

12 Jul 1995 14:54

BLUMBACH KRAMER & PARTNER

Nr. 2296 S. 5/28

Rtmp copy

1

95-041 SN

SPECIFICATIONTHIS SHEET HAS BEEN
REPLACEDELECTRICAL CONNECTOR TERMINAL AND METHOD OF
MAKING ELECTRICAL CONNECTOR WITH SAMEBackground of the Invention

5 The present invention relates to terminals used in electrical connectors and a method of making electrical connectors, and more particularly to an improved terminal assembly of reduced pitch which assures reliable arrangement during mounting in an associated connector housing, as well as a method of making electrical connectors using such terminals.

10 As is well known, electrical connectors are used to connect different electrical components to each other, and wires to printed circuit boards in various electrical apparatus. Such connectors are of multi-pole or terminal structure and use a plurality of terminals laterally arranged at regular intervals and fixed to the housing of the connector. Each terminal typically has a solder tail portion extending from the base of the housing for soldering to an associated wire or electrical trace or contact pad.

20 In making such connectors, a plurality of terminals may be either press-fitted in corresponding holes of a connector housing, or may be embedded in the housing during injection molding of the housing. Specifically, a plurality of terminals may be integrally connected in series to an associated lateral carrier strip, and the series is either press-fit into the connector housing or embedded as a whole in the housing by injection molding an insulative material, such as a plastic, therearound. Finally, the lateral carrier strip is cut and separated from the terminals thus press-fitted or embedded in the housing.

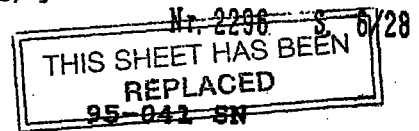
30 In the injection molding of connector housings, inner and outer molds are used to define a mold cavity

This Sheet Has Been Replaced



12 Jul 1995 14:55

BLUMBACH KRAMER & PARTNER



2

and a series terminal-arrangement is inserted
therebetween, so that an insulative housing may be molded
with the series terminal-arrangement embedded therein.
Then, the inner and outer molds are removed and the
5 carrier strip is cut and removed to provide an electric
connector.

Undesired irregular arrangement of terminals,
however, may occur in press-fitting terminals into the
holes of a housing or when inserting them into a mold
10 cavity where terminals and the inner and outer molds are
potentially misaligned relative to each other. The
terminals are very thin and small, and therefore, they
are prone to being misaligned or bent. As the pitch of
the terminals (i.e., the spacing between adjacent
15 terminals) decreases, the potential for misalignment
during assembly of the terminals into a connector housing
increases.

In an attempt to reduce such problems, some
proposals have been made for the manner of press-fitting
20 or for special jigs for setting terminals in molds and
special designed molds. Such proposals are satisfactory
to some extent in improving precision of products, but
they require extra steps and complicated or time-consum-
ing work. Accordingly the manufacturing cost increases,
25 and the manufacturing efficiency decreases.

Summary of the Invention

It is therefore an object of the invention to
provide electrical connectors in which the terminals are
30 substantially free of the disadvantages described above,
assuring the exact positioning of terminals in their
associated connector housings and attaining substantial
improvement of production thereof.

Another object of the invention is to provide a
35 method of making electrical connectors using terminals
having a very small pitch.

To attain these objects, a group of terminals

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

3

95-041 SN

are laterally arranged at regular intervals and connected to a lateral carrier strip via joint portions and contained within an insulative housing. Each terminal has a tapered end at the side opposite to the side on which the terminal is connected to the lateral carrier strip.

This tapered end may converge toward the centerline of the terminal, thus defining two opposing angled, or slanted, surfaces extending from the opposite parallel sides of the terminal rectangular body.

An electrical connector comprising an insulative housing and a group of terminals arranged at regular intervals and mounted to the housing, is therefore improved according to the present invention in that each terminal has a contact portion, a first end at one end thereof and a mold engagement portion at the other end thereof, the engagement portion having a tapered end.

In mounting a plurality of terminals in a connector housing, the arranging of such terminals at reliable and exact intervals can be attained by using appropriate jig means in the form of specially configured mold components having notches arranged at regular intervals corresponding to the desired intervals between the terminals and at which the terminals are to be arranged when fixed in the connector housing. The jig means is used to keep all terminals arranged at exact intervals by interdigitally nesting the tapered ends of the terminals with the notches of the jig means. Thus, irregular arrangement of terminals may be substantially reduced once these terminals are put in the jig means.

