

- [54] **ELECTRICAL CONNECTING APPARATUS**
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 Co., Ltd.**, Tokyo, Japan
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 [51] Int. Cl.²..... **H01R 31/08**
 [58] Field of Search..... **339/19, 121, 222**

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 Zinn & Macpeak

[57] **ABSTRACT**

Herein disclosed is an electrical connecting apparatus adapted for the interconnection of wiring harnesses such as the wiring harnesses in motor vehicles. The electrical connecting apparatus for wiring harnesses includes a socket block having a multiplicity of connecting chambers, a plurality of plug blocks having a multiplicity of connecting chambers, and terminal members in the connecting chambers of the socket block and the plug blocks respectively, the plug blocks being mated to the socket block in a predetermined relationship and the terminal members in the plug blocks being mated to the terminal members in the socket block. The terminal members in each plug block are connected to the wires belonging to a corresponding wiring harness. Connecting means, which electrically interconnects at least one of the terminal members accommodated in the socket block and mating with one of the terminal members accommodated in one of the plug blocks with at least one of the terminal members accommodated in the socket block and mating with one of the terminal members accommodated in another plug block, is attached to the socket block.

4 Claims, 9 Drawing Figures

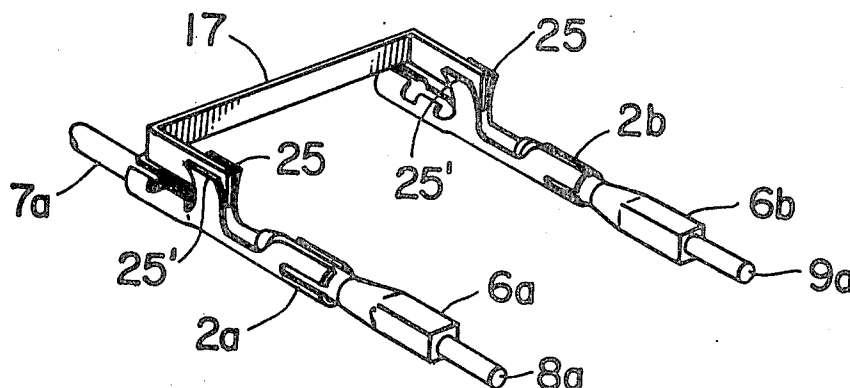


FIG. 1

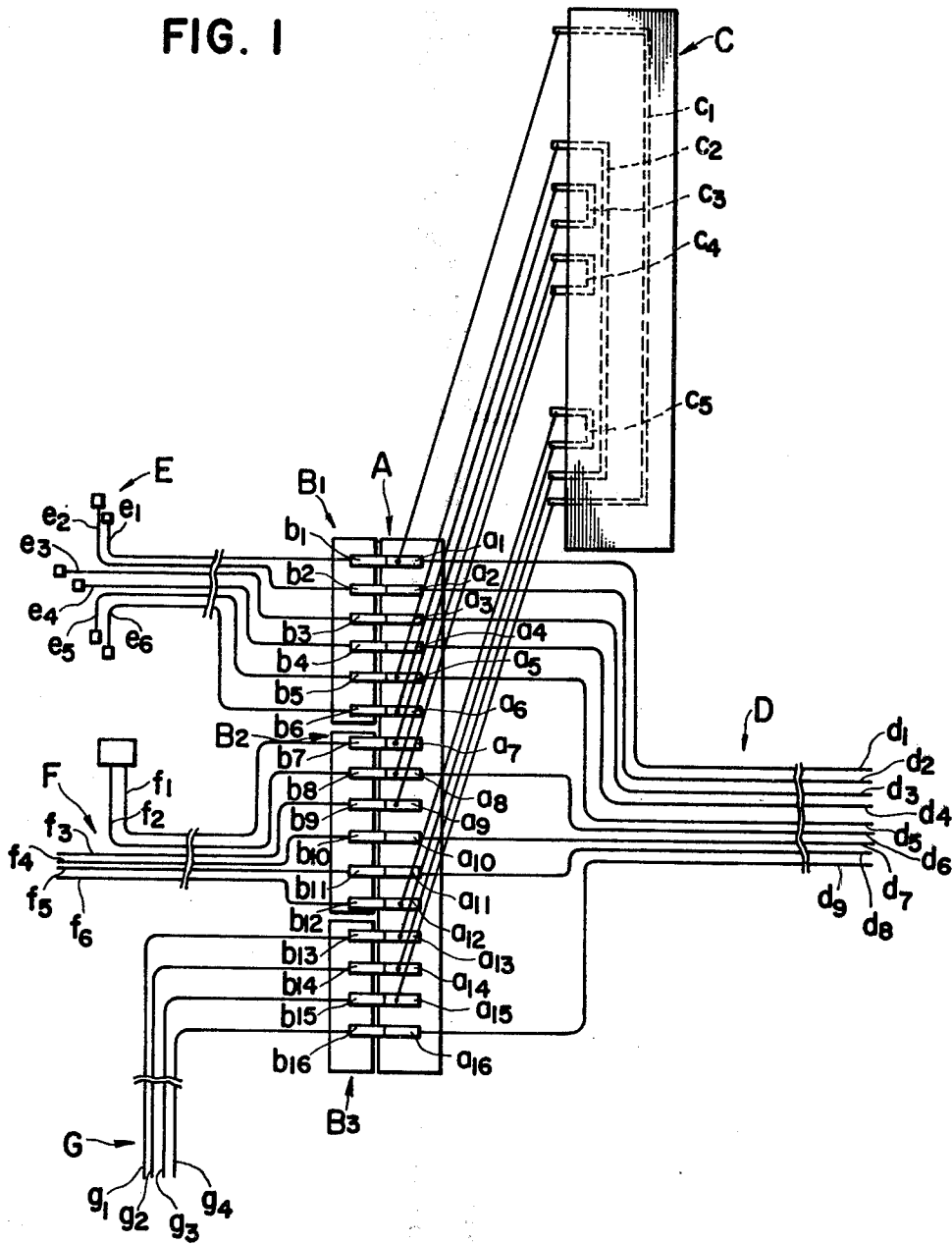


FIG. 2

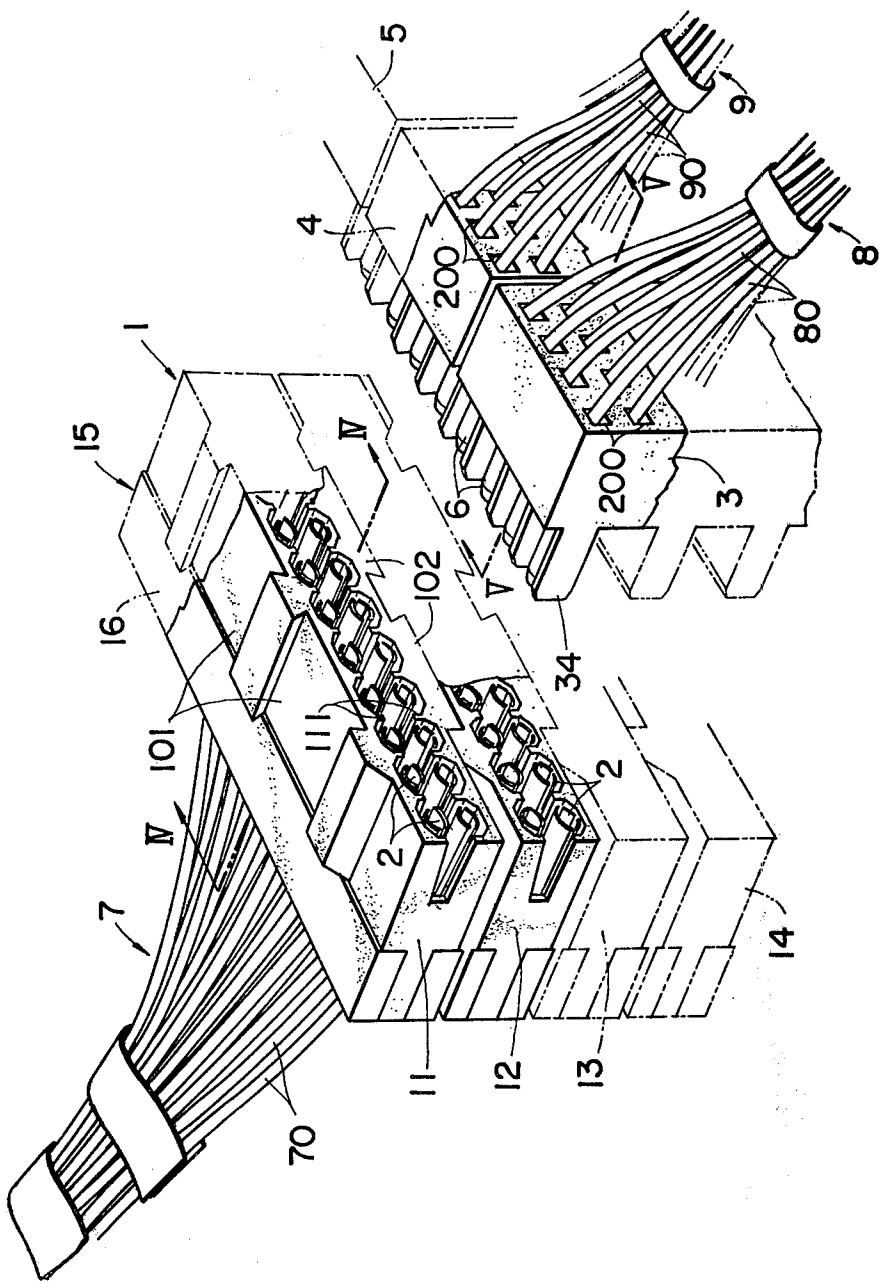


FIG. 3

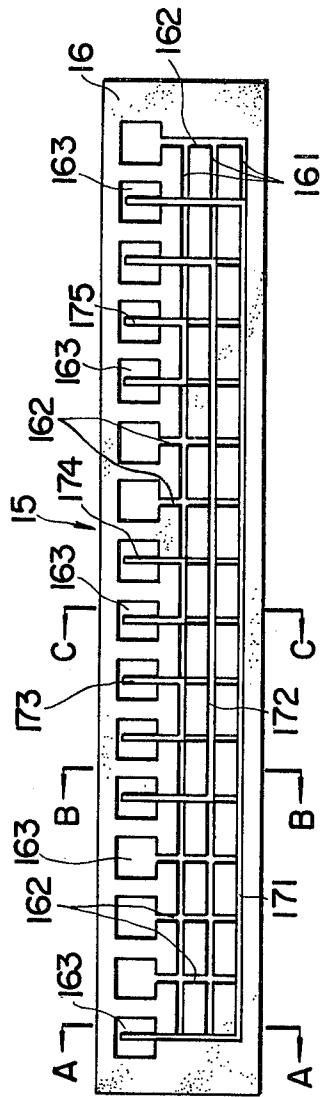


FIG. 3A

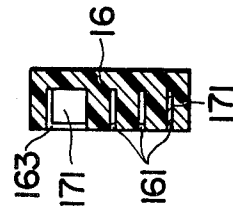


FIG. 3B

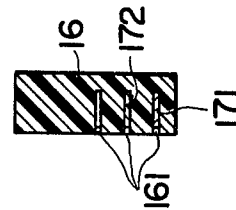


FIG. 3C

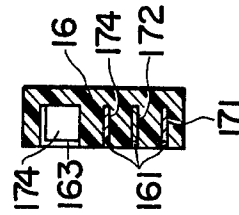


FIG. 5

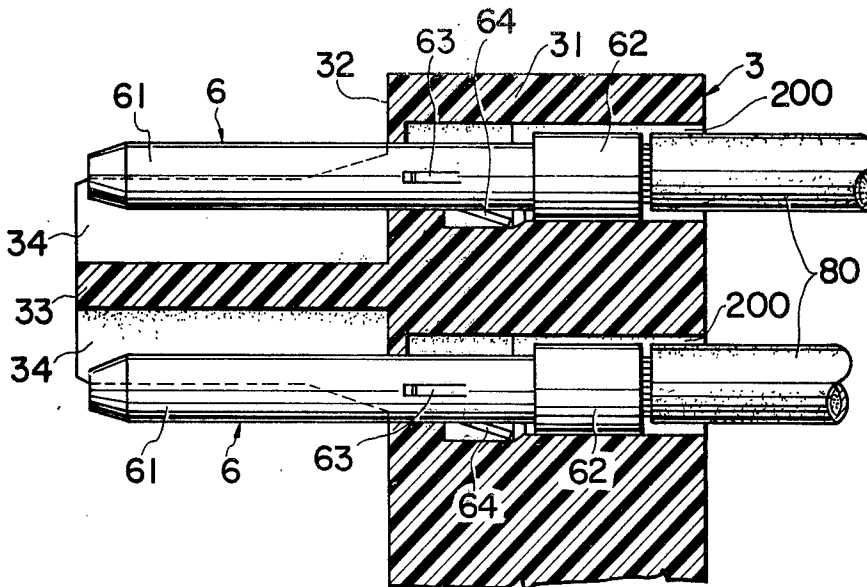
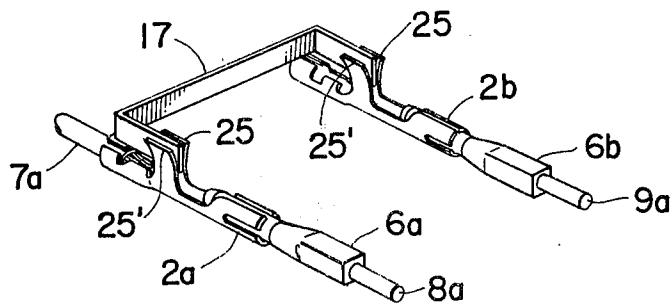


FIG. 6



ELECTRICAL CONNECTING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electrical connecting apparatus adapted for the interconnection of wiring harnesses such as the wiring harness of motor vehicles.

2. Description of the Prior Art

The electrical wiring circuits interconnecting the many electrical components in motor vehicles are quite complex. Therefore, the constructions and interconnections between the wiring harnesses forming such