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(54) Connector assembly with coded secondary locking mechanism

(57) A connector assembly comprises a housing (4) and a secondary locking member (6) for coupling to a complementary connector assembly comprising a housing (104) and a secondary locking member (106). The housing (4) comprises a central coding cavity (24) that allows insertion therethrough of prismatic coding bars (32) that extend from the secondary locking member (6). The complementary connector housing (104) similarly comprises a through cavity (124) to allow passage therein of a coding bar (132) of the secondary locking member (106) that is complementary to the coding bar (32). The secondary locking member (6) can be assembled to the connector housing (4) within a shroud (16) in a preassembled position and then shifted in the direction (D) to the fully assembled locked position. Similarly, the secondary locking member (106) of the complementary connector can be inserted in the shroud (116) in a preassembled position and then shifted in the direction of arrow D to the fully locked position. When both secondary locking members (6,106) are fully locked to their respective housings (4,104), the connector assemblies can then be mated whereby the coding bars (32) are inserted into the coding cavity (124) of the mating connector housing (104) thereby interleaving with the complementary coding bar (132). The coding bars (32,132) thus perform the functions of coding and of preventing coupling of connector assemblies if the secondary locking members are not fully locked. Furthermore, integral moulding of the coding bars to the secondary locking mechanism provides a sturdy and reliable coding system with many possibilities.

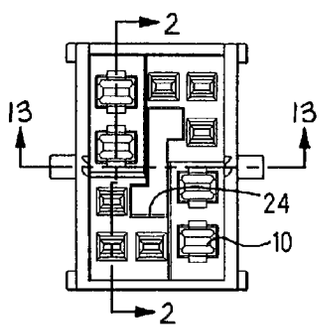

FIG. 1

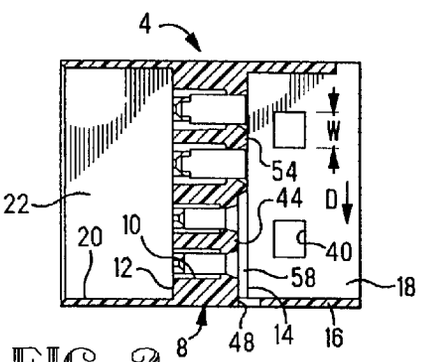

FIG. 2

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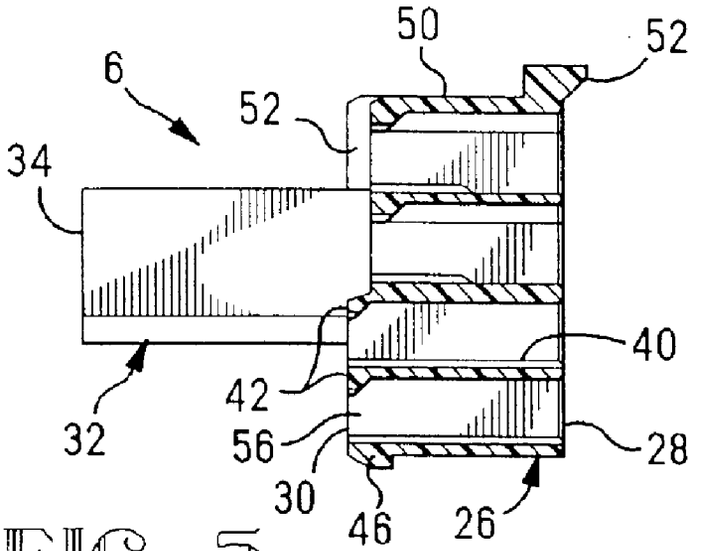

FIG. 5

Description

This invention relates to a connector assembly having a secondary locking mechanism and a coding mechanism for ensuring coupling to the correct complementary assembly, wherein the coding member is incorporated on the secondary locking mechanism.

It is common to find electrical connector assemblies comprising a first insulative housing for receiving electrical terminals therein, and further member comprising a movable secondary locking mechanism that can be activated from a pre-assembly to a fully assembled position to securely lock the terminals within the housing once they have been fully inserted thereinto. It is also known to provide coding means between mating connectors to ensure that the correct connectors are coupled together. It is however a continuous requirement to increase the cost-effectiveness, reliability and robustness of electrical connectors. It is also desirable to provide a large number of coding possibilities for certain applications. Furthermore, many connectors must enable reliable sealing due to the harsh environments in which some are placed, for example in automotive applications.

It is therefore an object of this invention to provide a connector assembly for mating with a complementary connector assembly, having a secondary locking means for securely locking terminals therein, and a coding means for preventing coupling of the connector assembly to the complementary connector assembly, when the secondary locking member is not fully assembled, in a robust, reliable and cost-effective manner.

It is a further object of this invention to provide a compact coding system for a connector assembly that allows a large number of coding combinations, in a reliable and cost-effective manner.

