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(12) # EUROPEAN PATENT APPLICATION

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(54) **Electrical connection device for use with flat cable.**

(57) A device for connecting flat cables (18) at an angle to one another comprises a base member (10) having a cable-receiving surface, provided with broad shallow grooves (16), in which the cables (18) to be joined are laid. The device includes an upper member (12) which, in use, is located over the cable-receiving surface of the base member (10) and which can be secured to the base member (10). The base member (10) has insulation displacing contact means (22) in it for connecting corresponding conductors (34, 36, 38) of the cables (18) to one another.

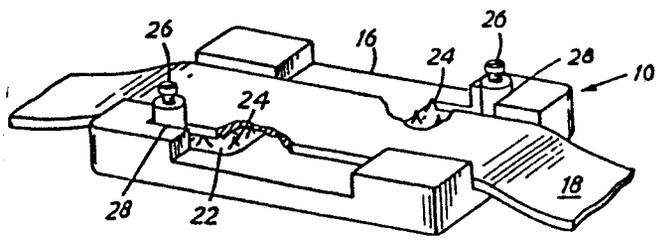

FIG. 2

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ELECTRICAL CONNECTION DEVICE FOR USE WITH FLAT CABLE

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to connection devices for use with flat power distribution cables of the type designed for undercarpet use.

Description of the Prior Art

One such cable is described in British patent application No. 8523359 of September 20, 1985 and has a wide flat earth strip under which are arranged, side-by-side, narrower live and neutral conductors. The live and neutral conductors are provided with an electrically-insulating sleeve and the cable as a whole is also provided with suitable insulation in the form of a flat insulative envelope sealed only along its side edges. The earth strip serves both as the earth conductor and as an electromagnetic screen for the live and neutral conductors. It is only lightly bonded to the live and neutral conductor package so that it can easily be separated from them.

One connection device for use with a cable of this kind is described in British patent application No. 8424281 of September 26, 1984. The device has a base over which the cable can be laid, an upper member which is positioned over the cable and secured to the base and an insulative separating plate for location between the upper and base members, which, in use, is passed between the earth conductor and live and neutral

conductors respectively, of the cable. The base and upper members are provided with insulation displacing contacts (IDC) by means of which connections to the cable conductors are made, the separating plate preventing the IDC means passing right through either the live or neutral conductors into the earth strip. The arrangement described in British patent application No. 8424281 is primarily intended for mounting a socket or junction box of conventional type.

It would be desirable to provide a connection device especially for two cable runs extending perpendicularly to one another. It would also be desirable to provide a connection device which can mount a conventional socket or junction box, or in the absence of such box, a device which has a low profile.

SUMMARY OF THE INVENTION

In accordance with this invention, there is provided a connection device for connecting flat cables at an angle to one another comprising a base member having a cable-receiving surface over which the cables to be joined are to be laid, an upper member for location over the cable-receiving surface of the base member, securing means for securing the upper and base members together and insulation displacement contact (IDC) means in the base member for connecting corresponding conductors of the cables to one another.

Also in accordance with this invention, there is provided a connection device for flat cables comprising a base member having a cable-receiving surface over which a cable is to be laid, an upper member for location over the cable-receiving surface of the base member and securing means for securing the upper and

base members together, one of the upper and base members being provided with IDC means including a projecting tine for contacting a conductor of the cable and the other having a recess for receiving the tine; the recess co-operating with the tine, in use, to cause the cable conductor to deform around the tine.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a first connection device for flat cables in accordance with the invention.

Figure 2 shows the base member of the device of Figure 1.

Figure 3 is a plan view of the base member of the device of Figure 1 with the cables laid over it.

Figure 4 is a schematic sectional view of the device of Figure 1.

Figure 5 is an exploded view of a second connection device in accordance with the invention.

Figure 6 is a plan view analogous to Figure 3 of the device of Figure 5.

