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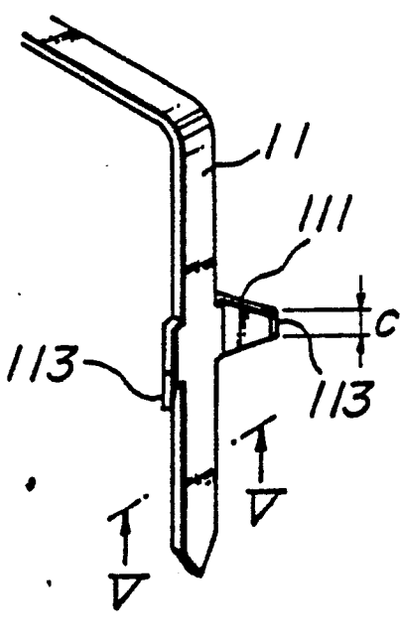
(54) Electrical connector.

(57) This invention concerns with an electrical connector, and more particularly with an electrical connector capable of fixing contacts by press-fitting in slits in a locator of an insulating main body. Even if a fixing force for the contacts is large enough, the contacts do not scrape inner walls of the slits so that any scraped chips are not produced.

FIG_4



EP 0 408 451 A1

ELECTRICAL CONNECTOR

This invention relates to an electrical connector, and more particularly to an electrical connector capable of fixing contacts by press-fitting at predetermined exact positions of an insulating main body by press-fitting.

Various electrical connectors have been used in electric and electronic appliances. An actual example is illustrated in Figs. 1a and 1b. The electrical connector shown in Fig. 1a includes an insulating main body 1 and contacts 2A and 2B press-fitted in a locator portion 3 of the main body 1 and fixed thereat.

Such a receptacle connector is arranged at a predetermined position, for example, on a circuit board 4 and fixed thereat by means of set screws 5 or the like.

Fig. 1b illustrates a condition that the receptacle connector is arranged and fixed onto a circuit board and a relationship between the arranged receptacle connector and a plug connector to be fitted with the receptacle connector.

Tail portions of the contacts 2A and 2B fixed to the insulating main body 1 extend through through-holes 4A and 4B provided in the circuit board 4 and electrically connected to a pattern of the circuit board on its back side by soldering as shown in Fig. 1b.

The receptacle connector mounted on the circuit board 4 is adapted to be fitted with a plug connector separately prepared.

With one method of fixing contacts at a predetermined position to an insulating main body of the connector of this kind, as shown in Fig. 2, a fixing portion 11 of a contact tail is press-fitted in a slit 32 of a locator plate 3 so that the contact tail is positioned relative to the locator plate 3.

In this method, however, in order to obtain a high positioning force which serves to securely fix the contact tail to prevent it from shifting from the position, it is necessary to enhance the force with which the fixing portion of the contact urges inner walls of the slit. For this purpose, the fixing portion of the contact is widened to provide a widened portion 111. As a result, the widened portion 111 cuts or scrapes the inner walls 321 of the slit 32 when the widened portion 111 is press-fitted in the slit 32. Therefore, chips of the inner walls 321 accumulate, for example, between a wall surface 322 of the slit 32 at its bottom and the widened portion 111 of the fixing portion 11 of the contact tail, with the result that the contact tail 11 cannot be positioned at a predetermined position, which is a technical problem to be solved for long time.

As shown in Fig. 3, moreover, there is another problem in that if the widened portion 111 is chamfered as shown at 112, contact areas between the slit 32 and the contact tail becomes small so that fixing force is weak, with the result that the position of the contact tail is likely to change.

It is an object of the invention to provide an improved electrical connector which eliminates all the disadvantages of the prior art.

In order to accomplish this object, in an electrical connector including an insulating main body having a locator and contacts press-fitted in slits formed in the locator and fixed thereat, according to the invention each of the contacts comprises a widened portion whose both ends are inclined rearward of inserting direction for press-fitting of the contact, and each contact has been distal ends and bottoms of the widened portion an elasticity against a force narrowing a distance between the distal ends.

