(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 219 935**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **86306111.5**

(22) Date of filing: **07.08.86**

(51) Int. Cl.⁴: **H 01 R 43/16**
H 01 R 43/20

(30) Priority: **12.08.85 JP 122786/85 U**

(43) Date of publication of application:
29.04.87 Bulletin 87/18

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: **E.I. DU PONT DE NEMOURS AND COMPANY**
1007 Market Street
Wilmington Delaware 19898(US)

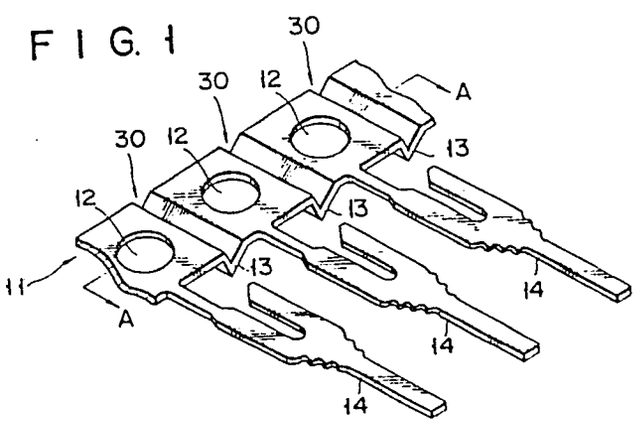
(72) Inventor: **Ting, Tse-wu**
No. 8, Lane 183 Hoping East Road
Section 1 Taipeh(TW)

(74) Representative: **Barnard, Eric Edward et al,**
BROOKES & MARTIN High Holborn House 52/54 High Holborn
London WC1V 6SE(GB)

(54) **Terminal assembly suitable for contact terminals of multi-contact electrical connectors.**

(57) A terminal assembly is composed of a conductive plate (20) with terminals (14) arranged alongside a belt-like terminal carrier (11) with a predetermined pitch (Da). Wrinkled portions (13,30) of predetermined pitch (Da) are formed in the terminal carrier (11) and these are pressed out and flattened at least partially to adjust the pitch of the terminals (14).

FIG. 1



EP 0 219 935 A2

TERMINAL ASSEMBLY SUITABLE FOR CONTACT TERMINALS OF MULTI-CONTACT ELECTRICAL CONNECTORS

Field of the Invention

The present invention relates to a terminal assembly having a series of terminals supported at a predetermined pitch along one longitudinal side of a terminal carrier.

Background of the Invention

A terminal assembly, used, for example, to manufacture a multi-contact electrical connector, is generally formed by punching out, at a predetermined pitch, non-required portions of a belt-like conductive plate or substrate, leaving a longitudinal region on one side of the substrate substantially intact as a carrier for the terminals thus formed.

In assembling a multi-contact electrical connector, the contact terminals of the terminal assembly are simultaneously set in the housing of a connector while they are still supported by the terminal carrier. Once set the terminals are then separated from the terminal carrier. Because this particular method of assembly has proven more efficient than that wherein the terminals are separated from the supportive carrier and then set in the housing of the connector individually, it is more widely used. This method of assembly, however, necessitates that, even if the terminals are of the same shape, when two types of connectors with different terminal pitches of, e.g. 2.0 mm and 2.54 mm, are required, separate terminal assemblies must be prepared to accommodate the

different pitches. This problem is common in terminal assemblies for IC pins (IC LEG), IC socket terminals, "Griplet" terminals (trade name of E.I. DU PONT DE NEMOURS AND COMPANY, U.S.A) and so on.

Summary of the Invention

It is an object of the present invention to provide a terminal assembly having a variable terminal pitch.