Figure 7 is a schematic sectional view of the connection device of Figure 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The connection device of Figures 1 to 4 is intended to serve a dual purpose; it connects two cable runs extending perpendicularly to one another and mounts a conventional socket or junction box.

The connection device comprises a base member 10, an upper member 12 and a separating plate 14. The base member 10 is generally rectangular and is provided with two broad shallow grooves 16 extending perpendicularly to one another across its upper surface for receiving two perpendicular lengths of flat cable 18 (only one of which is shown in Figure 2). The periphery of the base member 10 may be slotted to receive the ends of stainless steel strips which are often placed over flat cables of the kind described to protect them from mechanical damage.

Mounted in shallow recesses 20 formed in the base member 10 are insulation-displacing contact ("IDC") means 22. Each IDC means 22 is generally triangular in shape, having the form of a right-angled isosceles triangle, and is provided at two of its vertices with rings of upwardly extending pointed teeth or tines 24. At its third vertex the IDC means 22 has a screw terminal post 26 of a conventional kind. The IDC means 22 are positioned diagonally opposite each other on the base member 10 so that when the cables 18 are laid over them one ring of teeth 24 of each IDC member lies beneath the central region in which the cable runs intersect each other and the other ring of teeth 24 lies within one of the cable-receiving grooves 16 but outside the central intersection area. The positions of the IDC means 22 are shown most clearly in Figure 3 of the drawings. Each terminal post 26 locates in a notch 28 formed at one of the intersections of the cable-receiving grooves 16.

The upper member 12 of the connection device is in the nature of a box-like cover which can be secured over the base member 10 and cables 18 by means of, for example, clamping screws (not shown). The upper member

12 may incorporate or may include means for mounting a junction box or power outlet socket 30 and may be provided with apertures 32 to house telephone or data outlet sockets which are themselves connected to undercarpet networks.

In use, as shown in Figure 4, the live and neutral conductors 34 and 36 of one cable 18 are moved away from the earth or ground conductor 38 so that the other cable 18 may be inserted between them. Before doing so, however, an insulative separating plate 14 is inserted between the live and neutral conductors 34 and 36 and earth conductor 38, respectively, of the second cable 18 in the region which, in the assembled junction, will lie in the central intersection region of the base member 10. The second cable 18 is then inserted through the first until the separating plate 14 lies in the intersection of the two cables 18. Both cables 18 are positioned so that the live and neutral conductors 34 and 36 lie beneath the separating plate 14 to ensure that the polarities are correct, with the earth conductors 38 adjacent one another above the separating plate 14.

The cable junction is then positioned on the base member 10 so that the cables lie in the cable-receiving grooves 16. The upper member 12 is located over the base member 10 and cable junction and then clamped down onto the base member 10. As the upper and base members 10 and 12 are forced together the teeth 24 of the IDC means 22 pierce the insulation surrounding the live and neutral conductors 34 and 36 of the two cables 18 to contact the conductors and connect each to the corresponding conductor of the other cable 18. The IDC means 22 are prevented from passing through the live and neutral conductors 34 and

36 and contacting the earth conductors 38 by the intervention of the insulative separating plate 14 which is of dimensions such that it overlies both rings of teeth 24 of each IDC means 22 but can be located in the cable-receiving grooves 16.

The underside of the upper member 12 may be provided with suitable IDC means (now shown) by means of which the earth conductors 38 of the two cables 18 are connected together. Again, the presence of the separating plate 14 will prevent the IDC means passing through the earth conductors to contact the live or neutral conductors.

It will be appreciated that a connecting device of the kind shown in Figures 1 to 4 can be used to connect two perpendicularly-extending runs of flat undercarpet cable at right-angle bends and T-junctions as well as at cross-overs, simply by cutting the cable off short at the connection device as desired. It may also be used to connect two parallel lengths of cable whose ends are butted together provided the join line passes between the two IDC portions of each IDC means.

Where two runs of cable are to be connected, but it is not required to mount an outlet at the junction, the connection device shown in Figures 5 to 7 can be used.