The objects of this invention have been achieved by providing a connector assembly comprising an insulative housing and a secondary locking mechanism mountable thereto in a pre-assembly position for receiving terminals in the housing, and movable to a fully assembled position such that the terminals are securely locked within the housing, the connector assembly further comprising coding means interengageable with coding means of a complementary connector assembly matable therewith, wherein the coding means is an integral extension of the secondary locking mechanism. The extension may have a prismatic, coded shape insertable into a code member receiving cavity of the housing such that the complementary code means of the complementary code assembly is insertable into the remaining space in the code member receiving cavity adjacent the code member. The secondary locking mechanism can be mounted from a terminal receiving face whereby the coding means is substantially centrally positioned such that a sealing surface around the mating face of the connector is unbroken. The latter thus enables easy and effective sealing of this connector whilst nevertheless providing secondary locking.

The preferred embodiment of this invention will now be described in more detail with reference to the Figures, whereby;

Figures 1-3 are top, cross-sectional and bottom views of a tab terminal receiving housing;
Figures 4-6 are top, cross-sectional and bottom views of a secondary locking and coding member for assembly to the housing of figure 1-3;
Figures 7-9 are top, cross-sectional and bottom views respectively of a housing of a complementary receptacle connector assembly for mating with the connector assembly of Figures 1-6;
Figures 10-12 are top, cross-sectional and bottom views respectively of a secondary locking and coding mechanism for assembly to the housing of Figures 7-9;
Figure 13 is a cross-sectional view through lines 13-13 of Figure 1;
Figure 14 is a cross-sectional view through lines 14-14 of Figure 7;
Figure 15 is a top view of a receptacle terminal housing;
Figures 16a-16h are top views of various secondary locking mechanisms having different coding bars, the secondary locking mechanisms for mounting in the housing of Figure 15;
Figure 17 is a top view of a tab terminal receiving housing; and
Figures 18a-18h are various secondary locking mechanisms with coding bars complementary to the coding bars of Figures 16a-16h respectively, the secondary locking mechanisms of Figure 18 mountable to the tab housing of Figure 17.

Referring first to Figures 1-6, a connector assembly for receiving tab terminals therein comprises an insulative housing 4 and a secondary locking member 6. The housing 4 comprises a terminal mounting section 8 having tab terminal receiving cavities 10 extending axially therethrough from a mating face 12 to a terminal receiving face 14. A shroud 16 extends axially away from the terminal receiving face 14 and forms a cavity 18 therein for receiving the secondary locking member. A further shroud 20 extends axially from the mating face 12 and forms a cavity 22 therein for receiving a complementary connector assembly that will be described further on.

The terminal receiving section 8 comprises a centrally positioned coding cavity 24 that extends axially between the terminal receiving and mating faces 14,12 respectively.

The secondary locking mechanism 6 comprises a body section 26 extending axially between a terminal entry in 28 and a terminal locking face 30, and a coding bar 32 that extends axially from the locking face 30 to a mating end 34. The locking bar 32 is prismatic and may be comprised of more than one prismatic bar member, for example two as shown in Figures 18e-18h whereby the two coding bar members are denoted 32' and 32".

The secondary locking member 6 is mountable to the housing 4 by insertion of the coding bar 32 into the housing coding cavity 24 and simultaneous insertion of the body section 26 into the cavity 18. Full insertion is achieved when the secondary locking member locking face 30 abuts the terminal receiving face 14 of the housing 4 and simultaneously locking protrusions 36 on side faces 38 of the body section 26 engage in latching windows 40 cut out of the shroud 16. The windows 40 have a sufficient width W transverse to the axial direction, to allow transverse sliding of the protrusions 36 for the reasons described herebelow.

Interengagement of the protrusions 36 and windows 40 enable retention of the secondary locking member 6 to the housing 4 in a preassembly position such that terminals (not shown) can be inserted through cavities 40 of the secondary locking member body section 6 and then into the housing cavities 10 for locking therein. Once all the terminals have been inserted into the housing cavities 10, the secondary locking member 6 can then be moved in the direction D perpendicular to the axial direction such that locking wall portions 42 that bound the cavities 40 project over edges 44 of the housing cavities 10, thereby projecting behind shoulders of terminals for axial retention thereof within the cavities 10. The secondary locking mechanism has a protrusion 46 that engages in a cutout 48 of the shroud 16 for providing further axial retention of the secondary locking member with respect to the housing, when in the fully assembled position. At an opposing transverse end 50 is a nob 52 for depressing the secondary locking mechanism in the direction D from the preassembled to the fully assembled position.

The secondary locking member and the housing have complementary recesses and protrusions 52,54,56,58 at their abutting faces 14 and 30 that interengage to ensure that the secondary locking member 6 is inserted correctly into the cavity 18. If it is not correctly inserted, for example at 180° rotation about the axial axis, then the raised portions 56 and 54 of the secondary locking member and housings 6,4 respectively will abut and prevent engagement of the latches 36 in the cutouts 40, thus ensuring that preassembly theretogether is not possible.