According to the present invention, there is provided a terminal assembly having a belt-like terminal carrier. A series of pitch adjusting portions, of predetermined pitch is formed across the terminal carrier in the longitudinal direction. Each pitch adjusting portion consists of at least one fold or wrinkle, one surface of which projects outwards and the other of which is recessed. Terminals are provided along one longitudinal side of the terminal carrier with the same pitch as that of the pitch adjusting portions. Conveniently, the or each wrinkle is V-shaped and formed by crimping. By pressing out and flattening the pitch adjusting portions, and at least in part, the pitch of the terminals can be increased if desired, when constructing a connector. Thus, the same terminal assembly can be used with connectors requiring different terminal pitches by adapting the terminal assembly unaltered or by pressing out.

The present invention thus also provides a method of assembling a multi-contact electrical connector by

utilizing a terminal assembly constructed in accordance with the invention wherein the terminals thereof have a pitch of Da and the connector requires contacts with a pitch of at least Da or Db where Db > Da and comprising setting the terminals in a housing of the connector and thereafter separating the terminals from the carrier of the assembly and adjusting the pitch of the terminals, if desired, from Da to Db by subjecting the pitch adjusting portions of the carrier, at least in part, to a pressing and flattening operation prior to setting the terminals in the housing.

In another aspect, the invention provides a method of making a terminal assembly comprising feeding a conductive metal plate longitudinally in steps of constant predetermined pitch, forming slits in one side margin of the plate with the predetermined pitch, forming pitch adjusting portions composed of folds or wrinkles in the side margin of the plate between the slits and a side edge of the plate at the side margin with the same predetermined pitch, forming pilot holes between the adjusting portions in the side margin with the same predetermined pitch and subjecting the plate to one or more punching operations to create shaped contact terminals aligned with the pilot holes and extending laterally outwardly from the side margin which forms a carrier for the terminals.

The invention may be understood more readily, and various other aspects and features of the invention may

become apparent, from consideration of the following description.

Brief Description of the Drawings

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:-

Fig. 1 is a perspective view of a terminal assembly constructed in accordance with the present invention;

Fig. 2a is a sectional view of the terminal assembly, the view being taken along the line A - A of Fig. 1;

Fig. 2b is a plan view of the terminal assembly;

Figs. 3a and 3b correspond to Figs. 2a and 2b and show the terminal assembly after terminal pitch alteration; and

Figs. 4a through 4g show steps in the manufacture of the terminal assembly of Fig. 1.

Description of Preferred Embodiment

Fig. 1 shows the appearance of a terminal assembly formed by punching and crimping a conductive metal plate in a manner described hereinafter. The terminal assembly has a side margin forming a belt-like terminal carrier 11. Pilot holts 12 are formed at predetermined pitch Da in the carrier 11 and in the longitudinal direction of the carrier 11. Wrinkles 13, constituting pitch adjusting portions 30, are formed widthwise across carrier 11 such that each portion 30 is disposed centrally between every two adjacent pilot holes 12. The pitch of the wrinkles 13 is thus equal to pitch Da of pilot holes 12. Shaped

contact terminals 14 are supported at the predetermined pitch Da along one longitudinal side of carrier 11. The terminal pitch of the contact terminals 14 is equal to pitch Da of the pilot holes 12.

The section of each wrinkle 13 is V-shaped and the dimensions of each wrinkle 13 are designed such that pitch Da between two adjacent pilot holes 12 on both sides of wrinkle 13 is increased to Db (Da < Db) when each wrinkle 13 is pressed and flattened. (In a preferred design Da is 2.00 mm and Db is 2.54 mm).

The terminal assembly as described can be used in connectors requiring a contact pitch of Da or Db. The sectional view of Fig. 3a and the plan view of Fig.3b, shows the contact terminals 14 of the terminal assembly adjusted to the terminal pitch Db. In this case, each wrinkle 13 is first pressed and flattened as shown in Figs. 3a and 3b. The pitch between pilot holes 12 is thus increased from Da to Db, as, concommitantly, is the pitch of contact terminals 14. Thus, a terminal assembly having original terminal pitch of Da can be used to assemble an electrical connector with terminal pitch Db. The terminal assembly can thus be used for two types of electrical connectors with different terminal pitches without the need to separate contact terminals 14 from carrier 11 in advance of setting them in a housing connector.