The device, again, comprises a base member 110 provided with perpendicular cable-receiving grooves 116 and IDC means 122 over which the cables 180 are laid. The IDC means 122 are each formed of sheet metal cut and shaped to form two rings of four upwardly-projecting tines 124. Each of the IDC means 122 is located in an recess 120 formed in the base

member 110 and they are similarly positioned to the IDC means in the device of Figures 1 to 4. No terminal posts are, however, provided as no connections to sockets or junction boxes are to be made.

The base member 110 is generally square and midway along each of its edges it is provided with a raised rectangular platform 140 having formed in it four shallow curved-cross-section depressions or recesses 142. The function of the recesses 142 will be made apparent below. The corners of the base member 110 may also be provided with slots 144 for receiving the ends of the stainless-steel strips 146 which are commonly used to protect undercarpet cables from mechanical damage.

The upper member 112 is in the form of a shallow cover plate which locates over the base member 110 and the cable-junction and which may be secured to the base member by means of, for example, clamping screws (not shown). On the underside of the upper member 112 is formed a cross-shaped boss 150 which is of dimensions such that it will locate in the cable-receiving grooves 116 when the upper and base members 110 and 112 are secured together. The end surface of the boss 150 is provided with depressions or recesses 152 similar to the recesses 142 formed on the base member 110. When the base and upper members are secured together the tines 124 of the IDC means 122 of the base member 110 are received in the recesses 152 in the upper member 112.

Between the base and upper members 110 and 112 is positioned an earth or ground ring 160 in the form of a conductive plate which is shaped to fit the end surface of the boss 150 on the underside of the upper

member 112. The plate is cut away to form a central opening 166 to expose the recesses 152 and is provided with four sets of downwardly-projecting tines 164 which, when the connection device is assembled, are received in the recesses 142 of the base member 110. For convenience, the earth ring 160 is fixed to the underside of the boss 150.

In use, each cable 180 in turn is laid over the base member 110 as shown in Figure 6 and stripped of its earth conductor 138 in the region in which the cables 180 intersect. The upper member 112, bearing the earth ring 160 is then secured to the base member 110, clamping the cables 180 between the two. As the base and upper members 110 and 112 are brought together, the tines 124 of the IDC means 122 on the base member 110 pierce the cable insulation to contact the live and neutral conductors 134 and 136 of the two cables 180 and connect them together. The tines 124 and recesses 152 on the underside of the upper member 112 cooperate to cause the copper sheet of which the live and neutral conductors 134 and 136 are formed to deform around the tines 124 rather than being ruptured by them. The deformation of the conductors 134 and 136 around the tines 124 leads to better electrical contact with the IDC means 122. Because the earth conductor 138 has been cut away to expose the recesses 152, there is no possibility of inadvertently connecting the live or neutral conductor 134 or 136 to the earth conductor 138 by means of the IDC tines 124.

At the same time, the tines 164 of the earth ring 160 pierce the cable insulation to contact the earth conductors 138 of the two cables 180 to connect them together. The tines 164 and recesses 142 formed in the base member 110 cooperate in a similar manner to

that described above to ensure that the earth conductors 138 are deformed around the tines 164, rather than pierced by them, to ensure good electrical contact. Because the tines 164 and recesses 142 are positioned centrally of the cables 180 they engage the portion of each earth conductor 138 which overlies the insulated gap between the live and neutral conductors 134 and 136. The tines 142 are also positioned outside the area over which the cables 180 intersect. There is, therefore, no risk of inadvertently connecting live, neutral and earth conductors by means of the earth ring tines 164.

The connection device may again be used to form cross-overs, T-junctions and right-angle bends. It may also be used to connect together two separate lengths of cable whose ends are butted together. In this latter case, however, care must again be taken to ensure that the join line between the ends of the two cables passes between the two rings of tines 142 on each of the two IDC means 122.