With the above arrangement, the distal ends of the widened portion are inclined rearward of inserting direction for press-fitting and the distance between the distal ends tends to narrow elastically. Therefore, during the insertion of the widened portion into the slit, the distal ends of the widened portion deform toward each other so that the force urging inner walls of the slit becomes weak with the result that the widened portion can be inserted into the slit without scraping the inner walls of the slit. If the widened portion tends to remove from the slit, the distal ends of the widened portion are likely to deform away from each other so that urging force of the distal ends against the inner walls of the slit increases to prevent any dislodgment of the contact from the slit.

As the electrical connector according to the invention comprises the above construction with the above effects, the inner walls of the slits are not scraped in inserting the contact into the slit so that any scraped chips are not produced. Therefore, there is no difficulty in positioning of a contact tail due to scraped chips. The fixing force of the contact tail in a removing direction is large so that the contact tail does not shift in any way. Accordingly, the significant effect of exact positioning of contacts particular to the invention can be accomplished.

The invention will be more fully understood by referring to the following detailed specification and claims taken in connection with the appended drawings.

Figs. 1a and 1b illustrate a connector of the prior art;

Fig. 2 illustrates respective parts a contact tail and a locator plate to which the contact tail is fixed in a connector of the prior art;

Fig. 3 is a bottom plan view of a widened portion of a contact tail of a connector of the prior art;

Fig. 4 illustrates a fixing portion of a contact used in the connector according to the invention;

Fig. 5 is a bottom plan view illustrating the contact according to the invention;

Fig. 6 is a perspective view of a contact tail of another embodiment of the invention; and

Fig. 7 is a sectional view taken along the line VII-VII in Fig. 6.

Fig. 4 is a perspective view illustrating a fixing portion of a contact 2A or 2B used in a connector according to the invention. The contact tail 11 is provided at the fixing portion with a widened portion 111 whose outer ends are bent in the proximity of its bottom 114 rearward of a press-fitting direction at a determined angle. Each of the outer ends of the widened portion 111 is slightly tapered toward its distal end 113. Such a tapered shape is only one example. The distal end 113 may be wider than the bottom 114. The distal end 113 may of course have a width substantially equal to that of the bottom 114.

Fig. 5 illustrates on an enlarged scale the fixing portion of the contact tail according to the invention in section taken along the line V-V in Fig. 4. As can be seen from Fig. 5, the distal end 113 of the widened portion 111 is inclined and the portion from the bottom 114 to the distal end 113 constitutes a cantilever having an elasticity against a force tending to narrow a distance a between both the distal ends.

An angle θ made by the portion from the bottom 14 to the distal end 113 with the contact tail is preferably 30° to 60°. The distal end 113 having the angle θ less than 30° disadvantageously tends to scrape inner walls of a slit 32.

In case that the angle θ is more than 60°, the force deforming the distal ends 113 of the widened portion 111 away from each other is too weak so that the widened portion 111 is likely to be dislodged from the slit unfavorably.

Moreover, an edge of the distal end 113 formed by punching using a press die may be used as a portion of the distal end 113 abutting against the inner wall 321 of the slit. The distal ends 113 in Fig. 5 illustrate the edges abutting against the inner walls 321 of the slit. As the distal end 113 is inclined at θ, the sharp edges of the distal ends 113 abut against the inner walls of the slit.

However, this feature is only one example. Other arrangements may be used so long as the widened portion of the contact and inner walls of the slit are not likely to slide with each other. Therefore, the edges of the distal ends 113 shown in Fig. 5 may be chamfered or hit in pressing to be dull or rounded, if required. This is advantageous in the case that the locator plate 3 is made of a material to be easily scraped or press-fitting force is too large.

The contacts used in the connector according to the invention have generally widths of 0.6 to 1.2 mm, and lengths of 15 to 45 mm and thicknesses of 0.2 to 0.35 mm in case of the widths and lengths within the above values.

With the contacts having the usual sizes above described, a length b (Fig. 5) from the bottom 114 to the distal end 113 obliquely extending is 0.2 to 1.5 mm. The length b less than 0.2 mm is not preferable because of less elasticity. The length b more than 1.5 mm is also disadvantageous because of low elasticity resulting in low fixing force of the contact.

With the widened portion of the contact shown in Fig. 5, the portions from the bottoms 114 to the distal end 113 extend straight. However, they may be curved on any side. Of course, the substantially straight portions are advantageous in manufacturing because the straight portions are only 0.2 to 1.5 mm in the usual sizes.