circuits are also complex, as is disclosed in the description of U.S. Pat. No. 2,809,361. In the motor vehicle assembling process, especially, in the equipping step, the connecting of the wiring harness to the electrical components and the interconnecting of the wiring harness are complex and time-consuming. Such complexity sometimes leads to the mis-connection of an electric wire in the wiring harness. For instance, the wiring harness for an instrument board is attached to the instrument board before the board is supplied to an assembly conveyer line, but most of the electrical connections are carried out after the board has been attached to the body of the motor vehicle. The electrical connections of a wiring harness with electrical components located in the vicinity of a steering wheel such as a column switch, a lever switch, a horn switch, a brake switch and the like, and the electrical connections of other wiring harnesses such as a wiring harness for the engine room, a wiring harness for the vehicle body and the like are all accomplished in the vehicle body which is being carried on an assembly conveyer line. In addition, such electrical connections are very hard because they are usually accomplished by the operator's hands inserted into a limited space. Thus, a considerable number of operators of considerable skill are required for ensuring proper electrical connections on an assembly line within a limited time period. For a maker of wiring harnesses, on the other hand, it is a great disadvantage that they are required to prepare varieties of complex wiring harnesses, which leads to remarkable increases in their production costs.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide an electrical connecting apparatus eliminating the above mentioned disadvantages, by which the interconnections of wiring harnesses are made remarkably simple, and whereby the construction of the wiring harness itself is remarkably simplified.

Another object of the present invention is to provide an electrical connecting apparatus centralizing the electrical interconnection between three or more wiring harnesses to be connected with a number of electrical components, thus reducing the required number and kinds of connectors interconnecting wiring harnesses.

Still another object is to provide an electrical connecting apparatus which enables the construction of wiring harness to be simplified.

