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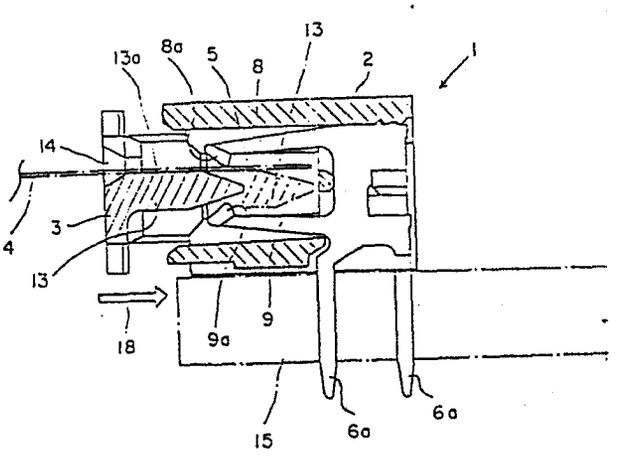
(54) An electrical connector for flexible flat cable.

(57) A connector housing (2) having a plurality of forked terminals (6), each terminal including a pair of spaced-apart terminal extensions (8, 9) and a cable holder (3). The cable holder (3) has a male projection (13) with a cable supporting surface (13*a*) and two lock elongations (A1, B') (see Fig. 2) integrally connected to both sides of the male projection (13). The cable holder (3) can be nested within the housing (2) so that the cable supporting surface (13*a*) faces either one terminal extension (8, 9) or the other. In either disposition, the cable supporting surface (13*a*) resiliently pinches the flat cable (4) between itself and the contact point of whichever of the terminal extensions (8, 9) it faces.

FIG.5



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AN ELECTRICAL CONNECTOR FOR FLEXIBLE FLAT CABLE

The present invention relates to an electrical connector for a flexible flat cable.

As is well known, flexible flat cables have been widely used, and there have been a variety of connectors appropriate for the purpose of connecting such flexible flat cables to other circuit elements. One example of a flat flexible cable (FFC) connector is a push-in type which comprises a connector housing having a terminal space therein a plurality of terminals mounted in the connector housing at regular intervals corresponding to those at which the strip conductors are arranged in the flexible flat cable, and a cable holder.

The cable holder has a male projection and two lock elongations integrally connected to the projection on either side and is designed to be inserted in the terminal space with its lock elongations sliding along the inner walls of the connector housing. The cable holder also has a cable slot through which the flat cable is inserted prior to the holder being nested in the connector housing and a cable supporting or bearing surface at the end of the projection.

The cable holder, with the cable end laid on the cable bearing surface, is pushed in the connector

housing until the opposite lock elongations of the cable holder have been caught in the connector housing. Then, the strip conductors of the flat cable are put in electrical contact with corresponding terminals of an associated printed board.

In prior art connectors, each terminal has a single terminal extension stretching out along the ceiling or floor of the housing space. Electrical contact is made by inserting the cable holder with its cable bearing surface facing the ceiling or floor of the terminal housing on which side the terminal extension stretches out. Otherwise, no electrical contact could be made between the cable end and the terminal extension.

The prior art connector which requires a proper orientation of male to female part in use causes certain problems.

SUMMARY OF THE INVENTION

The object of the present invention is to provide an improved electrical connector for flexible flat cable permitting the common use of a single type connector to make electrical connections with flat flexible cable in different ways. Accordingly, the inventory control of parts is made simple and easy and the degree of freedom in designing is increased.

These and other objects of the present invention are met by providing an electrical connector for a flexible flat cable having spaced-apart parallel conductive strips mounted thereon, arranged at a regular distance apart, said connector including a connector housing having a terminal space, a plurality of terminals mounted in the connector housing at regular intervals corresponding to those at which the strip conductors of the flat cable are arranged, and a cable holder having a male projection with a forward cable supporting surface and two lock elongations integrally connected to both sides of the projection. The male projection of said cable holder is adapted to be inserted in the terminal space with the lock elongations sliding along the walls of the connector housing. The cable holder has a cable slot, permitting the insertion of the cable in the terminal space when the cable holder is brought to the upper insertion limit, the strip conductors of the cable lying on the cable supporting surface and adapted to be brought and kept in electrical contact with the corresponding terminals when the cable holder is brought to the lower insertion limit and is locked. The improvement in the connector comprises each terminal having a pair of spaced-apart extensions and defining a bilateral fork, said pair of terminal extensions having contact points at their free ends in opposing

relationship, whereby the cable holder can be inserted in the connector housing so that the cable supporting surface is brought into contact with either contact point of the terminal extensions, assuring that the cable is resiliently pinched and held between the cable supporting surface and the opposing contact point regardless of which of the terminal extensions the male projection of the cable holder faces.