It will be appreciated that the connection device shown in Figures 5 to 7 is easy to use, correct connection being effected once the earth conductors have been removed simply by clamping the cables between the base and upper members of the device. The use of the IDC means is in part responsible for the simplicity of the device and, furthermore, enables it to be made extremely slim in profile; the assembled junction may be as little as 5 mm in thickness. The cooperation of the IDC tines with the recesses also ensures that a good electrical contact is made.

CLAIMS:

1. A connection device for connecting flat cables to one another comprising a base member having a cable-receiving surface over which the cables to be joined are to be laid, an upper member for location over the cable-receiving surface of the base member, securing means for securing the upper and base members together and insulation displacement contact (IDC) means in one of the upper and base members for connecting corresponding conductors of the cables to one another.

2. A device according to claim 1, wherein said IDC means includes a projecting tine for contacting a conductor of the cable and the other of said one of the upper and base members having a recess for receiving the tine; the recess co-operating with the tine, in use, to cause the cable conductor to deform around the tine.

3. A device according to claim 2 for connecting flat cables to one another in which the IDC means are disposed in the base member and arranged to connect corresponding conductors of the cables to one another.

4. A device according to claim 2 in which each IDC means is provided with two IDC portions electrically connected together; one IDC portion lying within an area of the cable-receiving surface over which both cables to be connected pass for contacting a conductor of the cable closest to the base member and

the other IDC portion lying within the cable-receiving surface but outside the said area for contacting a conductor of the other said cable.

5. A device according to claim 4 having two IDC means located adjacent diagonally opposite corners of the said area.

6. A device according to any preceding claim in which the IDC means are provided with at least one screw terminal for connection to a conductor wire.

7. A device according to any preceding claim in which each IDC means is provided with a number of projecting tines for piercing the cable insulation to contact the cable connector.

8. A device according to claim 7 including an insulative separation plate for location between the base and upper members and which in use is passed transversely through a cable to separate conductors thereof.

9. A device according to claim 7 having a plurality of recesses formed in the surface of the upper member facing the base member, for receiving the tines, the recesses cooperating, in use, with the tines to cause the cable conductors to deform about the tines.

10. A device according to any preceding claim comprising further IDC means for contacting conductors on the other side of the cables.