The coding bar 32 occupies some of the space within the coding cavity 24 of the housing 4, whereby the mating end 34 projects beyond the mating face 12 of the terminal receiving section 8.

Referring now to Figures 7-12, a complementary connector assembly for mating to the connector assembly of Figures 1-6 is shown comprising a housing 104 and a secondary locking mechanism 106. The complementary connector assembly has many similar features and functions as the connector assembly of Figure 1-6 and these features will be denoted with the same number raised to 100. Similar features can be understood by making reference to the description of Figures 1-6. The housing 104 has a terminal receiving section 108 having cavities 110 extending therethrough between a terminal receiving face 114 and a mating face 112, the cavities 110 for receiving receptacle terminals for mating with tab terminals of the connector assembly 4,6. The outer periphery 60 of the terminal receiving section 108 is substantially the same prismatic shape as the cavity 20 of the shroud 22 and is receivable therein mating the connector assemblies 4,104. The housing 104 similarly has a shroud 116 extending axially from the terminal receiving face 114, forming a cavity 118 for receiving the secondary locking member 106 therein. The shroud 116 also has windows 140 for engagement with latch protrusions 136 of the secondary connector member, which is also slidable in the direction of arrow D from a preassembly to a fully assembled position. Similarly, in the preassembly position receptacle terminals can be inserted into their housing cavities 110, and once fully inserted the secondary locking member 106 can be shifted in the direction of arrow D which is transverse of the axial direction to lock the terminals therein with the locking wall edges 142. The secondary locking member 106 also comprises one or more coding bars 132 that extends axially in a prismatic shape from the locking end face 130 to a mating end 134. The mating end 134 of the coding bar 132 is however substantially flush with the mating face 112 of the housing 104 when assembled thereto.

The housing 104 also comprises an axially extending centrally positioned coding cavity 124 that is substantially aligned with the coding cavity 24 of the complementary connector housing 4 when the connector assemblies are coupled together. The coding bar 132 thus occupies some of the space of the coding cavity 124 when assembled thereto in a manner complementary to the coding bar 32 within the coding cavity 24, such that when the complementary assembly 104,106 is inserted into the shroud cavity 22 of the connector assembly 4,6, then the coding bar 32 is inserted into the coding cavity 124 of the complementary connector assembly 124. Full mating of the connector assemblies is complete when the mating faces 12,112 abut. The coding bar 32 of the connector assembly 4,6 thus projects beyond the housing mating face 12 and into the coding cavity 124 of the complementary connector housing 104 alongside and interleaving with the coding bar 132 which is also disposed within the coding cavity 124 of the complementary connector housing. The complementary prismatic profiles of the coding bars 32, 132 are made in such a way that if either of the secondary locking members 106 or 6 have not been moved into their fully assembled positions, the mating ends 134,34 of the coding bars abut each other and prevent coupling of the connector assemblies. The coding bars thus also have the function of preventing coupling of the connector assemblies if the secondary locking members are not properly engaged.

Figures 18a-18h show various coding bar shapes of the male terminal connector assembly 4,6 that are complementary to the coding bar profiles of Figures 16a-16h respectively. The connector housing 4 assembled with the secondary locking member 6 of Figures 18a will thus be matable (when fully assembled) to the complementary connector housing 104 assembled to the secondary

locking member 106 of Figure 16a, however they would not be matable with the complementary housing was assembled to any of the other secondary locking members of Figures 16b-16h. Only the combinations of secondary locking members 6,106 from Figures 18 and 16 having the same letter (e.g. 18c is complementary to 16c) enables those connector assemblies to be mated together.

The housing 4 may comprise axially extending coding recesses 70,72 on the shroud 20, complementary and cooperable with coding protrusions 74,76 extending longitudinally along the outer periphery 60 of the terminal receiving section 108 of the complementary housing 104. Coding combinations are thus created by varying the position and number of the complementary recesses and protrusions (70,72,74,76). The number of the latter coding possibilities thus multiplies with the number of coding combinations of the complementary coding bars 32,132, thus providing a great number of coding combinations. The housings 4,104 with matching coding can also be provided with various matching colours corresponding to the various matching coding combinations for easy distinction.