The method of manufacturing the electrical connector terminal assembly will now be described with reference to

Figs. 4a to 4g.

The leading edge of a belt-like conductive metal plate 20 is guided, to a progressive die (not shown) by a feeder (not shown) at the substantially constant pitch steps of Da. In the first stage of the progressive die, pre-pilot holes 21 are formed at one side margin of the plate 20, as shown in Fig. 4a. The pre-pilot hole 21 are used for positioning the plate 20 in the progressive die and compensates for the error in the feed pitch of the feeder before further pilot holes 12 are formed.

As shown in Fig. 4b, in the second stage of the progressive die, slits 22 are formed in the longitudinal direction of plate 20 in a side margin opposite that of pre-pilot holes 21. Naturally, since the conveyance steps of the plate 20 is Da, the pitch of the slits 22 is, likewise, Da.

In the third stage of the progressive die, portions of the plate 20 are, as illustrated in Fig. 4c, crimped by pressing to form V-shaped wrinkles 13 each of which extends from one of the slits 22 to the edge of the plate 20, in line with the pre-pilot holes 21 but opposite that side of the plate 20 in which the holes 21 have been formed. The pitch of the holes 21 is generally maintained despite the crimping operation but stresses are prevented by the provision of the slits 22.

In the fourth stage of the progressive die, pilot holes 12 are formed centrally between each adjacent pair of wrinkles 13, as shown in Fig. 4d and the pilot holes 12

are thereafter used instead of the holes 21 to position the plate 20 in the progressive die.

In the fifth and sixth stages of the progressive die, punching is performed as shown in Figures 4e and 4f to form the individual contact terminals 14 with pitch Da as shown in Fig.4g.

The above-described embodiment of the present invention is merely illustrative and the present invention is not limited to the exact details of this embodiment. Various changes and modifications can be made within the scope of the invention. For example, the wrinkles 13 need not be V-shaped but can be of a U-shape. The pitch adjusting portions 30 can each consist of not just one but a plurality of wrinkles 13 which can be selectively flattened in units of wrinkle groups to provide three or more selectible terminal pitches from a single terminal assembly. The present invention is also applicable to terminal assemblies for manufacturing not only electrical connectors but also IC pins (IC LEG), IC socket terminals, "Griplet" terminals (trade name of E.I. DU PONT DE NEMOURS AND COMPANY, U.S.A.) and so on. Similarly, the wrinkles 13 need not be V-shaped but can be of a U-shape, while pitch adjusting portion 30 can consist not just of one but a plurality of wrinkles 13 which can be selectively flattened in units of wrinkle groups to provide three or more selectible terminal pitches though only a single terminal assembly is used.

CLAIMS

1. A terminal assembly in the form of a conductive plate with a belt-like terminal carrier (11),

a series of pitch adjusting portions (30), of predetermined pitch (Da), formed longitudinally of the terminal carrier and

a series of terminals (14) provided along one longitudinal side of said terminal carrier with a pitch equal to that of said pitch adjusting portions (30), wherein the pitch of the terminals (14) can be altered by pressing and flattening the adjusting portions (30), at least in part.

2. A terminal assembly according to claim 1, wherein said pitch adjusting portions (30) comprise folds or wrinkles.

3. A terminal assembly according to claim 1, wherein each pitch adjusting portion (30) comprises at least one wrinkle, one surface of which projects outward and the other surface of which is recessed.

4. A terminal assembly according to claim 2 or 3, wherein each of said wrinkles is formed widthwise across said terminal carrier.

5. A terminal assembly according to claim 2, 3 or 4, wherein the wrinkles are formed by crimping.

6. A terminal assembly according to any one of claims 2 to 5, wherein each wrinkle is V-shaped.

7. A terminal assembly according to any one of the preceding claims wherein there are pilot holes (12) in the carrier (11) with the predetermined pitch (Da) and the dimensions of each pitch adjusting portion (30) is such that when the portion is pressed and flattened the pitch of the terminals is increased to another predetermined value (Db).