In order to accomplish the above objects, the present invention provides an electrical connecting apparatus for providing wiring connections of wiring harnesses including a socket block having a multiplicity of connecting chambers, a plurality of plug blocks having a

multiplicity of connecting chambers, and terminal members accommodated in the connecting chambers of the socket block and the plug blocks respectively, the plug blocks being mated with the socket block in a predetermined relationship and the terminal members in the plug blocks being mated with the terminal members in the socket blocks, characterized in that the terminal members accommodated in each plug block are connected to the wires belonging to a corresponding wiring harness, and that connecting means, which electrically interconnects at least one of the terminal members accommodated in the socket block and mating with one of the terminal members accommodated in one of the plug blocks with at least one of the terminal members accommodated in the socket block and mating with one of the terminal members accommodated in another plug block, is attached to the socket block.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will be apparent from the following description in conjunction with the accompanying drawings, in which:

FIG. 1 is a connection diagram of electrical connecting apparatus of the present invention for providing wiring connections for wiring harness;

FIG. 2 is a perspective view showing one embodiment of electrical connecting apparatus according to the present invention;

FIG. 3 is an enlarged front view showing the connector means exemplified FIG. 2;

FIGS. 3A, 3B and 3C are, respectively, sectional views taken along lines A—A, B—B and C—C of FIG. 3;

FIG. 4 is an enlarged sectional view taken along line IV—IV of FIG. 2;

FIG. 5 is an enlarged sectional view taken along line V—V of FIG. 2; and

FIG. 6 is a perspective view showing one embodiment of connections among the terminal member accommodated in the socket block, the terminal member accommodated in the plug block and the connecting bar of the connecting means.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, a socket block A is provided with terminal members $a_1, a_2 - a_{16}$, in which the terminal member a_1 is connected with an electric wire d_1 of an engine room harness D and the terminal members $a_2, a_3, a_4, a_5, a_8, a_{10}, a_{11}, a_{16}$ with electric wires $d_2, d_3, d_4, d_5, d_6, d_7, d_8, d_9$ of the engine room harness, respectively. Plug blocks B_1, B_2, B_3 having a mating relationship with the socket block A are mating with the socket block A in a predetermined relationship, as shown in FIG. 1. Terminal members $b_1, b_2 - b_6$ accommodated in the plug block B_1 mate, respectively, with the terminal members $a_1, a_2 - a_6$ accommodated in the socket block A. Similarly, terminal members $b_7, b_8 - b_{12}$ in the plug block B_2 mate, respectively, with the terminal members $a_7, a_8 - a_{12}$ in the socket block A. Moreover, terminal members $b_{13}, b_{14} - b_{16}$ in the plug block B_3 mate, respectively, with the terminal members $a_{13}, a_{14} - a_{16}$ in the socket block A. Each of the plug blocks B_1, B_2, B_3 , on the other hand, are connected to different wiring harnesses, for instance, the terminal members in the plug block B_1 are connected with respective electric wires $e_1, e_2 - e_6$ of a wiring harness E for the instrument

board, the terminal members in the plug block B_2 are connected with respective electric wires $f_1, f_2 - f_6$ of a wiring harness F for the dash board, while the terminal members in the plug block are connected with respective electric wires $g_1, g_2 - g_4$ of a wiring harness G for the vehicle body (namely, for the tail lamp or the like). The electric wires $d_1, d_2 - d_8$ are, on the other hand, connected with a power source, a head lamp and so on.

In the socket block A there is mounted connecting means C which is provided with connecting bars $c_1, c_2 - c_5$ for providing respective interconnection in a predetermined relationship between two terminal members accommodated in the socket block. That is, for example, the connecting bar c_1 provides an interconnection between the terminal members a_1 and a_{15} . As has been described in the above, the terminal member a_1 is connected with the terminal b_1 in the plug block B_1 , and accordingly with the electric wire e_1 of the wiring harness E, while the terminal member a_{15} is connected with the terminal member b_{15} in the plug block B_3 , and accordingly with the electric wire g_3 of the wiring harness G. More specifically, the connecting bar c_1 provides an interconnection between the terminal members a_1 and a_{15} which are connected, respectively, with the electric wires e_1 and g_3 belonging to a different wiring harnesses E and G. In a like manner, the connecting bars $c_2 - c_5$, respectively, provide predetermined interconnections between paired terminal members of the socket block A thereby interconnecting the paired electric wires which belong to the different wiring harnesses. For instance, the connecting bar c_5 connects the terminal member a_{12} in the socket block A with the terminal member a_{13} in the socket block A, the terminal member b_{12} in the plug block B_2 mates with the terminal member a_{12} and is connected with the electric wire f_6 of the wiring harness F, and the terminal member b_{13} in the plug block B_3 mates with the terminal member a_{13} and is connected with the electric wire g_1 of the wiring harness G.