Due to the wide variety of complementary shapes that the interengaging coding bars 32,132 can take, a wide variation of coding possibilities are available. Furthermore, the coding bar of the male connector assembly 104,106 is well protected as it does not project beyond the mating face 112. The connector assembly for receiving tab terminals 4,6 has a shroud 20 that protects not only the tabs terminals from damage, but also the coding bar 32 that projects beyond the mating face 12. Due to the positioning of the coding bars on the secondary locking members and integral therewith, they cannot be lost. They also provide the double function of ensuring correct coupling of connector assemblies, and preventing coupling if the secondary locking members are not fully assembled to the housings. The secondary locking members can be injection moulded from plastics of different colours for each coding combination, whereby for example the complementary secondary locking members of Figures 18a and 16a would have the same colour, thereby assisting the visual detection of connector assemblies for coupling together. As the coding bars are on the secondary locking housings, they cannot get lost, and furthermore due to their prismatic shape extending from the main body of the secondary locking member they can be easily injected with small modifications to the moulding dies without a redesign of the whole die. The number of coding combinations is greatly increased by providing further coding members on the housings (4,104). The latter can also be colour matched for easy visual detection. The coding bar 32 is positioned within the area surrounded by the shroud 20, and is assembled to the connector housing from a terminal receiving end. The latter allows the shroud 20 to remain unbroken around the periphery such that the inner surface of the shroud can be used as an effective sealing surface for sealing between the coupled connectors. The cutout 48 could be removed, and the latch cutouts 40 replaced with protrusions, and a seal positioned over the terminal receiving face of the secondary locking member 6 for effective sealing of the connector, if this was required.

Advantageously therefore, a large range of coding possibilities are provided in a robust, reliable and compact form. Additionally, the coding members accomplish the function of ensuring full assembly of the secondary locking members and prevent coupling of connector assemblies if this is not the case.

Claims

1. A connector assembly comprising an insulative housing (4,104) and a secondary locking member (6,106) mountable securely thereto in a first preassembly position for insertion of terminals into cavities (10,110) of the housing (4,104), the cavities (10,110) extending axially between a mating face (12,112) and a terminal receiving face (14,114) of a terminal section (8,108) of the housing (4,104), the secondary locking member (6,106) movable to a second fully assembled position for locking the terminals in the housing cavities (10,110), characterized in that the secondary locking member (6,106) comprises a locking bar (32,132) extending axially from a locking end face (30,130) thereof to a mating end (34,134), the coding bar insertable in a coding bar receiving cavity (24,124) of the housing extending axially through the terminal section (8,108), the coding bar interleavable with a complementary coding bar of a complementary connector assembly to allow coupling of specific matching coded connector assemblies only when the secondary locking mechanism (6,106) is fully assembled to the housing (4,104).

2. The connector assembly of claim 1 characterized in that coding bar (32,132) is prismatic.

3. The connector assembly of any preceding claim characterized in that the housing (4,104) comprises a shroud (16,116) extending axially away from the terminal receiving face (14,114) to form a cavity (18,118) for receiving the secondary locking member (6,106) therein when assembled thereto.

4. The connector assembly of any preceding claim characterized in that the locking end face (30,130) of the secondary locking member (6,106) is mountable against the terminal receiving face (14,114) of the housing (4,104), wherein the faces (30,130; 14,114) have complementary interengaging protrusions and recesses (54,58; 52,56) to prevent assembly of the secondary locking member (6,106) to the housing (4,104) unless correctly orientated with respect thereto.

5. The connector assembly of any preceding claim characterized in that the coding cavity (24,124) is centrally positioned within the terminal section (8,108).

6. The connector assembly of any preceding claim characterized in that the mating end (34) of coding bar (32) projects beyond the mating face (12) of the terminal section (8).

7. The connector assembly of claim 6 characterized in that the housing (4) has a shroud (20) extending axially from the mating face (12) and forming a cavity (22) for receiving a terminal section (108) of a complementary connector therein.

8. The connector assembly of any of claims 1-5 characterized in that the mating end (134) of the coding bar (132) does not substantially project beyond the mating face (112) of the terminal section (108).

9. The connector assembly of any preceding claim characterized in that the insulative housing (4) comprises axially extending coding recesses (70,72) complementary and interengageable with axially extending coding protrusions (74,76) of a complementary housing (104) for further coding combinations.