Some ways of carrying out the present invention will hereinafter be described in detail by way of example with reference to Figs. 1 to 9 of the accompanying drawings which show specific embodiments, Figs. 10 to 13 showing the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end view of an electrical connector according to one embodiment of the present invention;

FIG. 2 is a plan view of the electrical connector with its cable holder in the raised position;

FIG. 3 is a plan view similar to Fig. 2, showing the electrical connector with its cable holder in the lowered position;

FIG. 4 is a side sectional view of the electrical connector taken generally along the line X-X in Fig. 1;

FIG. 5 is a sectional side view of the electrical connector similar to Fig. 4 showing the cable supporting

surface of the male projection of the cable holder facing the terminal in its elongation opposite to the one it faces in Fig. 4;

FIG. 6 is a partial plan view of the end of a flexible flat cable;

FIG. 7 shows the arrangement of terminal holes made in a printed circuit board;

FIGS. 8 and 9 show different modes in which flexible flat cables connect two printed circuit boards which are arranged perpendicular to each other, using an electrical connector according to the present invention; and

FIGS. 10 to 13 are views similar to Fig. 9 showing different prior art connecting modes of flexible flat cables, using a conventional electrical connector.

With reference first to Figs. 10 to 13, these show four different ways of using a flexible flat cable connector which requires a proper orientation of male to female part. In these Figs. a printed circuit board to which a conventional connector 51 is applied is indicated at 50; a flexible flat cable is indicated at 52; the strip conductors of the cable are indicated at 53; another printed circuit board to which the other end of the flexible flat cable is connected is indicated at 55; a printed circuit pattern appearing on the printed circuit board 55 is indicated at 56; and terminals

are indicated at 57.

In the example shown in Fig. 10, the flexible flat cable 52 is inserted in the lower part 51a of the connector housing 51, and the other end of the flat cable is applied to the circuit board. In the example shown in Fig. 11, the flexible flat cable 52 is inserted in the upper part 51b of the connector housing 51, and the other end of the flat cable 52 is applied to the circuit pattern 56, which is on the left side of the printed circuit board as seen in the drawing. In the example shown in Fig. 12, the flexible flat cable 52 is inserted in the upper part 51b of the connector housing 51, and the other end 54 of the flat cable 52 is applied to the circuit pattern 56, which is on the right side of the printed circuit board as seen in the drawing. In the example shown in Fig. 13, the flexible flat cable 52 is inserted in the lower part 51a of the connector housing 51, and the other end 54 of the flat cable 52 is applied to the circuit pattern 56, which is on the right side of the printed board as seen in the drawing.

In Figs. 11 and 13, the other ends of the flexible flat cables are bent and applied to the printed circuit boards 55 and 56. The mounting space as required in such examples is large. For these reasons, the connecting modes just described are impractical, and not used.

As for the examples shown in Figs. 10 and 12, two different kinds of connectors are selectively used. One is designed to permit the insertion of a flexible flat cable in the upper part of the connector, and the other is designed to permit the insertion of a flexible flat cable in the lower part of the connector.

DETAILED DESCRIPTION OF THE SPECIFIC EMBODIMENTS

Figs. 1 to 9 show an electrical connector, generally designated 1, of the present invention. The electrical connector 1 generally comprises a connector housing 2 and a cable holder 3. The connector 1 is designed to be used in connecting a flexible flat cable 4 as shown in Fig. 6. The cable 4 has a plurality of parallel conductive strips 7 that are spaced-apart a distance equal to P.

The housing 2 has a terminal space 5 formed therein and a plurality of terminals 6 are mounted within the space 5 of housing 2. The terminals 6 are arranged at regular intervals P' equal to P.

As shown in Figs. 4 and 5, each terminal 6 has a pair of symmetrical spaced-apart extensions 8 and 9 defining a cable engaging fork. Each extension 8 and 9 has a contact point at its free end as indicated at 8a and 9a. The contact points 8a and 9a face each other symmetrically. Each side wall A or B of the

housing 2 has two lock recesses 10 and 11.

The cable holder 3, which is adapted to hold cable 4 and to be inserted within housing space 5, has two lock elongations A' and B' integrally connected to both sides of a male projection 13. Lock elongations A' and B' slide on the opposite side walls of the terminal space 5 when the cable holder 3 is nested within the housing 2. Each lock elongation A' and B' has a male projection 12 at its free end. In nesting the cable holder 3 within the housing 2 the male projections 12 of the lock elongations A' and B' will be caught by the lock recesses of the opposite sidewalls of the housing 2 so that the cable holder 3 may be locked sequentially at upper and lower positions as shown in Figs. 2 and 3, respectively.

The male projection 13 of the cable holder 3 has a cable supporting or bearing surface 13a which functions to pinch a stripped end of the flat cable 4 between itself and the counter contact point of the terminal elongation 8 or 9. The stripped end of the flat cable 4 may be inserted in a cable slot 14 formed in the cable holder 3. This configuration permits the conductors 7 of the flat cable 4 to be pinched between the bearing surface 13a of the male projection and the upper or lower terminal extension depending upon the user's choice. No matter which terminal

elongation 8 or 9 may be selected as a counter part to the bearing surface 13a of the male projection 13 of the cable holder 3, the stripped end of a flexible flat cable 4 will be resiliently pinched therebetween.

As best shown in Fig. 4, each terminal 6 has a leg 6a projecting downward from the housing 2. The housing 2 shown is intended to be mounted on a printed circuit board 15 with terminal legs 6a inserted into holes 16 formed therein. In this particular embodiment, the terminals 6 are arranged at very close centerline space so that their legs 6a and corresponding holes 16 must be staggered as shown in Fig. 7.

