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H2E EEA
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(56) Documents Cited
EP 0366405 A2 WO 94/28597 A1

(58) Field of Search
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INT CL^6 H01R
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(54) Terminal connecting structure

(57) In a terminal connecting structure between a flexible board and a printed circuit board, the width of each land (13a) of a copper foil pattern (13) on the printed circuit board (10) is less than 0.6 mm, preferably 0.4 mm, and solder (15) is formed on the surface of the lands (13a) using a dip method. A flexible board (7) is placed on the printed circuit board (10) and urged towards it by an elastic member (5) so as to press each connecting terminal (9a) of a circuit pattern (9) on the flexible board (7) into pressure-bonded contact with the solder (15) of respective lands (13a). By setting the width of each land to 0.6 mm or less and adhering solder to the surface thereof using a dip method, variation in the height of the solder becomes smaller, improving reliability.

FIG. 2

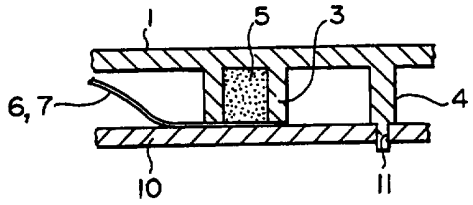

FIG. 5

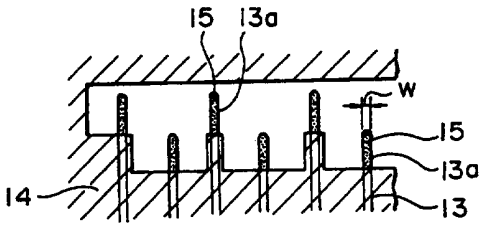

FIG. 6

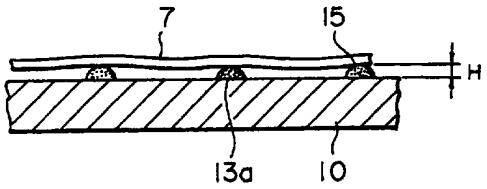

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FIG. 1

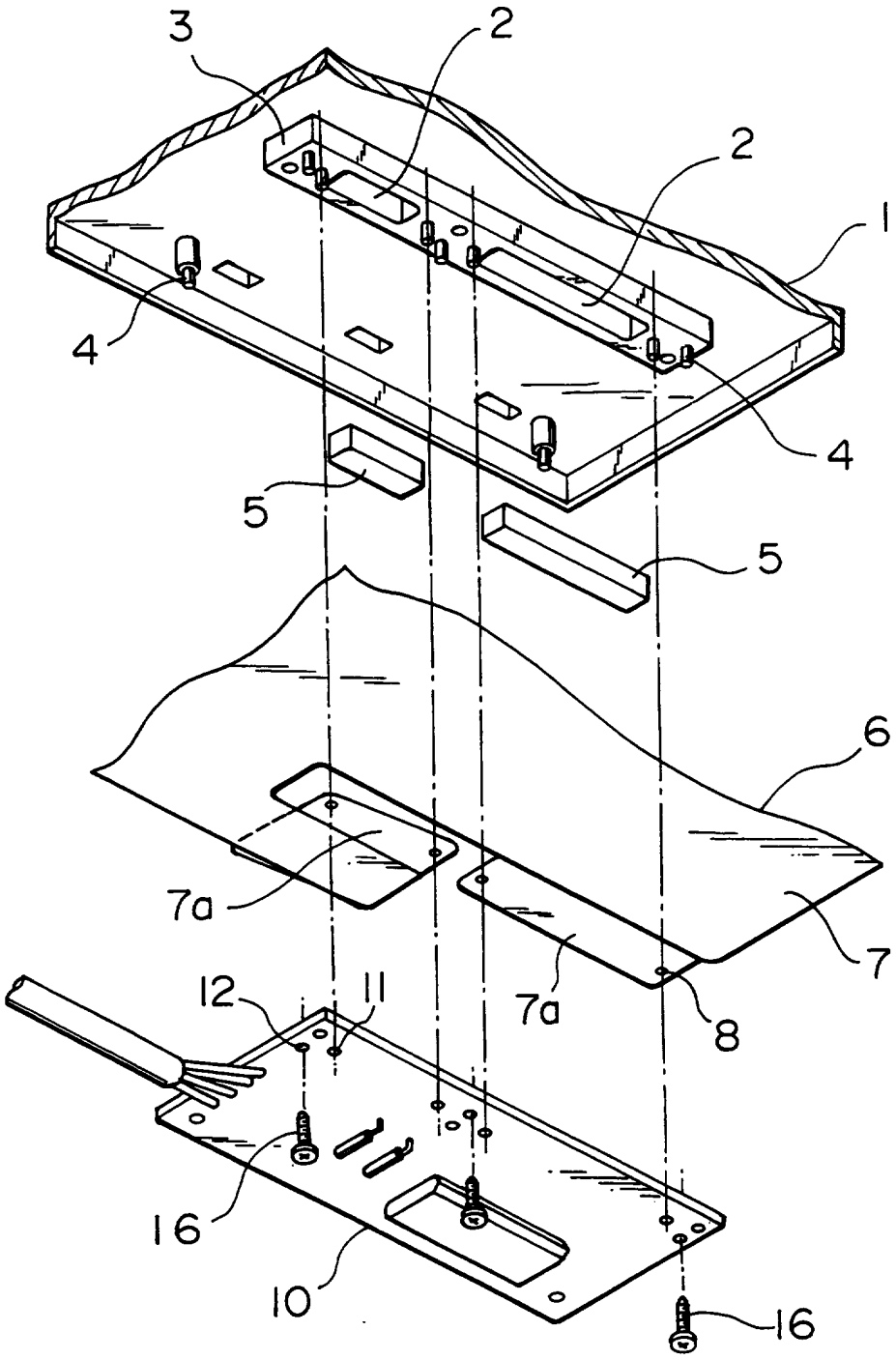


FIG. 2

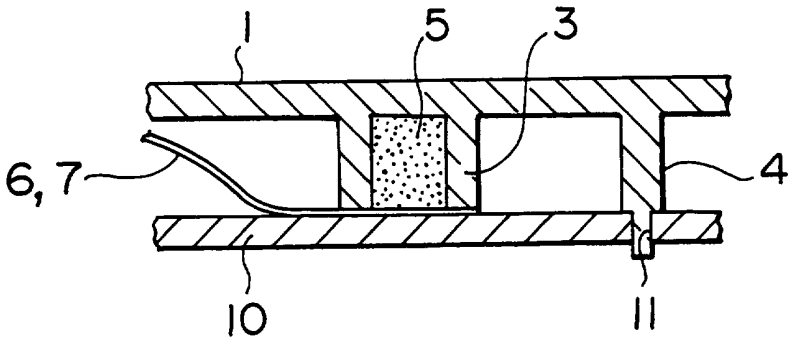


FIG. 3

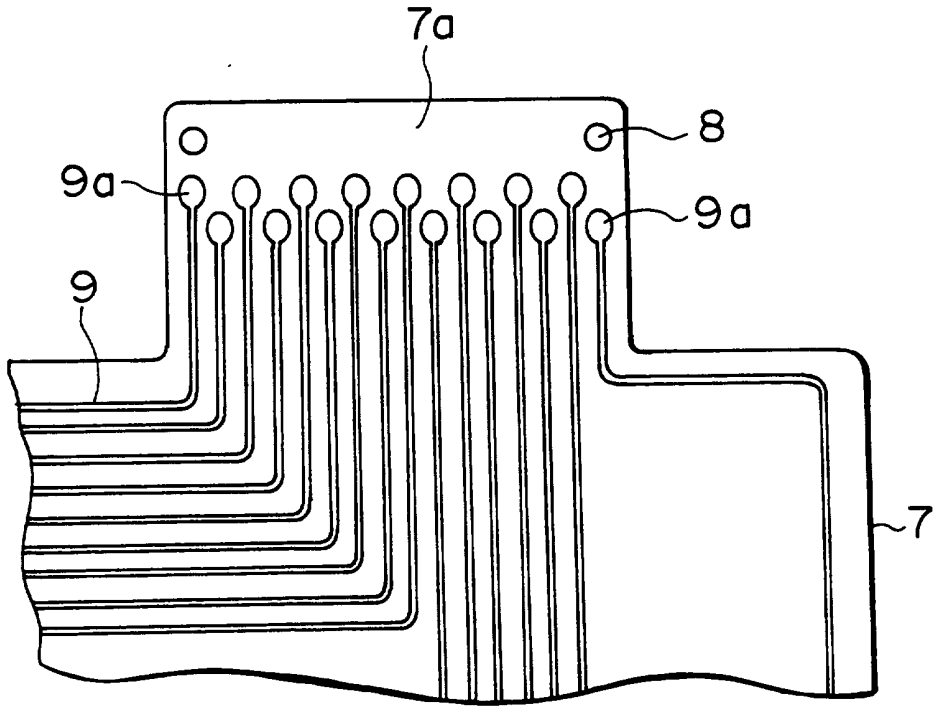


FIG. 4

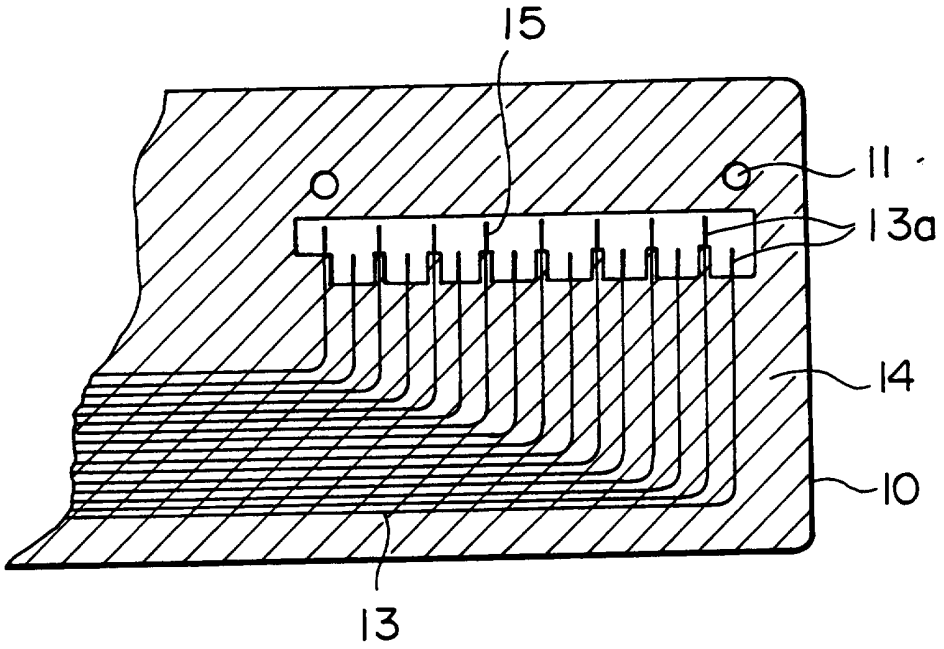


FIG. 5

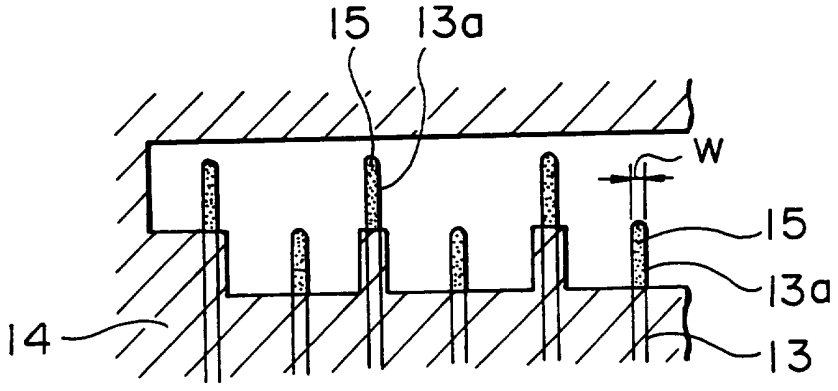


FIG. 6

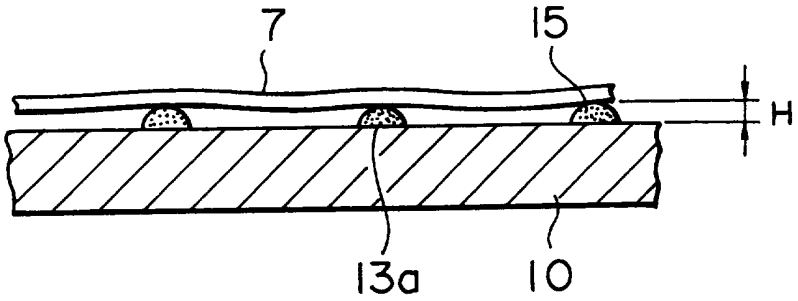
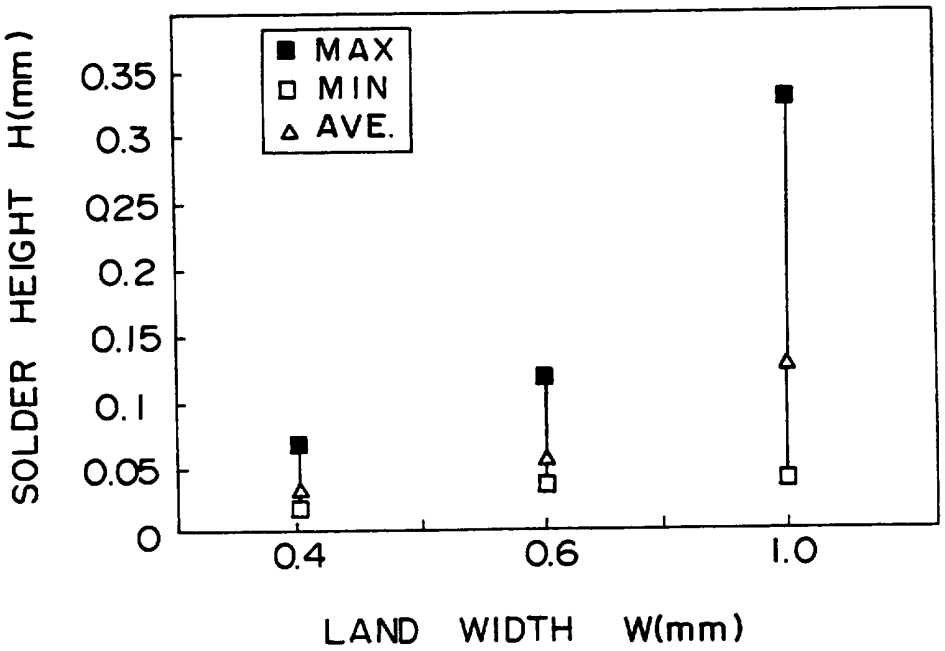

7
15
H
13a
10

FIG. 7


MAX
MIN
AVE.
SOLDER HEIGHT H(mm)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.4
0.6
1.0
LAND WIDTH W(mm)

TERMINAL CONNECTING STRUCTURE

