are connected to a male type terminal 18 mounted in the plug 12. A second group of wires 20 are connected to female type terminals 22 which are mounted in the receptacle 14. The terminals 18 and 22 are built and mounted as illustrated in my prior United States Patent No. 3,178,673, and reference may be had thereto for further details concerning the mounting and interengagement of the terminals.

The receptacle 12 includes a base section 26 in which the terminals 18 are mounted and a socket section 28 integrally formed with the base section 26. The socket section 28 includes a pair of side walls 30 and 32 which extend longitudinally of the plug 12 and project transversely outwardly from the base section adjacent to a face wall 34 of the base section 26 (see FIG. 2). A pair of latch shelves or recesses 36 and 38 are formed at opposite ends of the socket section 28 intermediate the side walls 30 and 32. As is perhaps best seen in FIG. 2, the latch recesses 36 and 38 include plate or support surfaces 40 and 42 which extend transversely between the side walls 30 and 32 in a substantially parallel relationship with an outer edge of the side walls and the face surface or wall 34. A pair of axially outwardly extending skirt or guide surfaces 44 and 46 are connected to the support surfaces 40 and 42. The two guide surfaces 44 and 46 face each other and are substantially parallel with side walls 48 and 50 of the base section 26. Axially inwardly projecting rim surfaces or walls 52 and 54 are integrally formed with the guide surfaces 44 and 46 and support surfaces 40 and 42. It should be noted that the guide surfaces 44 and 46, which are the innermost surfaces of the two recesses 36 and 38, are positioned transversely outwardly of the walls 48 and 50 of the base section 26 to facilitate insertion of the plug 14.

The longitudinal sides of the recesses 36 and 38 are defined by outwardly extending side wall sections 58 and 60 of the side wall 30 and the sections 62 and 64 of the side wall 32 (see FIGS. 1 and 2). A transversely extending roof or top wall 66 interconnects the two side walls 30 and 32 of the socket section 28 adjacent to the base wall 48 of the base section 26. A cylindrical outwardly projecting positioning peg or lug 70 is integrally formed with the wall 66 and extends outwardly adjacent to the recess 36.

The plug 14, as is illustrated in FIGS. 1 and 2, includes an outermost face or end wall 74 which is integrally formed with axially inwardly extending side walls 76, 78, 80 and 82. A pair of longitudinally outwardly extending latch levers or ears 86 and 88 are integrally formed with the side walls 76 and 80. The latch levers 86 and 88 include flexible end portions 90 and 92 which connect the

latch levers to the side walls 76 and 80. The end portions 90 and 92 are formed with an arcuate bent which extends longitudinally outwardly and axially inwardly away from the face wall 74. The end portions 90 and 92 are resiliently deformable to enable the latch levers to be pressed inwardly from their position shown in FIG. 2. The latch levers 86 and 88 also include end surfaces 96 and 98 which are positioned in abutting engagement with the support surfaces 40 and 42 of the latch recesses 36 and 38 (see FIG. 3) when the plug 14 is inserted in the receptacle 12. The latch levers 86 and 88 also include side surfaces 100 (see FIG. 4) which are positioned adjacent to the side wall 30 of the socket section 28 and side surfaces 102 which are positioned adjacent to the side wall 32 of the socket 28.

When the latch levers 86 and 88 are in locking engagement with the support surfaces 40 and 42, as shown in FIG. 3, the end surfaces 96 and 98 abut the support surfaces 40 and 42 to prevent the plug 14 from being withdrawn from the receptacle 12. When the latch levers 86 and 88 are in abutting engagement with the support surfaces 40 and 42 the sections 58, 60, 62 and 64 of the side walls 30 and 32 are adjacent to the side surfaces 100 and 102 of the latch levers 86 to shield the latch levers against accidental inward displacement, as indicated by the dashed lines in FIG. 3, which would disengage the latch levers from their respective support surfaces. The latch levers are retained in a somewhat inwardly displaced position, relative to the initial position indicated in FIG. 2, by the rim walls or surfaces 52 and 54 of the recesses 56 and 58. Thus, the latch levers 86 and 88 resiliently engage the rim surfaces or walls 52 and 54 when the plug and receptacle are interconnected as shown in FIG. 3. It will also be apparent that the rim surfaces 52 and 54 prevent the latch levers from being deflected outwardly relative to the support surfaces 40 and 42.