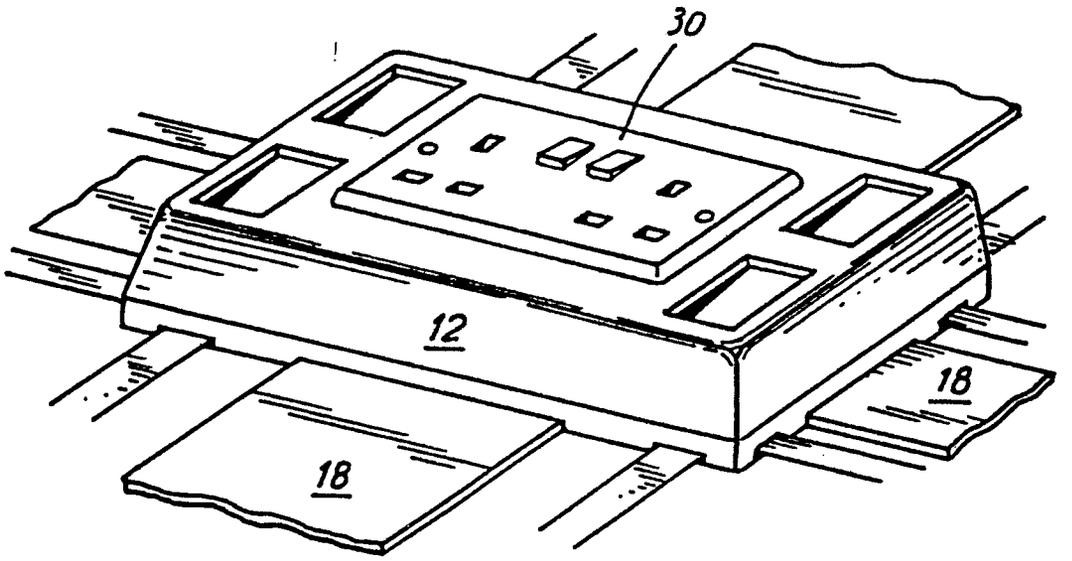


FIG. 1

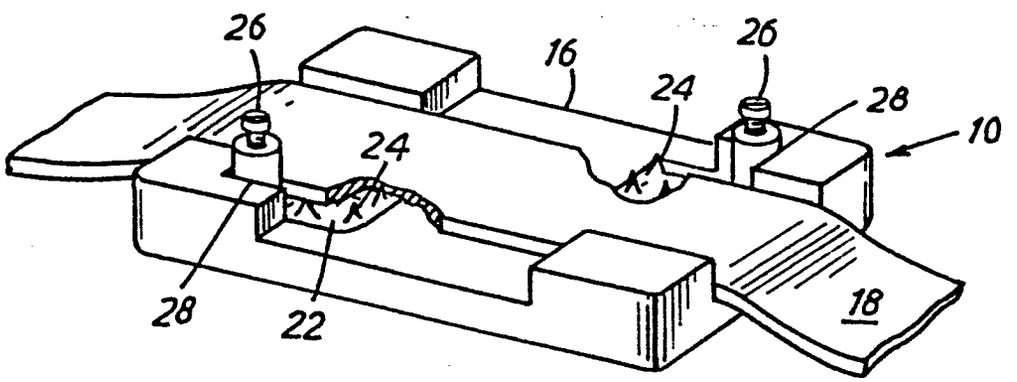