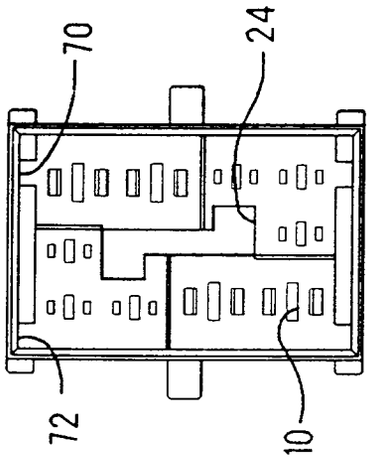

FIG. 3

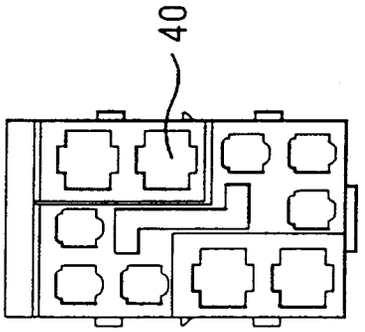

FIG. 6

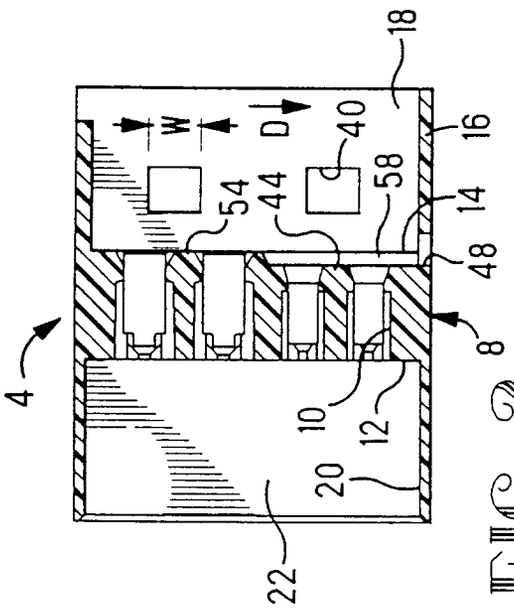

FIG. 2

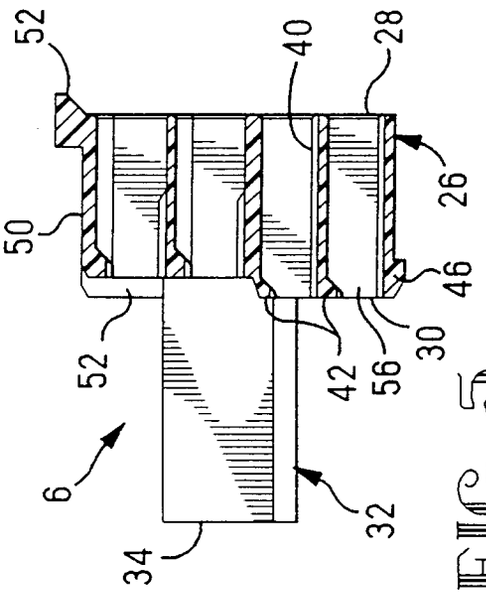

FIG. 5

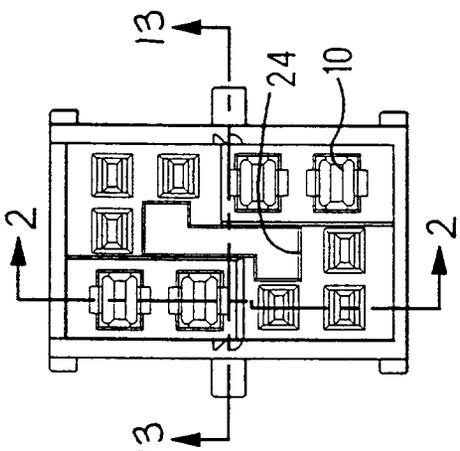

FIG. 1

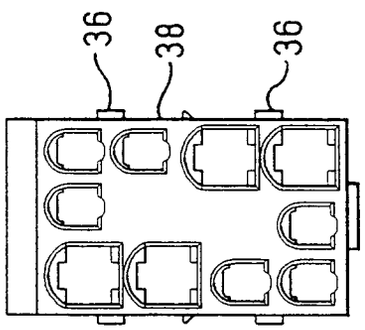

FIG. 4

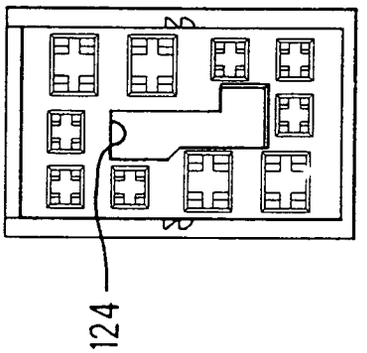

FIG. 9

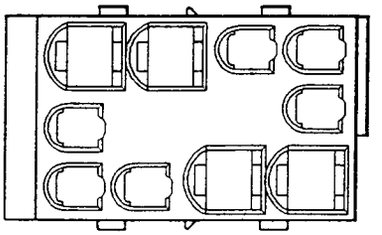

FIG. 12