8. A method of assembling a multi-contact electrical connector, utilizing a terminal assembly in accordance with any one of the preceding claims wherein the terminals have a predetermined pitch Da and the connector requires contacts with a selectable pitch of at least Da or Db where Db > Da and comprising setting the terminals in a housing of the connector and thereafter separating the terminals from the carrier of the assembly and adjusting the pitch of the terminals, if desired, from Da to Db by subjecting the pitch adjusting portions of the carrier to a pressing and flattening operation prior to setting the terminals in the housing.

9. A method of making a terminal assembly comprising feeding a conductive metal plate (20) longitudinally in steps of constant predetermined pitch (Da), forming slits (22) in one side margin of the plate with the predetermined pitch (Da), forming pitch adjusting portions (30) composed of folds or wrinkles (13) in the side margin of the plate between the slits (22) and a side edge of the plate at the side margin with the same predetermined pitch (Da), forming pilot holes (12) between

the adjusting portions (30) in the side margin with the same predetermined pitch (Da) and subjecting the plate (20) to one or more punching operations to create shaped contact terminals (14) aligned with the pilot holes (12) and extending laterally outwardly from the side margin which forms a carrier (11) for the terminals (14).

10. A method according to claim 9 and further comprising initially forming pre-pilot holes (21) in the plate along the edge margin opposite the first mentioned margin with the same predetermined pitch (Da) and to aid at least the formation of the slits.