The manner of using such electrical connector is described below. Owing to the connector structure as described above, the connector 1 can be used to meet every possible connecting mode. For instance, looking at Fig. 8, a connector 1 is fixed to the upper surface of a printed circuit board 15a with the cable connector to another printed circuit board 15b. Printed circuit board 15b is arranged perpendicular to printed circuit board 15a and has a printed circuit pattern 17 on the right side as seen in Fig. 8. In this case, the cable holder 3 is inserted in the housing 2 with the cable bearing surface 13a of the male projection upward to permit the insertion of the cable end in the upper part of the connector.

The positioning and holding of cable 4 is best shown in Fig. 5. First, one end 4a of a flexible flat cable 4 is inserted in the terminal space 5 through the cable slot 14, which is contiguous to the bearing surface 13a of the male projection of the cable holder 3. Then, the cable holder 3 is moved in the direction as indicated at 18 until it has been locked. The end 4a of the flexible flat cable 4 is resiliently pinched between the contact point 8a of the terminal elongation 8 and the bearing surface 13a of the male projection 13 of the cable holder 3. In this mode of connection, the other end 4b of the flexible flat cable 4 is attached to the right side of another printed board 15b (Fig. 8). In this case, the strip conductors 7 appear on the upper surface of the flexible flat cable 4, and the flat conductors 7 are brought into electrical contact with the contact point 8a of the terminal elongation 8 which stretches out along the ceiling of the terminal space 5.

In case a circuit pattern 17 appears on the left side of another printed board 15b as shown in Fig. 9, the strip conductors 7 are on the back side of a flexible flat cable 4. In this instance, the cable holder 3 is turned upside down so that the bearing surface 13a of the male projection 13 faces the terminal elongation 9 stretching out along the floor of the

terminal space 5 of the housing 3. Thus, one end 4a of the flexible flat cable 4 may be pinched resiliently between the bearing surface 13a of the male projection 13 and the terminal elongation 9 to permit the strip conductors 7 to be in electrical contact with the terminal elongation 9 in housing 2.

The electrical connector 1 of the present embodiment is described as being applied to a printed circuit board which has a circuit pattern on its one surface. However, it will be appreciated that the connector 1 is applied to a printed circuit board having a circuit pattern on its opposite sides.

The following advantages result from the connector 1 described:

the connector 1 can be equally applied to different connection modes using a flexible flat cable 4 having conductors on the upper surface of the cable or on the lower surface of the cable;

only one kind of connector is sufficient to meet requirements for different connection modes and hence, the kinds of connectors as required is reduced to one, and accordingly inventory control of parts is made simple; and

the degree of freedom with which a circuit arrangement is designed is increased.

CLAIMS:

1. An electrical connector for a flexible flat cable (4) having spaced-apart parallel conductive strips (7) mounted thereon, arranged at a regular distance (P) apart, said connector including a connector housing (2) having a terminal space (5), a plurality of terminals (6) mounted in the connector housing at regular intervals (P') corresponding to those (P) at which the strip conductors (7) of the flat cable (4) are arranged, and a cable holder (3) having a male projection (13) with a forward cable supporting surface (13a) and two lock elongations (A' and B') integrally connected to both sides of the projection, the male projection of said cable holder (3) being adapted to be inserted in the terminal space (5) with the lock elongations sliding along the walls (A and B) of the connector housing, said cable holder having a cable slot (14), permitting the insertion of the cable in the terminals space (5) when the cable holder is brought to the upper insertion limit, the strip conductors (7) of the cable lying on the cable supporting surface (13a) and adapted to be brought and kept in electrical contact with the corresponding terminals (6) when the cable holder is brought to the lower insertion limit and is locked, characterized in that

each terminal (6) includes a pair of spaced-apart extensions (8 and 9) defining a bilateral fork, said pair of terminal extensions having contact points (8a and 9a) at their free ends in opposing relationship,

whereby the cable holder is inserted in the connector housing (2) so that the cable supporting surface (13a) is brought into contact with either contact point (8a or 9a) of the terminal extension (8 or 9), assuring that cable (4) is resiliently pinched and held between the cable supporting surface and the opposing contact point (8a or 9a) regardless of which of the terminal extensions (8 and 9) the male projection of the cable holder faces.