In this manner, the connecting apparatus according to the present invention has connecting means which electrically interconnects at least one of the terminal members accommodated in the socket block and mating with one of the terminal members accommodated in one of the plug blocks with at least another one of the terminal members accommodated in the socket block and mating with one of terminal members accommodated in another plug block, and which is attached to the socket block. More specifically, the connecting means C attached to the socket block A can provide interconnections of the terminal members in the socket block A which are mating with the terminal members belonging to different plug blocks. The terminal members in the plug blocks are connected with the electric wires of different wiring harnesses. With this arrangement therefore, one of the electric wires of the wiring harness D for the engine room can be connected to both of the electric wires belonging to two different wiring harnesses, for example, to electric wire e_1 of the wiring harness E and to the electric wire g_3 of the wiring harness G. In this instance, it should be noted that neither one of the terminal members a_1 or a_{15} is not connected to an electric wire of the wiring harness D. In FIG. 1, the terminal member a_1 is connected to electric wire d_1 but the terminal member a_{15} is not connected to any electric wire.

When, on the other hand, it is intended to provide interconnections of the electric wires which belong to

different wiring harnesses and which are connected to terminal members in different plug blocks, the terminal members in the socket block which are mating with the terminal members in the plug blocks are interconnected by means of connecting means, and each terminal member in the socket block and interconnected as above is not connected to any wire of the wiring harness D.

Referring now to FIG. 1, the electric wire f_6 of the wiring harness F is connected via connecting bar c_5 with the electric wire g_1 of the wiring harness G. Since, in this instance, the terminal members a_{12} and a_{13} of the socket block A are not connected with the wiring harness D, the electric wires of the wiring harness D are not connected to the electric wires f_6 and g_1 .

Owing to the connections and shuntings as performed in the electrical connecting apparatus of the present invention, the interconnections of the wiring harness are made remarkably simple. From the practical view point, the wiring harness D for the engine room is usually connected with the socket block A, while the remaining harness E, F and G are, respectively, connected to different plug blocks. As a result, all the wiring connections of the wiring harnesses can be centrally made with the use of the electrical connecting apparatus of the present invention, and the number and kind of the connectors required for interconnecting the harnesses are materially reduced. At the same time, the construction of the respective wiring harness is remarkably simplified.

Referring now to FIG. 2, in which one embodiment of electrical connecting apparatus according to the present invention is described in detail, a socket block 1 is provided with similarly shaped socket members 11, 12, 13 and 14 which are piled on each other. Each of the socket members 11 to 14 has formed on its upper surface two undercut grooves 101 and on its lower surface two complementary projections 102, which are can be inserted into the undercut grooves 101 for integrally securing the socket members 11 to 14 to each other. In each of socket members 11 to 14 there are two rows of terminal members 2, which are arranged with one row lying upon the other row. The terminal members 2 are respectively connected with electric wires 70 of a wiring harness 7, such as that for the engine room. Reference numeral 15 indicates connecting means for providing interconnections of the terminal members 2. Socket member 11 is, as shown in FIG. 4, made of an insulating plastic material and is divided into upper and lower portions by an intermediate wall 103. A number of vertical walls 106 extend upwardly and downwardly from the intermediate wall 103 in a direction perpendicular to the intermediate wall 103, thus defining therebetween a number of connecting chambers 107 and 108. The lower or right-hand sides of the connecting chambers 107 and 108 are covered with horizontal walls 109 and 110, which further extend in the forward direction to thereby form an opening 105 at the forward end of both the extending end 104 of the intermediate wall 103 and the extending end of the vertical wall 106. The horizontal walls 109 and 110 are formed with a number of projections 111 on their surfaces which face the opening 105. In the connecting chambers 107 and 108 are accommodated the terminal members 2, which are respectively connected with the electric wires 70 of the harness 7. The terminal members 2 accommodated in the connecting chambers 107 are arranged, as shown in FIG. 4, in a back to back