Widths c (Fig. 4) of the distal ends 113 are preferably as wide as possible because the wider the widths, the higher is the fixing force in stability and reliability. However, the widths c of the distal ends 113 more than a thickness of the locator plate are disadvantageous, because the widened portion 111 of the contact will abut against the circuit board when the connector is equipped on a circuit board and may shift the fitting position.

The contacts used in this invention can be made any metallic materials so long as they have been used for this kind of contacts. For example, the contacts can be typically made of various copper alloys such as phosphor bronze, solder-plated phosphor bronze, beryllium-copper brass, German silver, Tando, Cadmium copper and Cu-Ni-Sn alloys.

The insulating main body used in the connector according to the invention can be made any materials so long as they have been used for the same purpose. However, in consideration of size, accuracy, ease to work and stability, engineering plastic materials, particularly liquid crystal plastics among them are preferable when it is desirable to improve the reliability. Usable plastic materials are, nylon 66, nylon 6, polyacetal, polycarbonate, PBT, PPE, PPS, PPD, PET and the like.

A width of a slit 32 provided in a locator into which the contact in press-fitting is 5 to 15% narrower than the distance a between the distal ends of the widened portion of the contact. If it is less than 5%, the press-fitting force is too small so that the fixing force for the contact becomes small. If it

is more than 15%, the deformation of the widened portion of the contact becomes large to increase its elastic force so that wall surfaces of the slit may be scraped.

Fig. 6 illustrates another embodiment of the invention which is preferably used in the case that the contact is made of a relatively thin material (for example, 0.1 to 0.2 mm thickness). Fig. 7 is an enlarged sectional view of the contact taken along the line VII-VII in Fig. 6.

Referring Fig. 6, the contact 11 is folded along its longitudinal center line into a form of a trough over its length, thereby increasing a strength against buckling.

With such a contact, the effect of the invention can be accomplished by folding the contact at 30° to 60° of θ as shown in Fig. 7.

When the folded angle θ exceeds 45°, cracks may sometimes occur by the abrupt folding angle for some materials. Therefore, the angle of 30° to 45° is most preferable.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details can be made therein without departing from the spirit and scope of the invention.

Claims

1. An electrical connector including an insulating main body having a locator and contacts press-fitted in slits formed in the locator and fixed thereat, wherein each of the contacts comprises a widened portion whose both ends are inclined rearward of inserting direction for press-fitting of the contact, and each contact has between distal ends and bottoms of the widened portion an elasticity against a force narrowing a distance between the distal ends.
2. An electrical connector as set forth in claim 1, wherein widths of the widened portion are uniform from the bottoms to the distal ends.
3. An electrical connector as set forth in claim 1, wherein angles θ of the both ends of the widened portion inclined rearward are 30° to 60°.
4. An electrical connector as set forth in claim 1, wherein a maximum width of the widened portion in a longitudinal direction of the contact is less than a thickness of the locator.
5. An electrical connector as set forth in claim 1, wherein a width of each of the slits is 5% to 15% less than the distance between the distal ends of the widened portion of the contact.