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FIG. 1

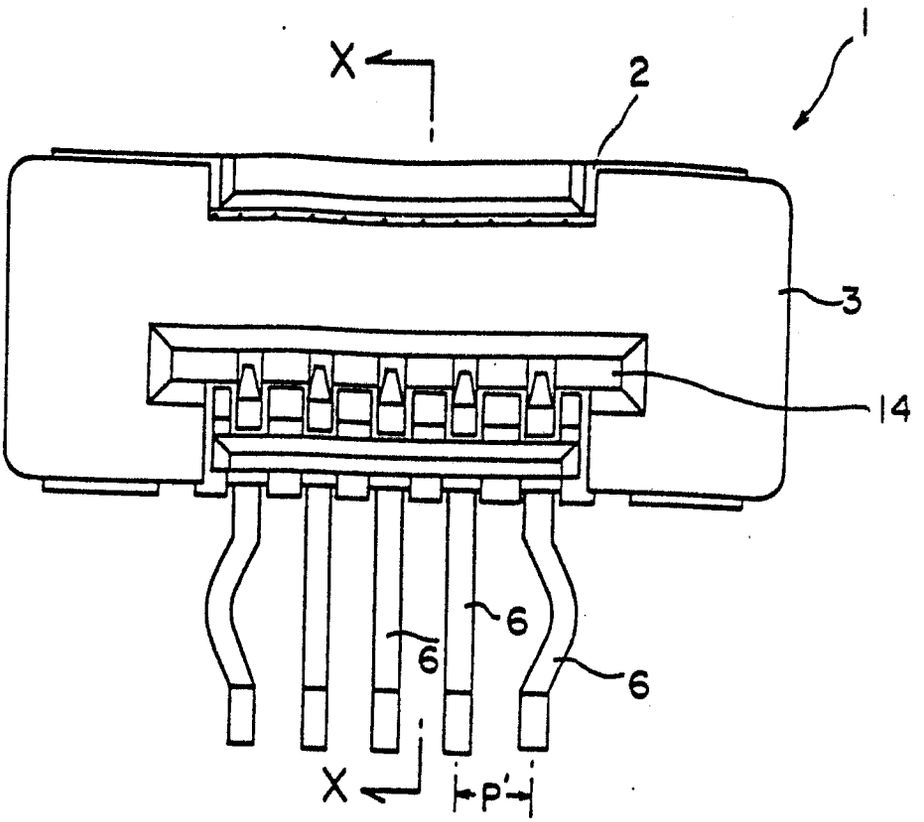

FIG. 6

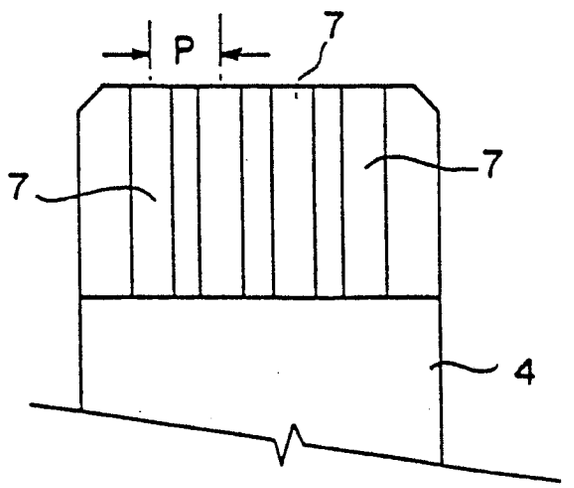

FIG.2

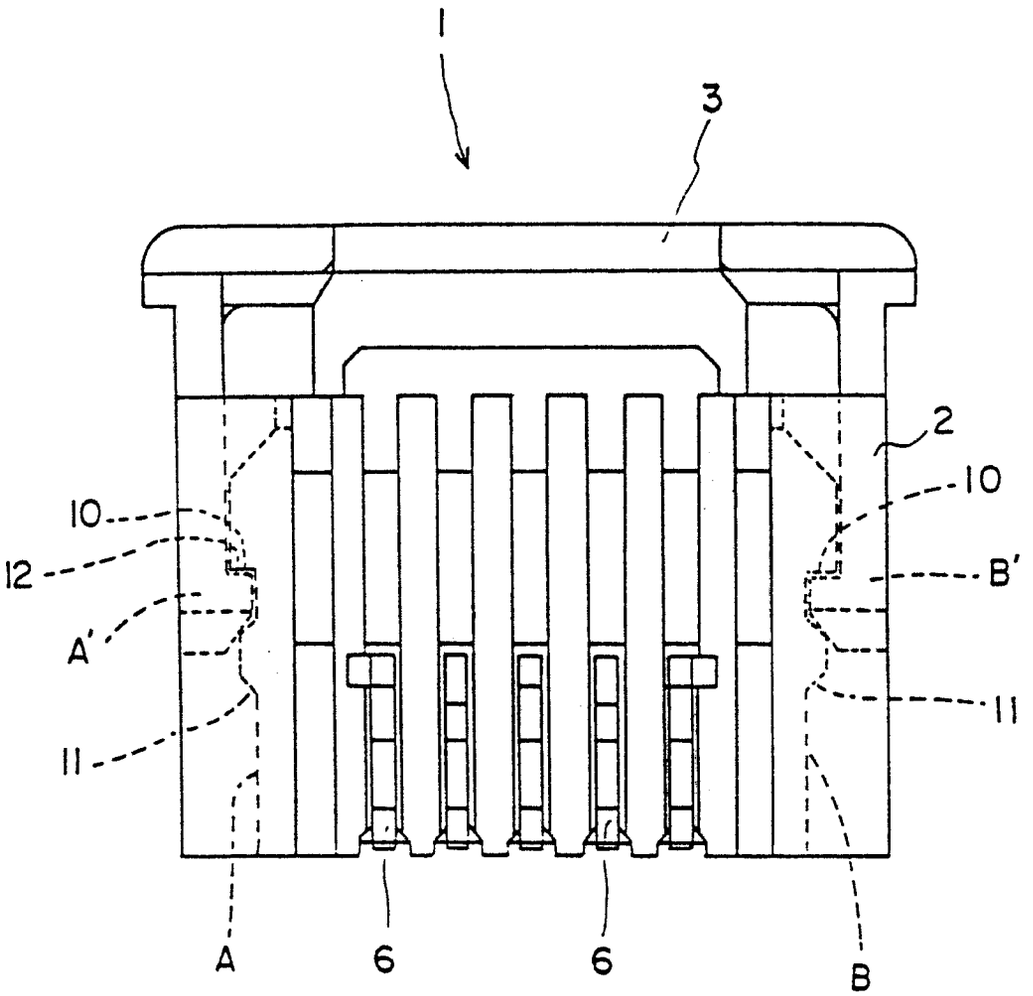

FIG.3

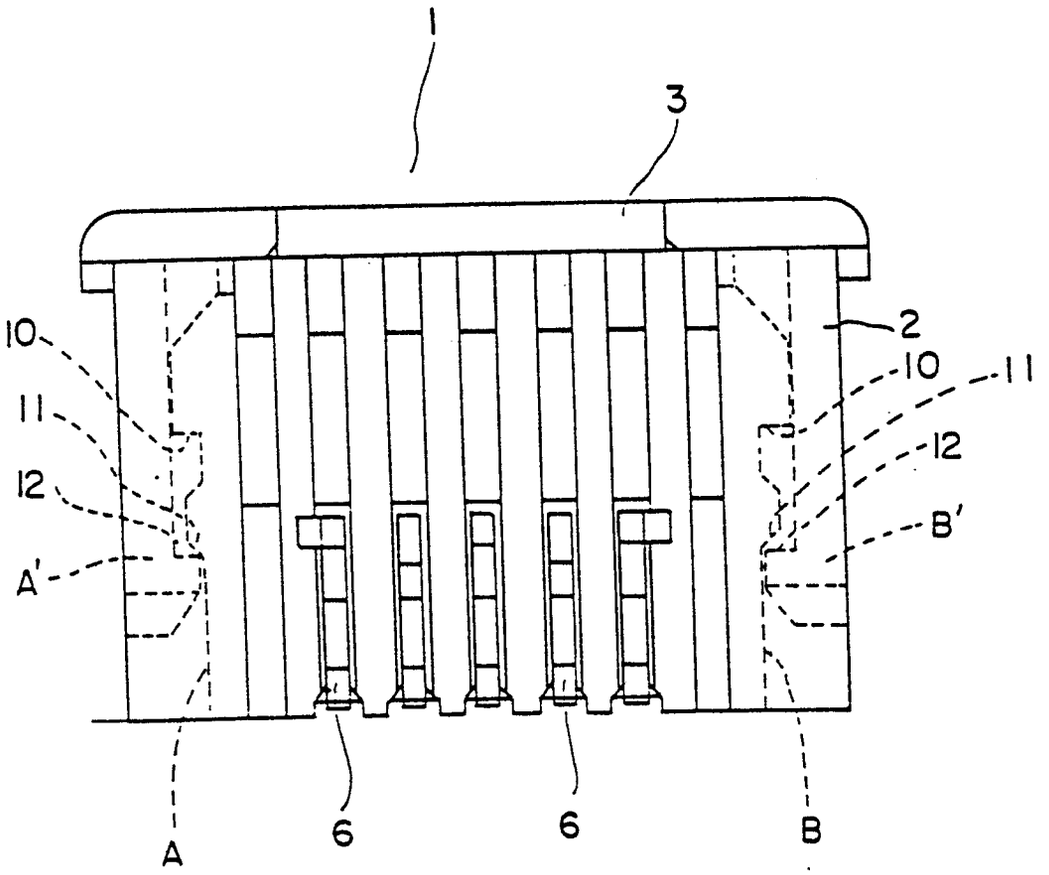

FIG.4