The present invention relates to a terminal connecting structure of a flexible board and a printed circuit board. More particularly, it relates to a terminal connecting structure of the type in which a connecting portion of a flexible board is pressed into contact with a land portion of a printed circuit board to make connection thereof.

In a connecting structure employed for example in a keyboard input device, a membrane sheet (flexible board) is used as a switching device to be operated by a depression of each keytop, thereby electrically connecting an output part of the membrane sheet and a printed circuit board that mounts circuit component parts.

In the known connecting structure of this type, an exclusive connector having a plurality of clip-like contacting elements is soldered onto the printed circuit board so that terminals of the two boards are conductive through the contacting elements by inserting an end portion of the membrane sheet into the connector. Since, however, such connector requires the plurality of clip-like contacting elements and an insulating case for containing these elements, a complicated structure is unavoidable and a higher cost results.

A terminal connecting structure of a flexible board and printed circuit board arrangement has been proposed by the present applicant in Japanese Utility Model Laid-Open Publication No. 62-76477, and includes a holding member fixed to the printed circuit board and flexible board through an elastic sheet. The respective terminals of the printed circuit board and flexible board are pressed into contact with each other by the elastic sheet so as to conduct electricity. In this construction, since the terminals on the printed circuit board and the flexible board are pressed into contact with each other by

the resilient force from the elastic sheet, a high-priced exclusive connector can be omitted to achieve a reduction in cost.