FIG. 2

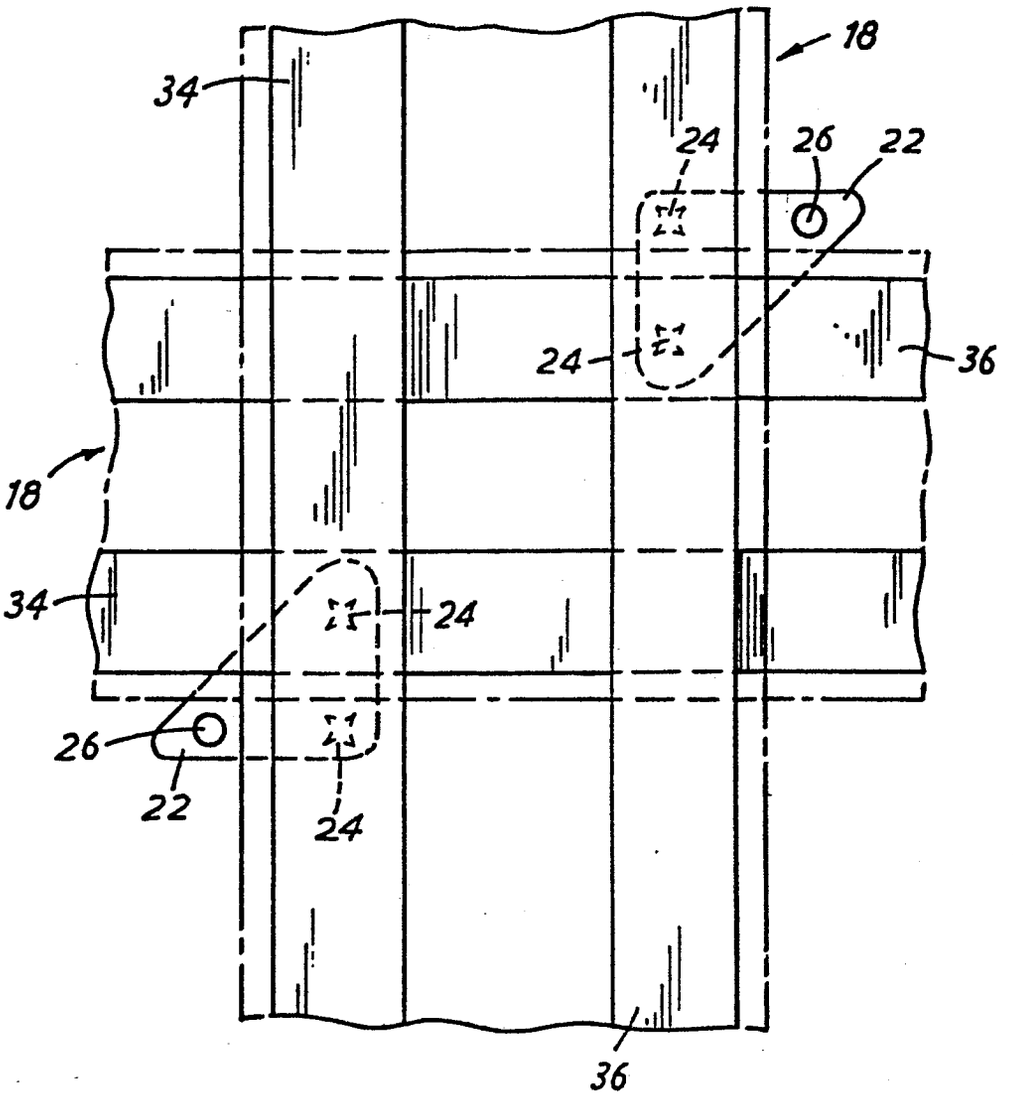


FIG. 3