FIG_1a
PRIOR ART

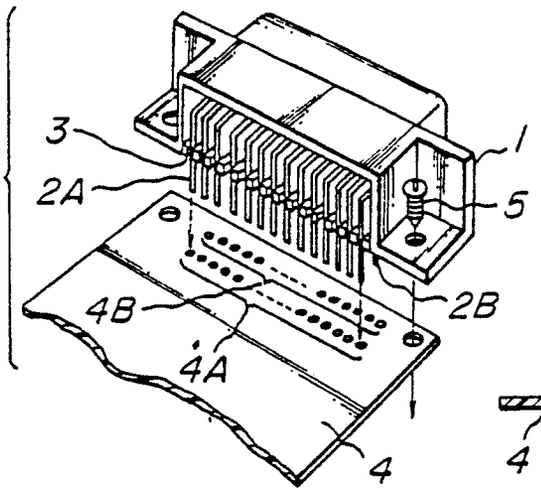


FIG_1b
PRIOR ART

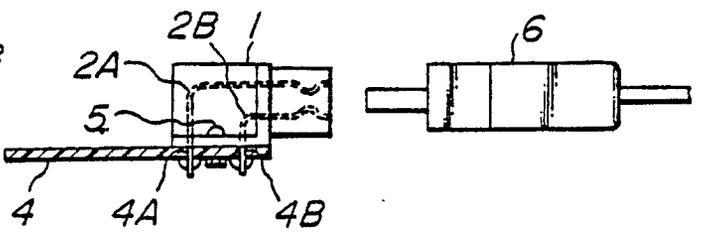


FIG_2
PRIOR ART

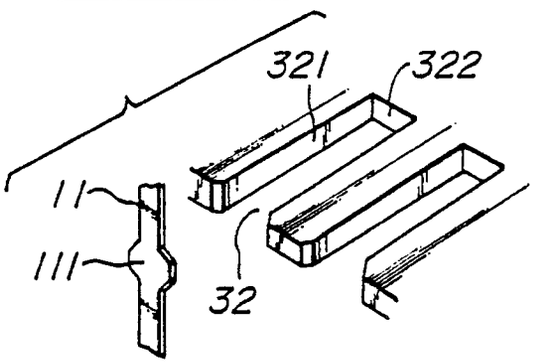


FIG_3
PRIOR ART

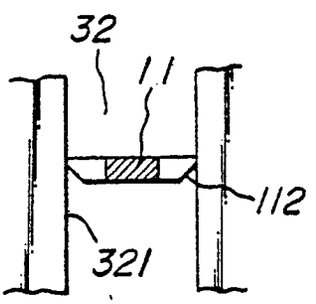


FIG_4

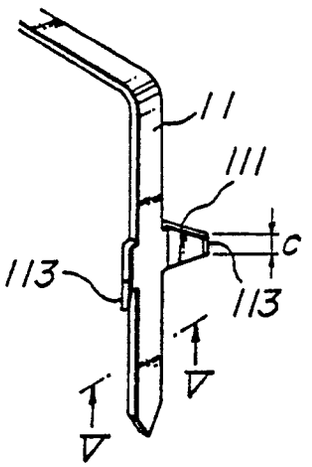


FIG_5

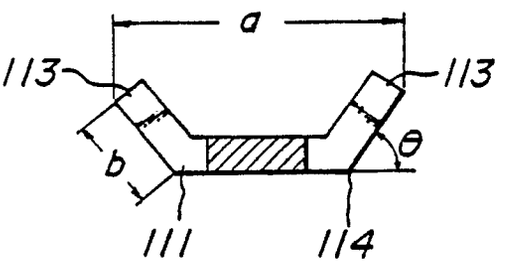


FIG_6

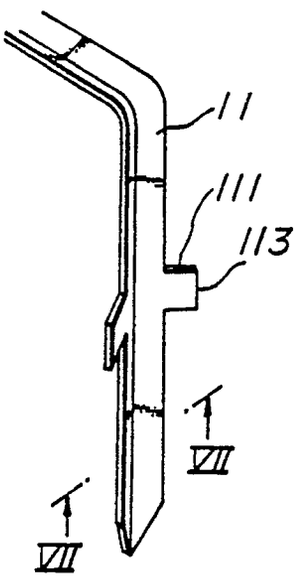
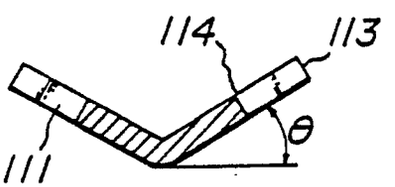


FIG_7



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EUROPEAN SEARCH REPORT

Application Number

EP 90 40 1999

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.5)
Y	DE-A-1 765 654 (MOLEX) * page 16, paragraph 1; page 18, paragraph 2; page 20, paragraph 2; figures 1,6-10 *	1	H 01 R 13/41 H 01 R 23/70
Y	EP-A-0 245 161 (DAIICHI DENSHI KOGYO KABUSHIKI KAISHA) * page 1, lines 1-3; page 2, lines 8-22; page 6, lines 3-6; figures 1a,2b,4b *	1	
A		2,5	
A	US-A-4 842 528 (R. FRANTZ) * column 6, lines 7-13,49-55; figures 1,4-8 *	1	
A	US-A-4 795 378 (M. TOMIZU) * column 1, lines 60-66; figures 2,3 *	1	
A	DE-U-8 431 966 (SIEMENS) * page 4, lines 12-14; figure 3 *	3	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 01 R 9/00
H 01 R 13/00
H 01 R 23/00
H 01 R 43/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	04-10-1990	ALEXATOS G

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