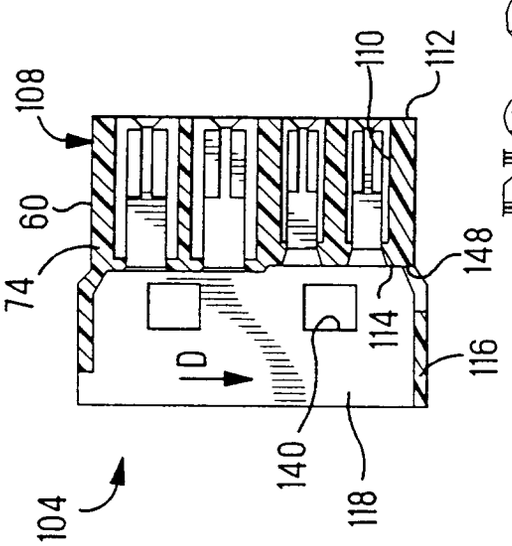

FIG. 8

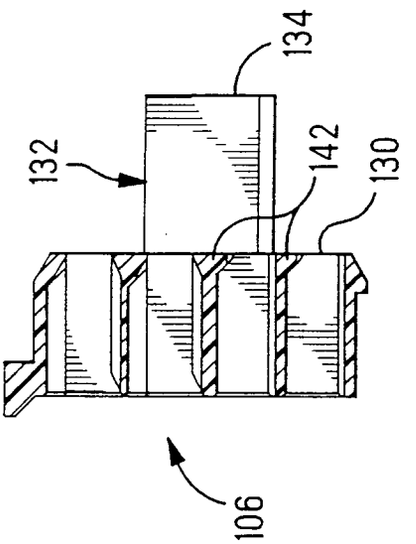

FIG. 11

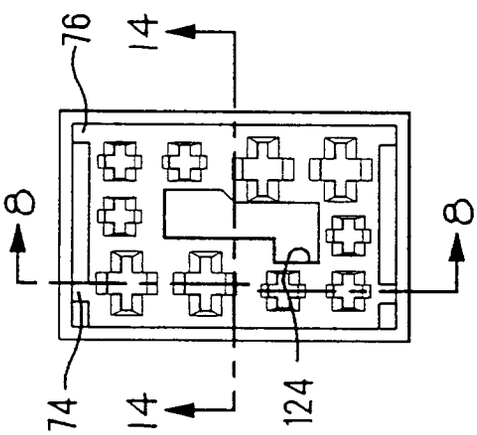

FIG. 7

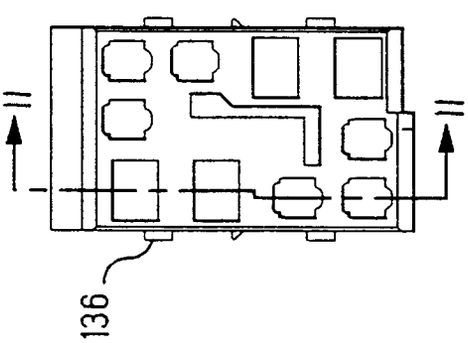

FIG. 10

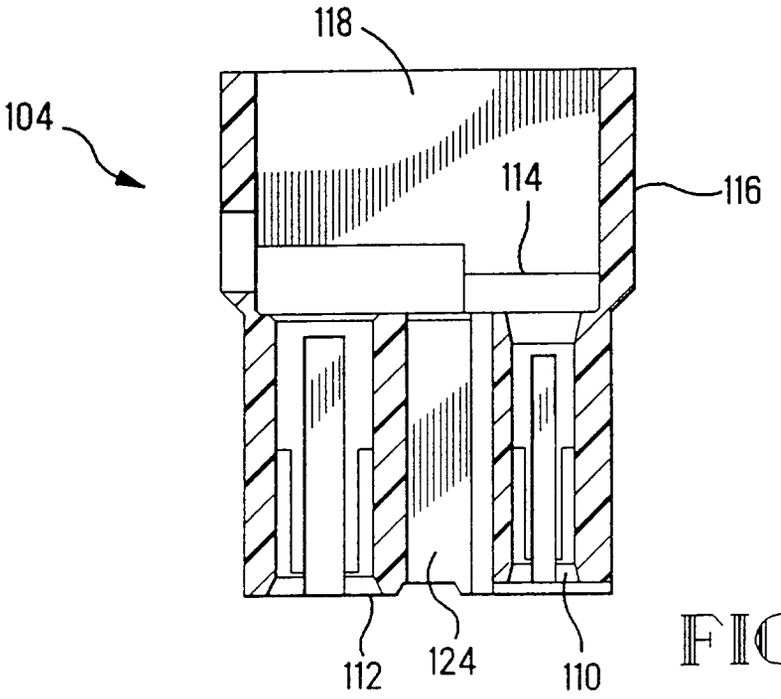

FIG. 13

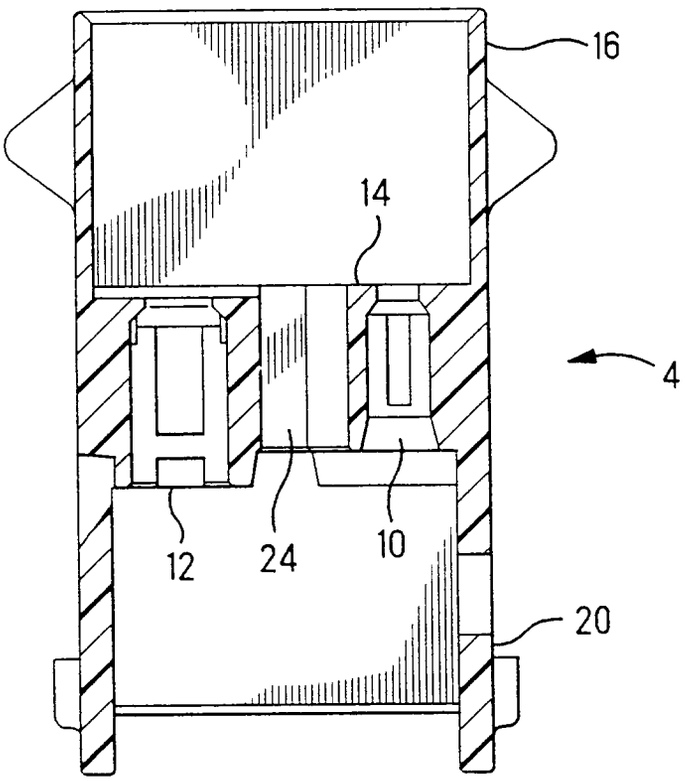

FIG. 14

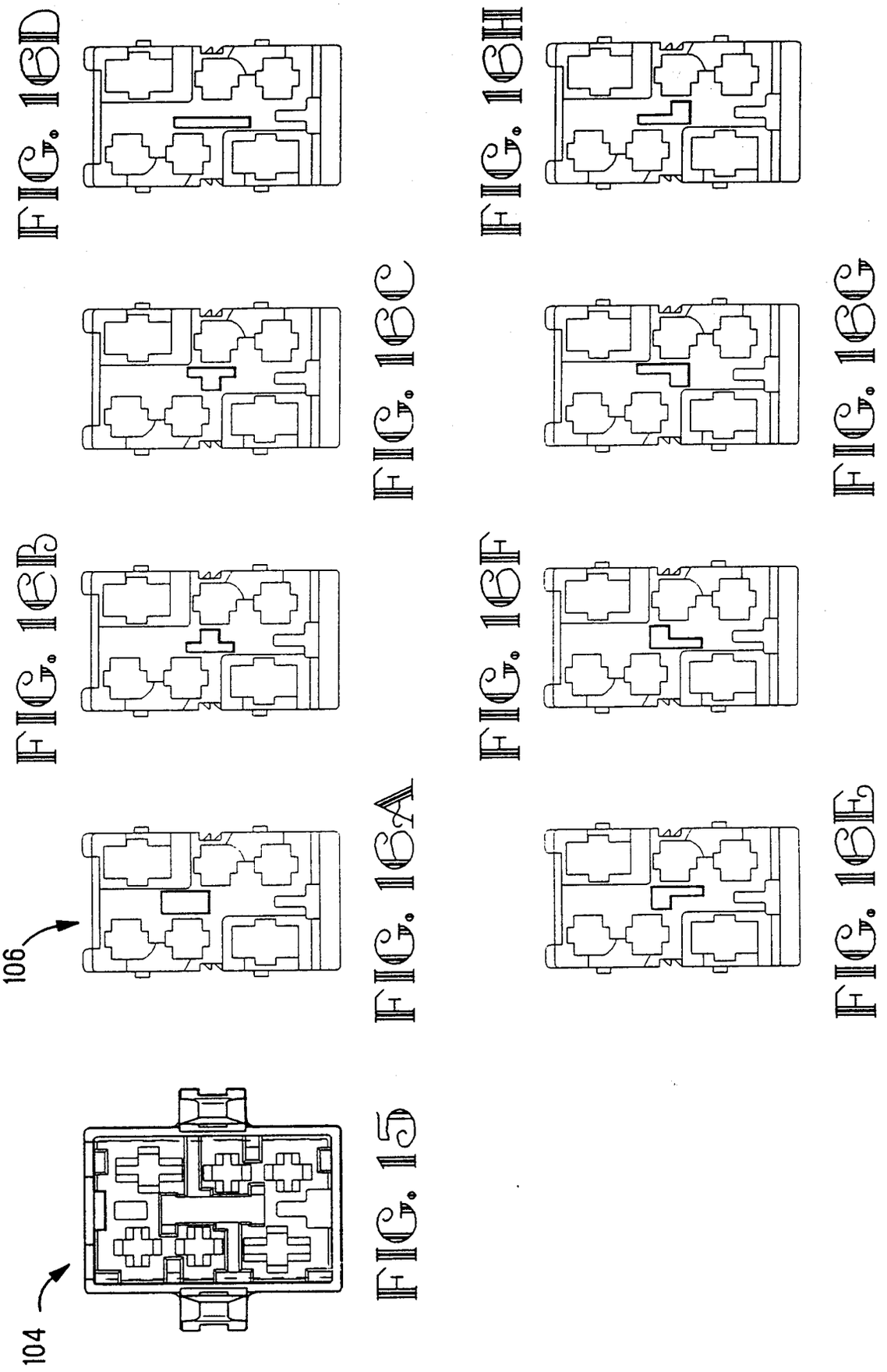

FIG. 15

FIG. 16A

FIG. 16B

FIG. 16C

FIG. 16D

FIG. 16E

FIG. 16F

FIG. 16G

FIG. 16H