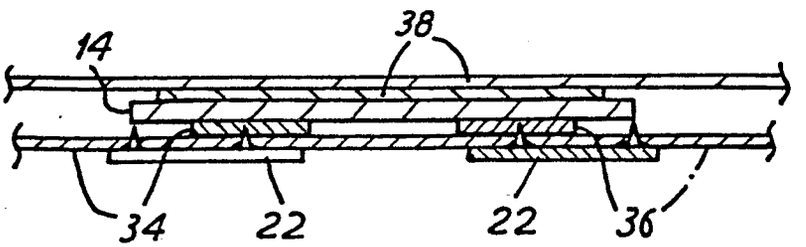
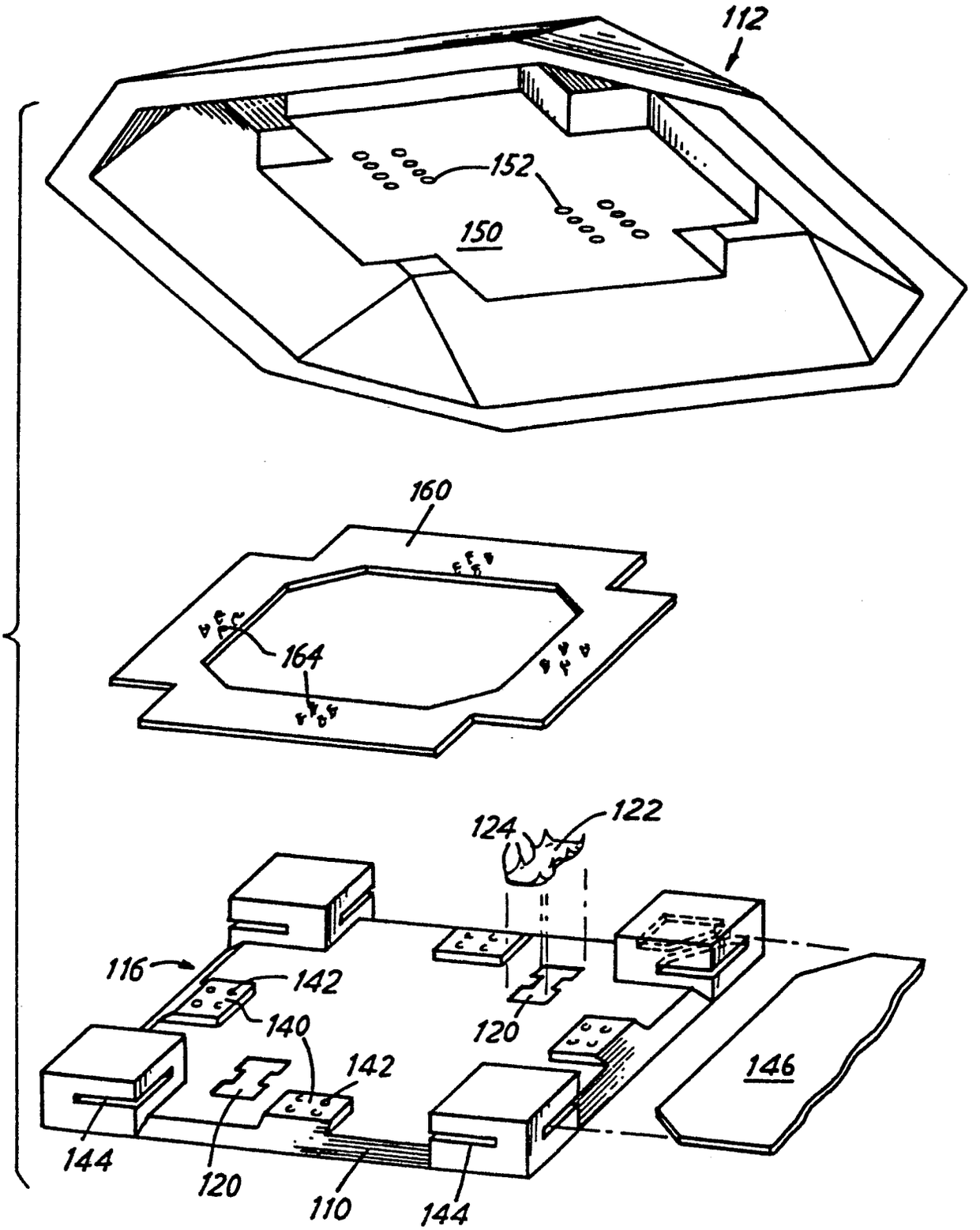