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FIG. 1

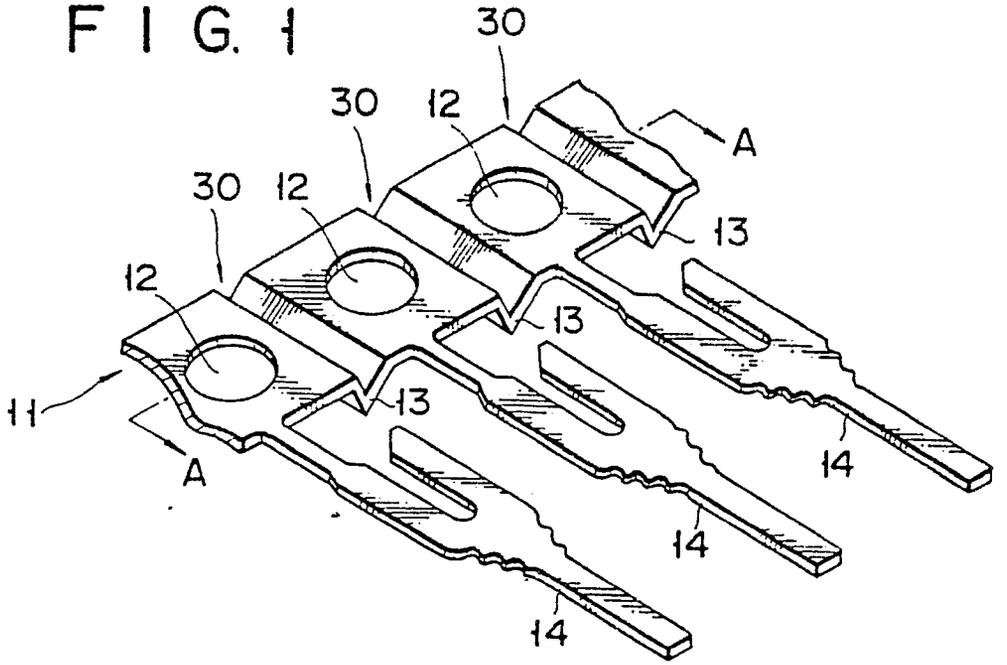

FIG. 2a

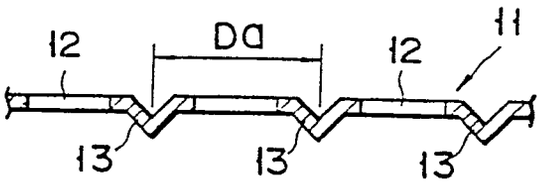

FIG. 3a

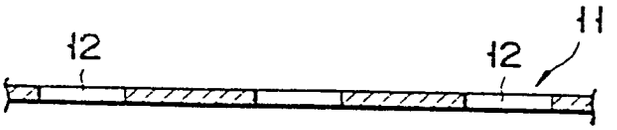

FIG. 2b

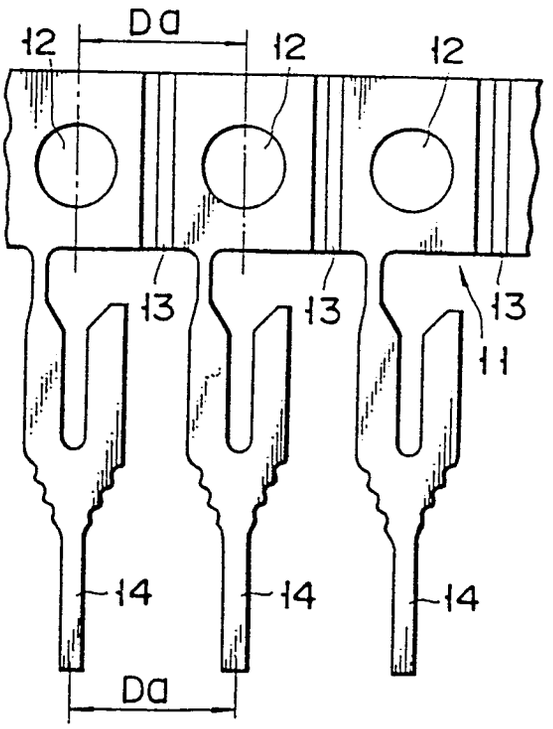

FIG. 3b

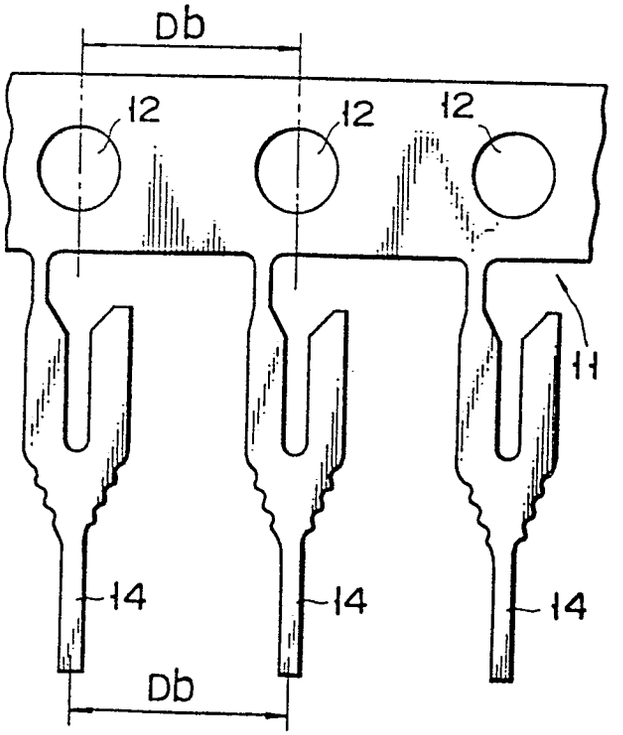