relationship with respect to the terminal members 2 accommodated in the connecting chambers 108. A conductor 71 of each of the electric wires 70 is pressed on one of the terminal members by means of a holder 21, and another holder 22 retains insulation 72 of one of the electric wires 70. A mating portion 23, at the forward extension of the terminal member 2 is located in the opening 105 of the socket member 11, while the terminal member 2 itself is fixed into the socket member 11 by means of locking tongues 26 and 27. The mating portion 23 has a shape suitable for mating engagement with the terminal member 6 accommodated in the plug block, for example, a tubular shape, and may desirably be formed with a slit 24 for increasing the elasticity required for ensuring mating contact. A pair of contact blades 25 and 25', or a terminal, are provided in the forward vicinity of the holder 21, as shown in FIG. 6. These contact blades 25 and 25' extend beyond the vertical walls 106 and are electrically connected to the connecting bars 171 to 175 of the connecting means, as will be described in detail later. Reference numeral 16 indicates a connecting bar holder mounted on the vertical wall 106, which will be explained in more detail.

Suitable indications may be provided on the socket block and the plug block so as to enable the assembly operator to easily and properly assemble the socket block and plug blocks.

Referring now to FIG. 2, plug blocks 3, 4 and 5 are respectively mated with the socket block 1 in a predetermined relationship, that is, each of the plug blocks 3, 4 and 5 has a number of connecting chambers 200 for accommodating the terminal members 6 mating with the terminal members 2 accommodated in the socket block 1.

More specifically, the terminal members 6 in the connecting chambers 200 of the plug block 3 are connected with electric wires 80 of a wiring harness 8, such as that for the instrument board, and the terminal members 6 in the plug block 4 are connected with electric wires 90 of a wiring harness 9, such as that for the dash board. In a like manner, the terminal members of the plug block 5 are connected with the electric wires of the wiring harness for the motor vehicle body. All of plug blocks 3 to 5 are made of the same material as the socket block 1.

Turning now to FIG. 5, showing a sectional view of the plug block 3, the plug block 3 is composed of a body 31 having connecting chambers 200, a horizontal wall 33 extending normally from the forward or left-hand side 32 of the body 31, and a number of vertical walls 34. In the connecting chambers 200 are accommodated the terminal members 6, each of which is connected with one of the electric wires 80 at members 62, and which are fixed in the body 31 by locking tongues 63 and 64. Mating portions 61 of the terminal members 6 extend from the body 31 through the ends of the connecting chambers 200. When it is intended to have the plug block 3 mate with the socket block 1, the vertical walls 34, the horizontal wall 33 and the mating portions 61 of the terminal members 6 are inserted into the opening 105 of the socket member 11. In other words, the vertical walls 34 are inserted into the clearances between the projections 111 of the horizontal walls 109 and 110 of the socket member 11 in a manner to have contact engagement therewith. The mating portions 61 of the terminal members 6 are mated with the mating

portions 23 of the terminal members 2 accommodated in the socket block 1.

Referring now to FIGS. 2 and 3, the connecting means 15 includes the connecting bar holder 16 and connecting bars 171 to 175 mounted in the holder 16 for connecting the terminal members in a predetermined relationship. As shown in FIG. 3, the connecting bar holder 16 is formed with a plurality of longitudinal grooves 161 (three in number in FIG. 3), a multiplicity of transverse grooves 162 (sixteen in number in the same figure) communicating with the longitudinal grooves 161, and recesses 163 communicating with the transverse grooves 162.

When it is desired to connect the terminal member a_1 with the terminal member a_{15} as shown in FIG. 1, the connecting bar 171 is mounted (as shown in FIG. 3) in the connecting bar holder 16, both ends thereof protruding into the first and fifteenth recesses 163 counted from the left side of FIG. 3. More specifically, the connecting bar 171 is received in the longitudinal and transverse grooves 161 and 162, and both ends thereof extend into the first and fifteenth recesses 163, respectively. Likewise, the remaining connecting bars 172 to 175 are received in the longitudinal and transverse grooves and provide communication between the corresponding recesses. In the recesses 163 the contact blades 25 and 25' of the terminal members 2 are received. The extensions of the connecting bars 171 to 175 in the recesses 163 are, as shown in FIGS. 4 and 6, connected with the contact blades 25 and 25' of the terminal members 2. On the other hand, the socket block 1 and the connecting bar holder 16 are secured to each other for preventing disengagement therebetween by a suitable means which is not shown in FIG. 4.