FIG. 4


112
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164
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122
116
142
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120
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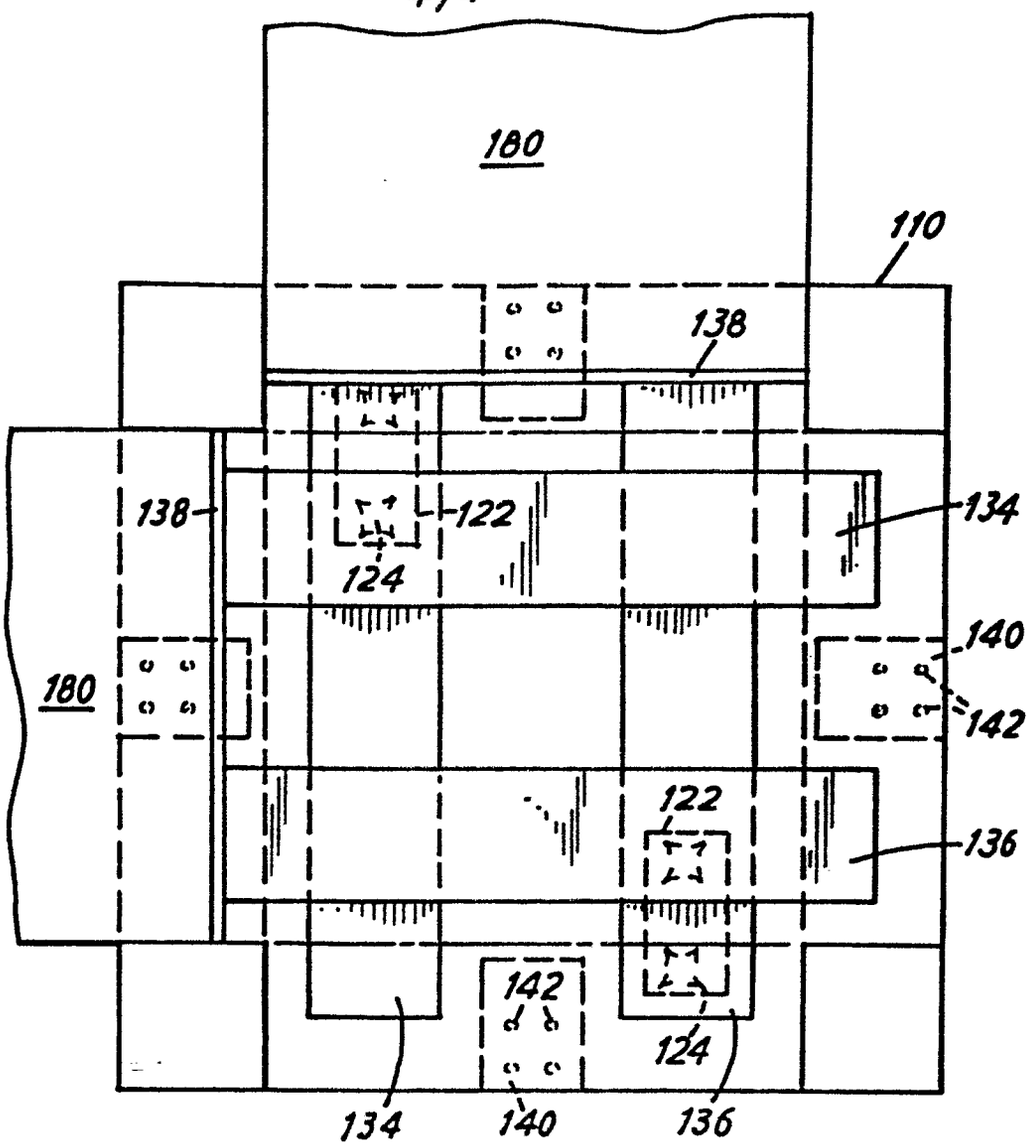
146
144
120
110
144

FIG.5


180
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140
136

FIG.6

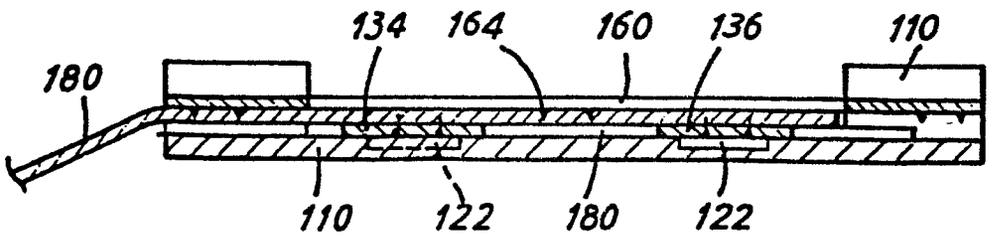
134
164
160
136
110
180
110
122
180
122

FIG.7

European Patent Office

EUROPEAN SEARCH REPORT

0233536
Application number

EP 87 10 1425

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.4)
D,P X	GB-A-2 165 101 (ALLIED CORP.) * page 1, lines 26-43; page 3, lines 78-88; figures 1,4 *	1,6-8	H 01 R 9/07
X	US-A-4 543 716 (R.R. DAMIANO et al.) * column 3, lines 42-55; column 4, lines 1-10; figures 1-16 *	1,7	
A		3,9	
X	US-A-4 429 940 (L.A. FRESHWATER) * column 1, lines 52-57; figure 4 *	1-3,7, 9	
A	FR-A-1 356 387 (J. PEYRONNET) * page 3, line 81 - page 4, line 6; figures 7-8 *	4,5	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 01 R 9/00 H 01 R 23/00 H 01 R 4/00
A	GB-A-2 161 998 (HARVEY HUBBELL INC.) * figure 8 *	6,10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	16-05-1987	LEOUFFRE M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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