If, however, the corresponding terminals on the flexible board are brought into direct contact with the respective terminals on the printed circuit board in the terminal connecting structure of the conventional pressure-connected type as described, a sufficient contacting pressure cannot be secured because the respective terminals come into contact at their flat surface. Although a method may thus be considered of increasing the contacting pressure by previously applying solder to land portions of each terminal of the printed circuit board and bringing the terminal on the flexible board into contact with a curved surface of the solder, the height dimension of each solder tends to vary when such soldering is performed by a dip method and a new problems occurs that the state of contact becomes unstable at the portion where the solder height is low.

In view of the conventional art as described, it is an object of the present invention to provide a terminal connecting structure of flexible board and printed circuit board which is inexpensive and securely makes connection.

The present invention achieves the above object by setting the width dimension of each land portion of a copper foil pattern provided on the printed circuit board to 0.6 mm or less, previously adhering solder to these land portions and pressure-bonding each connecting portion provided on the flexible board to the solder of said land portion.

Further, in a preferred embodiment, the land portions of said printed circuit board are arranged in a zigzag.

As a result of study on the cause of dispersion

in the height dimension of the solder which has been dip-soldered to each land portion, the present inventor has found that the height dimension of the solder is greatly varied by the width dimension of the land portion and has decided to set the width dimension of each land to 0.6 mm or less and preferably to about 0.4 mm. When, as described, solder is applied by means of dip method to a thin land portion having a width dimension of 0.6 mm or less, dispersion in the height dimension among the solders becomes less, though the solder height becomes smaller due to the fact that the adhered amount of the solder is reduced. As a result, the solder height to be applied to each land portion of the printed circuit board is uniform and each terminal on the flexible board may be securely pressed into contact with respective solder at a high contacting pressure.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is an exploded perspective view showing the terminal connecting structure of flexible board and printed circuit board according to an embodiment of the present invention;

Figure 2 is a sectional view of certain portions of the terminal connecting structure;

Figure 3 is a back view of a flexible board included in the terminal connecting structure;

Figure 4 is a plan view of a printed circuit board included in the terminal connecting structure;

Figure 5 illustrates land portions of the printed circuit board;

Figure 6 illustrates solder to be adhered to the land portions; and

Figure 7 explains the relationship between land width W and solder height H of the land portion 13a.

Referring to the drawings, a housing 1 for forming an outer shell of a keyboard input device or the like includes on the back surface thereof a projection 3 having a recess 2 and a plurality of locating pins 4. An elastic member 5 made of a sponge or the like is contained in said recess 2 such that the elastic member 5 in its unpressed state projects from a lower surface of the projection 3. A membrane sheet 6 is constituted by a pair of flexible boards 7 which are laminated through a spacer film (not shown) and has a plurality of locating holes 8. The flexible board 7 is formed from a film material having a flexibility such as PET or polyimide. As shown in Figure 3, circuit patterns 9 made of silver paste or the like are formed on the flexible board 7. The circuit patterns 9 are aggregated into an output part 7a which is formed on the flexible board 7 in the manner of a projection, connecting terminals 9a of the circuit patterns 9 at the output part 7a being arranged in two rows so as to form a zigzag.

A printed circuit board 10 has a plurality of locating holes 11 and screw insertion holes 12 formed therein and various electronic component parts such as capacitor and IC soldered thereon. As shown in Figure 4, a copper foil pattern 13 is provided on a surface of the printed circuit board 10, and the portion of the copper foil pattern 13 except for land portions 13a is covered with a resist layer 14. As shown in Figures 5 and 6, while the land portions 13a are arranged in two rows forming a zigzag corresponding to the contacting terminals 9a, all of these are the same in their width dimension. Further, the surface of each land portion 13a is covered with solder 15 having a height dimension H, the solder 15 being formed by a dip method where the printed circuit board 10 is dipped into a fused solder.