Reference will not be made to FIG. 6, in which connections between terminal members 2a and 2b accommodated in the socket block, terminal members 6a and 6b accommodated in one of the plug blocks and the connecting bar 17 are shown in detail. That is, the terminal member 2a is connected to an electric wire 7a of a wiring harness, such as that for the engine room, while the terminal member 2b is connected to an electric wire 8a of the wiring harness for the instrument board. The terminal member 2b is also connected to an electric wire 9a of the wiring harness for the dash board.

In order to provide interconnections of the wiring harnesses for weak current, on the other hand, the connecting means employed in the present invention may be a printed circuit.

As a modification, moreover, some connecting bar may interconnect the wires of different wiring harnesses, and some connecting bars may interconnect the wires of the same wiring harness. It should, however, be noted that the object of the present invention can not be attained if all of the connecting bars provide interconnections of the wires of the same wiring harness.

A connecting bar can be interconnected to three or more terminal members in the socket block. Moreover, the terminal members in the socket block and the terminal member in the plug block can have a male-female (ie. hermaphroditic) configuration or can have a different but mateable configuration. With respect to the configurations of the socket block and the plug block, when socket block may have female configuration, the plug block may have male configuration, and vice versa.

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It will be understood that the invention is not to be limited by the particular embodiments illustrated and described herein, but only by the scope of the appended claims.

What is claimed is:

1. In an electrical connecting apparatus for wiring harnesses including a socket block having a multiplicity of connecting chambers, a plurality of plug blocks having a multiplicity of connecting chambers, a plurality of first terminal members accommodated in the connecting chambers of the socket block and each having a mating portion, and a plurality of second terminal members accommodated in the plug blocks, said plug blocks being mated with said socket block in a predetermined relationship and said second terminal members in said plug blocks being mated via the mating portions with said first terminal members in said socket block, all of the wires in each wiring harness being connected to the second terminal members of a corresponding plug block, and further at least one of said first terminal members mating with one of said second terminal members in one plug block being electrically interconnected with at least another of said first terminal members mating with one of said second terminal members in another plug block; the improvement comprising:

a contact blade portion provided at approximately the center of each of said first terminal members and extending vertically therefrom, so that said contact blade portion is separated from the mating portion on each first terminal member,

electrically conductive connecting bar means for directly interconnecting the contact blade portions on at least two of said first terminal members, said connecting bar means comprising a plurality of electrically conductive connecting bars for selectively and directly interconnecting the contact blade portions of any pair of said first terminal members, and

a connecting bar holder for holding said connecting bars and secured to said socket block at a place dif-

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ferent from that at which said socket block is mated with said plug blocks,

said socket block comprising a plurality of socket members each accommodating a multiplicity of said first terminal members arranged side by side, said socket members being piled on each other to form a stack.

2. An electrical connecting apparatus according to claim 1, wherein each of said socket members has an intermediate wall and a plurality of vertical walls extending from said intermediate wall in a direction perpendicular to the intermediate wall to define two rows of connecting chambers, wherein the first terminal members are accommodated in said rows of chambers in such a manner that the first terminal members accommodated in one row of said chambers are arranged in a back to back relationship with respect to the first terminal members accommodated in the other row of said chambers, and blade said second mating portions of the first terminal members are arranged opposite to said intermediate wall, wherein the connecting bar holder holding said connecting bars is secured to each said socket member in a manner to substantially cover said chambers.

3. An electrical connecting apparatus according to claim 1 wherein said connecting bar holder has a plurality of longitudinal grooves and a plurality of transverse grooves crossing substantially perpendicularly to the longitudinal grooves and has recesses communicating with said transverse grooves, and said connecting bars are selectively set in said longitudinal grooves, said transverse grooves and said recess, and wherein said contact blade portions are received in said recesses.

4. An electrical connecting apparatus according to claim 3, wherein said socket block comprises a plurality of socket members each accommodating a multiplicity of said first terminal members arranged side by side, said socket members being piled on each other to form a stack.

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