FIG. 4a

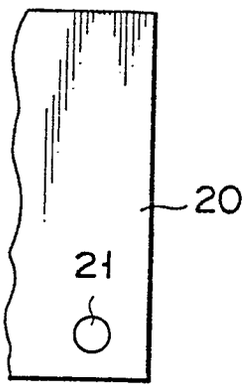

FIG. 4b

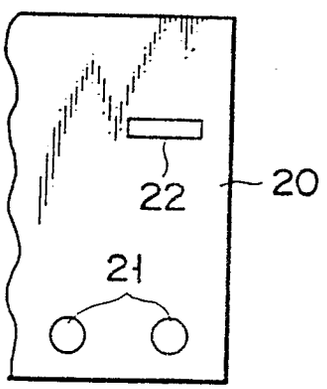

FIG. 4c

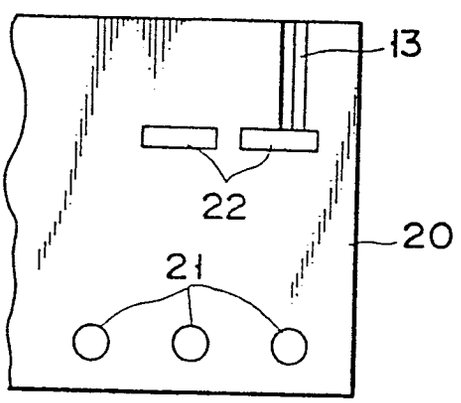

FIG. 4d

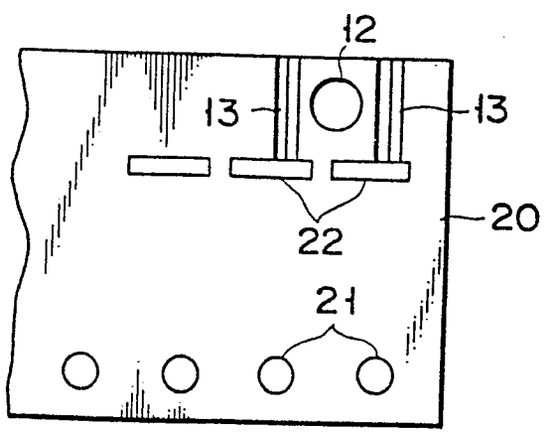

FIG. 4e

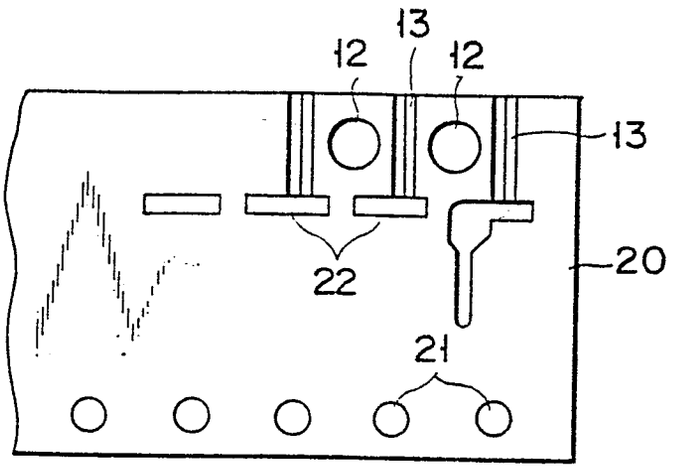

FIG. 4f

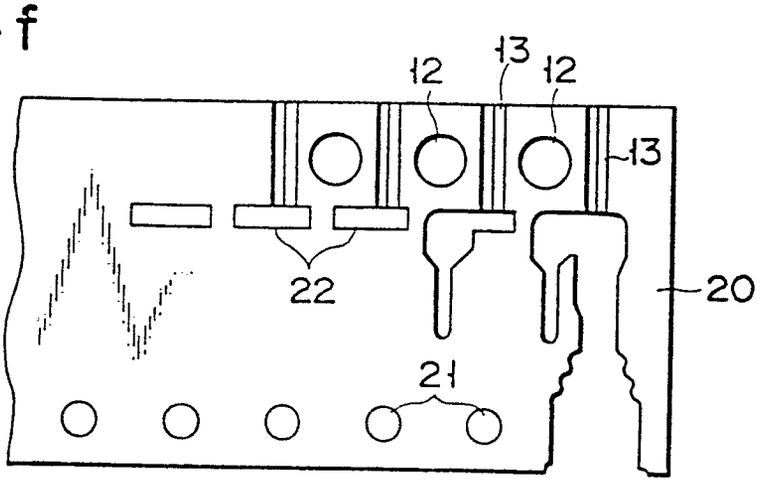

FIG. 4g