A cylindrical hole or recess 110 is formed in the plug 14 for mating engagement with the peg or lug 70 to position the plug 14 relative to the receptacle 12. If an attempt should be made to insert the plug in an orientation other than that shown in FIG. 2, the positioning peg 70 will not line up with the hole or recess 110 and the attempt to so position the plug relative to the receptacle will fail due to a blocking engagement of the peg 70 with the plug 14.

For purposes of affording a more complete understanding of the invention it is advantageous now to provide a functional description of the mode in which the component parts thus far identified cooperate. When the plug 14 is to be inserted in the receptacle 12, the plug is first orientated to align the positioning peg 70 with the cylindrical recess or socket 110. The face wall 74 of the plug will then be inserted intermediate the two side walls 30 and 32 of the socket section 28 of the receptacle 12. The plug will then be moved toward the receptacle. As the plug is moved toward the receptacle, the latch levers 86 and 88 will be cammed inwardly due to a sliding engagement of the guide surfaces 44 and 46 with the angularly outwardly extending latch levers 86 and 88. This camming action results in the latch levers moving inwardly toward the side walls 76 and 80 of the plug, as indicated by the dashed lines in FIG. 3.

As the insertion of the plug into the receptacle is continued, the end surfaces 96 and 98 of the latch levers 86 and 88 will just clear the guide surfaces 44 and 46 so that the latch levers 86 and 88 can resiliently pivot outwardly, to engage the support surfaces 40 and 42 of the latching recesses 36 and 38. When the latching levers have snapped or pivoted outwardly in this manner, the end surfaces 96 and 98 of the latch levers will be in abutting blocking engagement with the support surfaces 40 and 42 to interlock the plug 14 with the receptacle 12. The latch levers 86 and 88 will also resiliently engage the rim surfaces 52 and 54 to maintain the interlock be-

tween the plug and receptacle until the latch levers are pivoted inwardly, as indicated in dotted lines in FIG. 3, to disengage the plug 14 from the receptacle. As will be apparent to those skilled in the art, when the plug is inserted in the receptacle, there will be a solid electrical connection between the terminals 18 and 22 to complete a circuit through the wires 16 and 20.

The steps for removing or disengaging the plug 14 from the receptacle 22 will be substantially the reverse of the steps for inserting the plug into the receptacle. Thus, the latch levers 86 and 88 are pivoted inwardly, adjacent to the side walls 76 and 80 of the plug 14, so that the end surfaces 96 and 98 of the latch levers will clear the support surfaces 40 and 42. The plug may then be withdrawn outwardly from the receptacle, since there will no longer be a blocking engagement of the latch levers 86 and 88 with the supporting surfaces 40 and 42 of the recesses 36 and 38 of the receptacle. It should be noted that the transversely open recesses 36 and 38 facilitate the inward movement of the latching levers 86 and 88.

It will be understood that the member 14 described herein for purposes of this specification and claims as a plug member is also known in the electrical component industry as a "receptacle." The designation of the member 12 as a receptacle by the electrical component industry results from the fact that the female type terminals 22 are mounted in the member 14. It will also be understood that the member 12 described herein, for purposes of this specification and claims, as a receptacle member is also known in the electrical component industry as a "plug." The member 12 is known in the electrical component industry as a "plug" because the male type terminals 16 are mounted therein. However, since this disclosure is drawn primarily to the connector members 12 and 14, without substantial regard to the relationship of the terminals 16 and 22, and because the member 14 is inserted into the member 12, the member 12 has been designated as a receptacle into which the member 14, designated as the plug, is inserted.