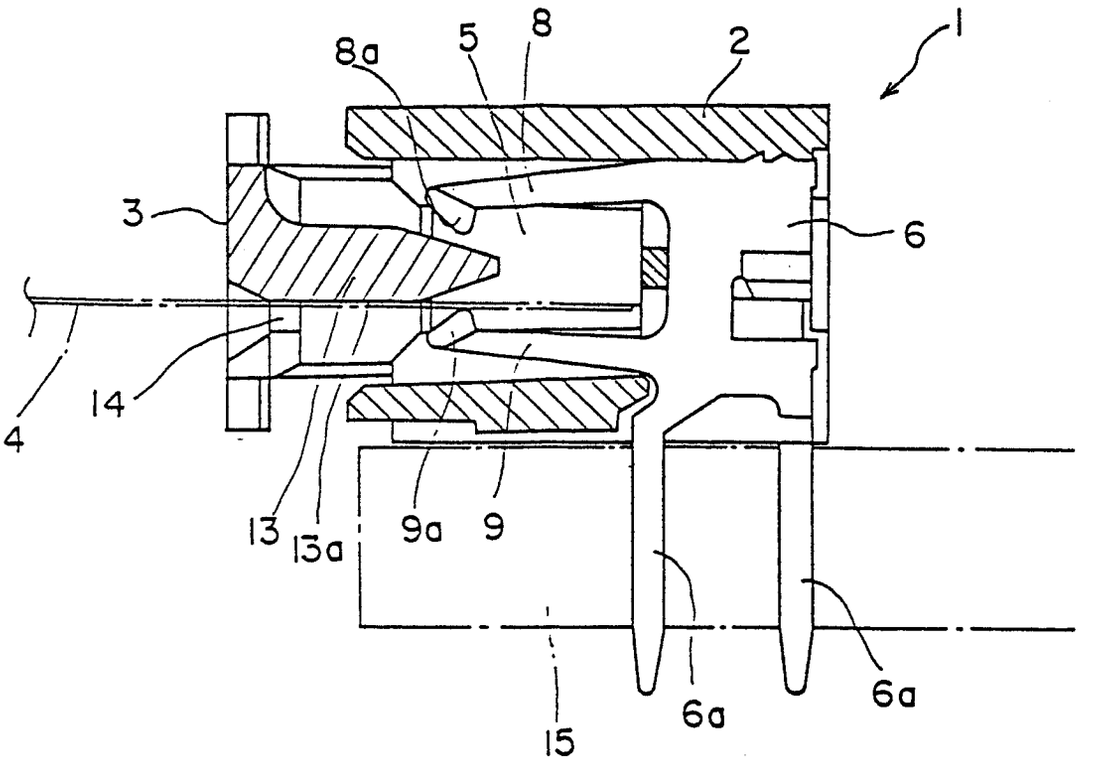

FIG.7

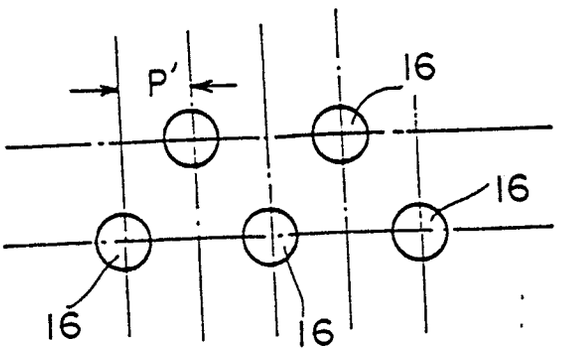

FIG.5

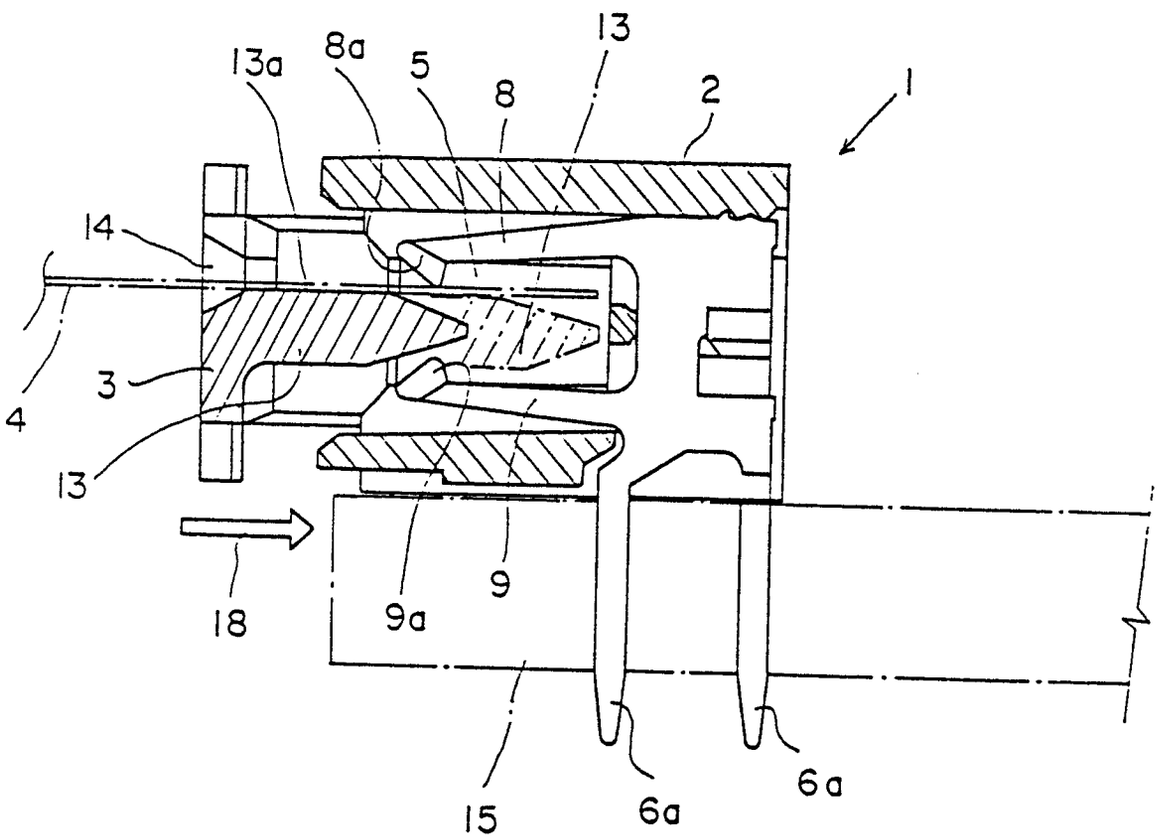

FIG.8

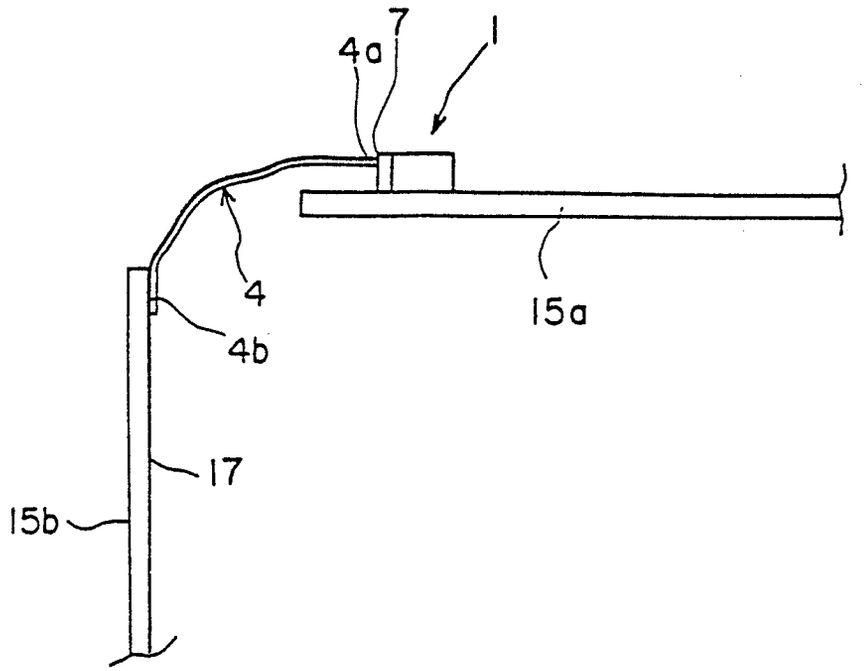

FIG.9

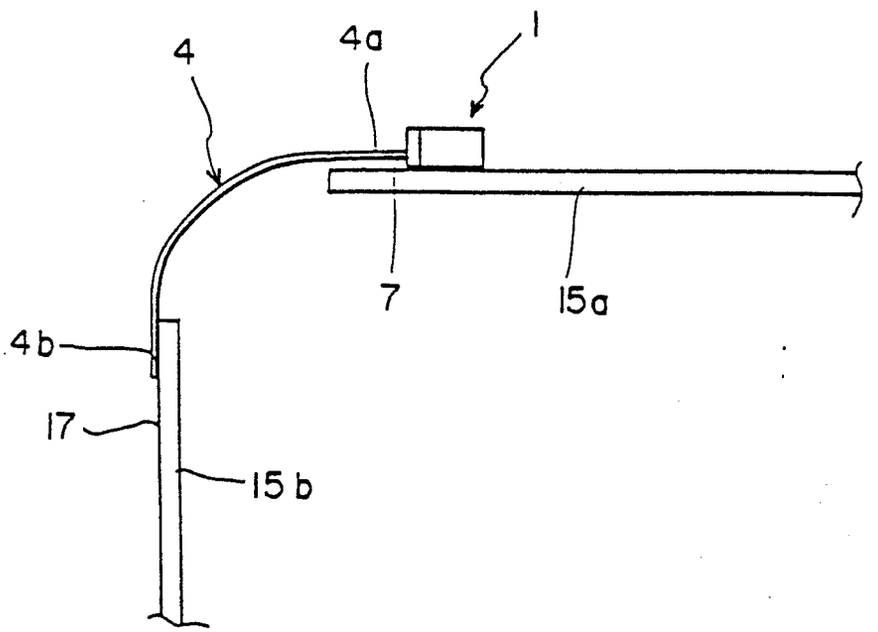