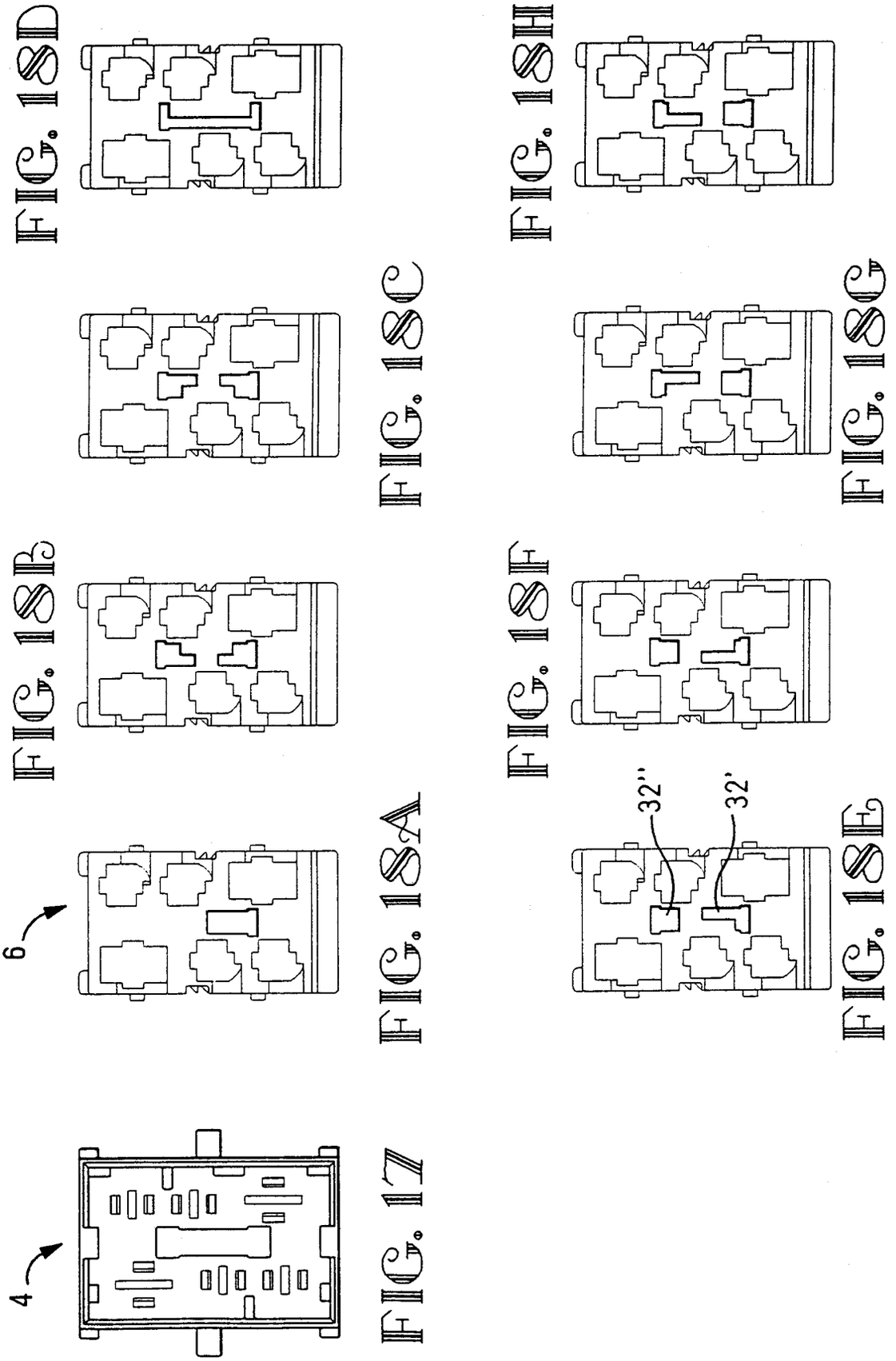
FIG. 17
4
FIG. 18A
6
FIG. 18B
FIG. 18C
FIG. 18D
FIG. 18E
32''
32'
FIG. 18F
FIG. 18G
FIG. 18H

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 3184

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE-A-40 30 621 (AMP) * column 5, line 2 - line 7 * * column 5, line 38 - line 42 * * column 5, line 63 - column 6, line 22; figures 1,4A-4E,6,7 * ---	1,3,4	H01R13/645 H01R13/436
A	FR-A-2 692 407 (SOURIAU) * page 8, line 30 - page 9, line 2; figures 5A,5B * -----	1,2,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	19 December 1995	Alexatos, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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D : document cited in the application
L : document cited for other reasons

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