As shown in Figures 1 and 2, the membrane sheet

6 is placed on said printed circuit board 10, and screws 16 are inserted into the screw inserting holes 12 to incorporate the printed circuit board 10, membrane sheet 6 and the housing 1 into one member. At this time, the elastic member 5 contained within the recess 2 of the housing 1 is compressed until it is brought into the same plane as the lower end of the projection 3 so that, due to the resilient force from the elastic member 5, the contacting terminals 9a of the circuit pattern 9 formed on the output part 7a of the flexible board 7 are pressed into contact with the solder 15 which has previously been adhered to the respective land portions 13a of the printed circuit board 10. Further, the relative position of the respective connecting terminals 9a and solders 15 at this time are accurately determined as the locating hole 8 of the membrane sheet 6 and the locating hole 11 of the printed circuit board 10 are fitted onto the locating pins 4 of the housing 1.

In the terminal connecting structure of the flexible board 7 and printed circuit board 10 constructed in this manner, it is important to make smaller the dispersion in the height dimension H of the solder 15 adhered to the land portion 13a in order to secure the state of contact between the respective connecting terminals 9a and solders 15. In other words, as the difference in solder height H (difference in step) between neighbouring solders 15 is increased, the resilient force of the elastic member 5 cannot be uniformly exerted on both solders 15 through the flexible board 7. A sufficient contacting force is not acted upon between the lower solder 15 and the connecting terminal 9a facing thereto and the contacting state at that portion becomes unstable.

Figure 7 illustrates the relationship between land width W and solder height H of the land portion 13a.

As is apparent from this figure, while the dispersion in solder height H is large or 0.03 to 0.33 mm (a difference in step of 0.3 mm) for the case where the land width is 1 mm, the dispersion in solder height H is significantly smaller or 0.03 to 0.13 mm (a difference in step of 0.1 mm) when land width W is 0.6 mm. In this manner, the dispersion in height dimension H of the solder 15 largely depends on the land width W of the land portion 13a and the dispersion in solder height H becomes significantly smaller if the land width W is 0.6 mm or less. Here, the case of defect due to a discontinuation of the pattern at the land portion 13a is also a consideration. The land width W is thus determined to be 0.4 mm in the present embodiment. As a result, the solder height H of each solder 15 is uniformed to 0.02 to 0.07 mm (a difference in step of 0.05 mm). The connecting terminals 9a are pressed into contact with the respective solders 15 at a high contacting pressure by the resilient force from the resilient member 5 so that the circuit pattern 9 of the flexible board 7 can be securely brought into electrically conductive state through the copper foil pattern 13 of the printed circuit board 10. Further, in the present embodiment, since the land portions 13a of the printed circuit board 10 are arranged in two rows forming a zigzag, the pitch between neighbouring two land portions 13a is expanded to two times with respect to each row comparing to the case where the land portions 13a are arranged in a single row. As a result, it is easier to cause the flexible board 7 to follow the respective solders 15. This also makes it possible to stabilize the connecting state of the connecting terminals 9a and solders 15.

In the above described embodiment, the flexible board 7 of the membrane sheet 6 is shown as an example of the member to be connected to the printed circuit board

10. However, the present invention may also be applied to other terminal connecting structures between a flexible board and a printed circuit board. For example, it can be applied to the case where a flexible board for use as a lead brought out from an LCD or the like is to be connected to a printed circuit board.

As has been described above, according to the present invention, the height of solder applied on each land portion of the printed circuit board is made uniform. The terminals on the flexible board may thus be securely pressed into contact with the respective solders at a high contacting pressure using a simple construction where the flexible board is resiliently urged toward the printed circuit board. It is therefore possible to provide a terminal connecting structure of flexible board and printed circuit board which securely makes connections at a low cost.

CLAIMS

1. A terminal connecting structure of a flexible board and a printed circuit board having solder adhered to each land portion of a copper foil pattern provided on the printed circuit board and having connecting portions provided on the flexible board to be pressure-bonded to the solder of said land portion, wherein said land portion has its width dimension of 0.6 mm or less.

2. A terminal connecting structure of flexible board and printed circuit board according to Claim 1, wherein the land portions of said printed circuit board are arranged in a zigzag.

3. A terminal connecting structure substantially as hereinbefore described with reference to, and as illustrated by, the accompanying drawings.

The Patent Office

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Application No: GB 9612243.7
Claims searched: 1 to 3

Examiner: F J Fee
Date of search: 21 August 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H2E [EHC, EEA]

Int Cl (Ed.6): H01R

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0366405 A2 [HEWLETT PACKARD]	
A	WO 94/28597 A1 [GORE]	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.