It is contemplated that with certain types of connector structure, it will be desirable to eliminate one of the latching levers and the associated recess. It is also contemplated that the latching levers may be positioned on the broad or wide side of the collector, rather than on the narrow side, as illustrated in the exemplary embodiment. Therefore, while exemplary embodiments of the invention have been shown, it should be understood, of course, that the invention is not limited thereto since many modifications may be made, and it is, therefore, contemplated to cover by the appended claims any such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An electrical connector comprising: a receptacle element adapted to engage terminal ends of a first group of wires, said receptacle element including a base section having a face surface and a socket section, said socket section including first and second spaced-apart substantially parallel side wall means extending from said base section adjacent to said face surface; latch recess means formed adjacent to a side of said base section intermediate said first and second side wall means, said latch recess means including a support surface means extending between said side wall means in a substantially parallel relationship with said face surface, a guide surface means formed integrally with said support surface means and extending outwardly from said support surface means, and a rim means formed integrally with said support surface means and extending inwardly from said support surface means; a plug element adapted to encase terminal ends of a second group of wires, said plug element having an end portion adapted to be inserted in said receptacle element intermediate said first and second side wall means, said end portion having a front

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surface through which the plug element terminal ends are accessible; said plug element including a latch lever integrally formed with a side wall of said plug element relatively adjacent said front surface and extending outwardly and rearwardly to an outer end for resilient engagement with said latch recess means, said latch lever being resiliently deformed inwardly toward said side wall by guide surface means of said latch recess means as said plug element is inserted into said receptacle element; and said latch lever outer end abutting said support surface means of said latch recess means to lock said plug element in a predetermined position relative to said receptacle element.

2. An electrical connector as set forth in claim 1 wherein: inner surfaces of said first and second side wall means are positioned adjacent longitudinally extending side surfaces of said latch lever when said latch lever is in engagement with said latch recess means to shield the side surfaces of said latch lever.

3. An electrical connector as set forth in claim 1 wherein: said recess means includes an inwardly extending rim means formed integrally with said support surface means and said latch lever presses resiliently outwardly against an inner surface of the rim means when said plug element is in said predetermined position relative to said receptacle element.

4. An electrical connector comprising: a receptacle element adapted to encase terminal ends of a first group of wires, said receptacle element including a base section having a face surface and a socket section, said socket section including first and second spaced-apart substantially parallel side wall means extending from said base section adjacent to said face surface; first and second latch recess means formed adjacent opposite sides of said base section intermediate said first and second side wall means, said first and second latch recess means each including a support surface means extending between said side wall means in a substantially parallel relationship with said face surface, a guide surface means formed integrally with said support surface means and extending outwardly from said support surface means, and a rim means formed integrally with said support surface means and extending inwardly from said support surface means; a plug element adapted to encase terminal ends of a second group of wires, said plug element having an end portion adapted to be inserted in said receptacle element intermediate said first and second side wall means, said end portion having a front surface through which the plug element terminal ends are accessible; said plug element including first and second spaced-apart walls, a first latch lever integrally formed with said first wall relatively

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adjacent said front surface and extending outwardly and rearwardly to an outer end for resilient engagement with said first latch recess means, a second latch lever integrally formed with said second wall relatively adjacent said front surface and extending outwardly and rearwardly to an outer end for resilient engagement with said second latch recess means, said first and second latch levers being resiliently deformed inwardly toward said first and second walls by the associated guide surface means of said first and second latch recess means as said plug element is inserted into said receptacle element; said first latch lever outer end abutting the support surface means of said first latch recess means to lock said plug element in a predetermined position relative to said receptacle element, the rim means of said first latch recess means retaining said first latch lever against movement outwardly relative to said first wall when said plug element is in said predetermined position relative to said receptacle element; and said second latch lever outer end surface abutting the support surface means of said second latch recess means to further lock said plug element in said predetermined position relative to said receptacle element, the rim means of said second latch recess means retaining said second latch lever against movement outwardly relative to said second wall when said plug element is in said predetermined position relative to said receptacle element.

5. An electrical connector as in claim 4 wherein: inner surfaces of said first and second side wall means are positioned adjacent longitudinally extending side surfaces of said first and second latch levers when said first and second latch levers are in engagement with their associated latch recess means to shield the side surfaces of said first and second latch levers.

6. An electrical connector as set forth in claim 4 wherein: said first and second latch levers press resiliently outwardly against inner surfaces of the associated rim means when said plug element is in said predetermined position relative to said receptacle element.

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