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FIG. 10

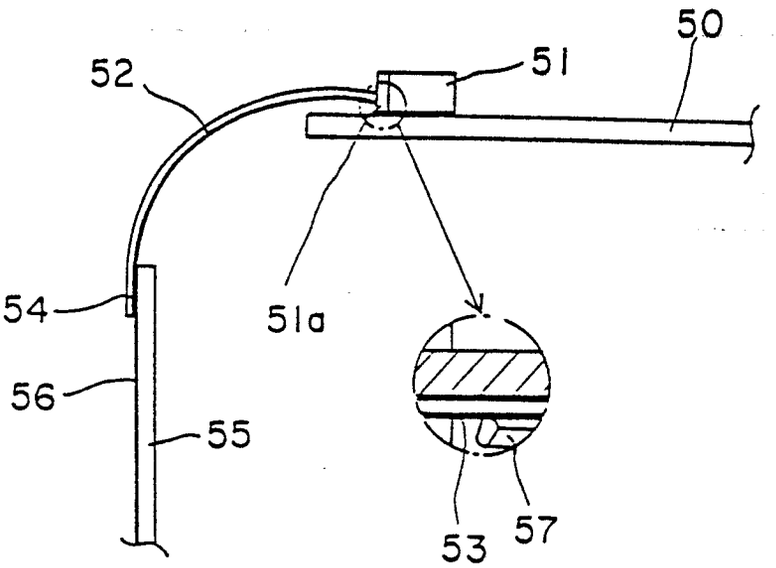


FIG. 12

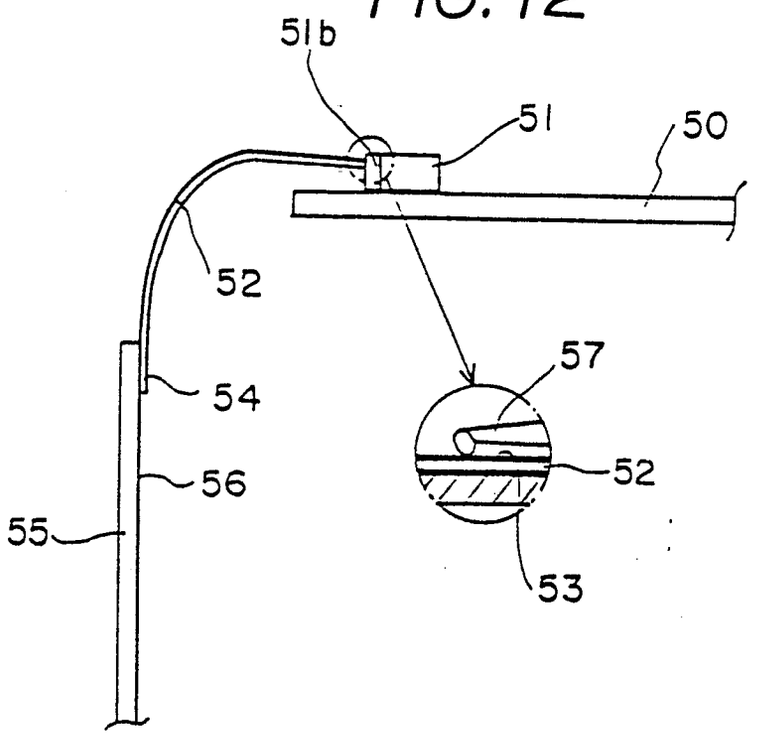


FIG. 11

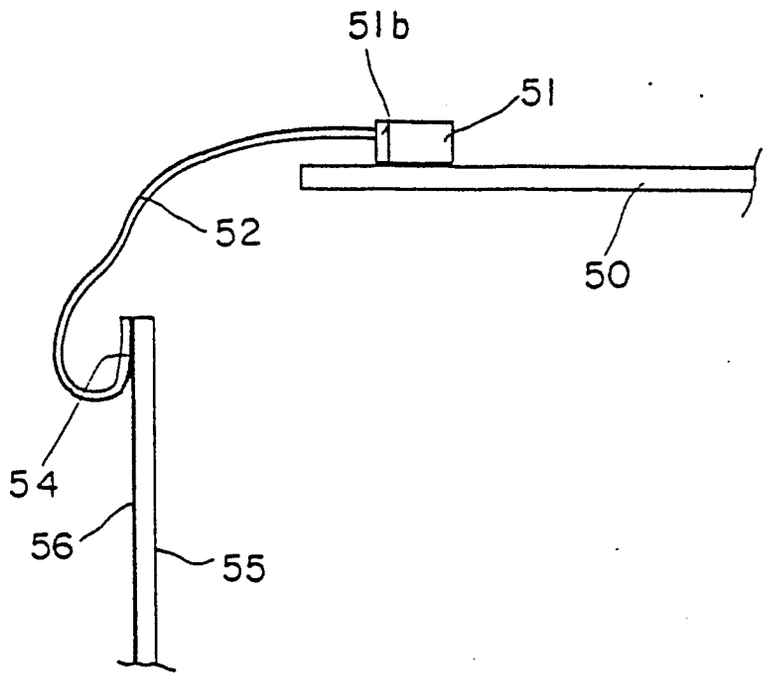
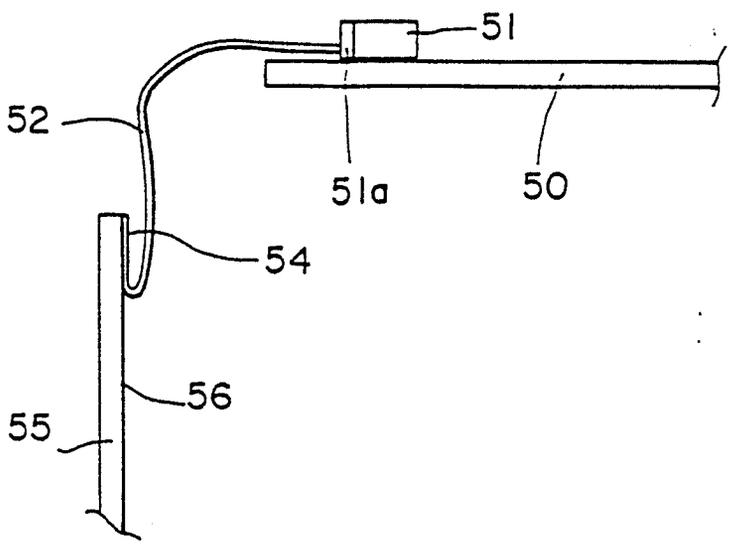


FIG. 13



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 30 6742

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)
Y	WO-A-8 603 345 (AMP) * Abstract; page 7, lines 1-33; figures 2,8 *	1	H 01 R 9/07
Y	FR-A-2 577 353 (CGCT) * Abstract; page 6, lines 1-22; figure 1 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 01 R 9/00
H 01 R 23/00
H 01 R 4/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30-11-1987	CLOSA D.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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