Such jig means may be provided in the form of a series of notches in one of the connector housing mold components. The arrangement of terminals are secured between the inside and outside mold components or blocks with the tapered end of each terminal fitted in the corresponding notch in the appropriate mold part prior to

This Sheet Has Been Replaced



12. Jul. 1995 14:56

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 8/28

THIS SHEET HAS BEEN
REPLACED

95-041 SN

4

injection molding, thereby assuring arrangement of all terminals at exact intervals.

5 The present invention also leads itself to a method of making electrical connector, which includes the steps of: providing interengaging mold components that form a cavity for molding insulative connector housings; placing a group of terminals into the mold cavity defined by the mold components; injection-molding an insulative material into the mold cavity and about a portion of the group of terminals, then removing the mold components to expose an electrical connector having the group of terminals arranged at regular intervals and embedded in the insulative connector housing. Such a method is improved according to the present invention in that one of the mold components is provided with a series of notches formed therein at regular intervals corresponding to those at which the group of terminals are to be arranged; the group of terminals are integrally connected to an associated carrier strip, each terminal having a tapered end complementary in shape to the notch made in the appropriate mold component; and the group of terminals are put between the interfitting mold components with the tapered free-end of each terminal fitted in the mold component notch prior to injection molding, thereby assuring arrangement of all terminals at exact intervals.

Other objects and advantages of the present invention will be understood from the following description of a preferred embodiment of the present invention.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED
95-041 SN

5

Brief Description of the Drawing

In the course of the following detailed description, reference will be made to the attached drawings wherein like reference numerals identify like parts and wherein:

FIG. 1 is an elevational view of an electrical connector constructed in accordance with the principles of the present invention;

FIG. 2 is a top plan view of the electrical connector of FIG. 1;

FIG. 3 is a bottom plan view of the electrical connector of FIG. 1;

FIG. 4 is an end view of the electrical connector of FIG. 1 taken along lines 4-4 thereof;

FIG. 5 is a cross sectional view of the electrical connector of FIG. 2 taken along the line F-F thereof;

FIG. 6 is a cross sectional view of the electrical connector of FIG. 2 taken along the line E-E thereof;

FIG. 7 is a longitudinal section of a portion of electrical connector of FIG. 2 taken along the line G-G thereof;

FIG. 8 is a longitudinal section of a portion of electrical connector of FIG. 6 taken along the line J-J thereof;

FIG. 9 is a longitudinal section of a portion of electrical connector of FIG. 6 taken along the line K-K thereof;

FIG. 10 is an enlarged perspective view of a portion of electrical connector of FIG. 1;

FIG. 11 is an enlarged perspective view of a portion of the group of terminals integrally connected to their lateral carrier strip;

FIG. 12 is a perspective view of a portion of the group of terminals connected to a carrier strip, showing how they are placed into a mold cavity between

This Sheet Has Been Replaced



12. Jul. 1995 14:57

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 10/28

THIS SHEET HAS BEEN
REPLACED

95-041 SN

inner and outer mold blocks;

FIG. 13 is a longitudinal section of the terminals of FIG. 12 taken along the line X-X thereof after positioned in place within the mold blocks, and;

5

FIG. 14 is a front view of terminals as seen in the direction indicated by arrow M in Fig. 13.

This Sheet Has Been Replaced

12 Jul. 1995 14:58

BLUMBACH KRAMER & PARTNER

THIS SHEET HAS BEEN
REPLACED

N° 2296

S. 11/28

7

95-041 SN

Detailed Description of the Preferred Embodiments

Referring to FIGS. 1-6, an electrical connector is shown as a receptacle housing with a central elongated space 9 and a plurality of terminals 3 arranged at regular intervals P in its insulative housing 1. Specifically, all of the terminals 3 are arranged laterally at regular intervals P in the central space 9 defined by opposite side walls 19 and 20 of the connector housing. This central space 9 is adapted to receive a mating electrical connector, that is, a plug housing (not shown) for establishing a required electrical connection between the two connector components.

As the trend for reduction in size of consumer electronics grows, the need for connectors of reduced size likewise increases. One way to reduce the overall size of electrical connectors is to reduce the pitch of the connectors, that is, the spacing between adjoining connector terminals. By reducing the pitch, a connector of a given size may accommodate more circuits. The reduction in pitch down to 0.625 mm and the like typically necessitates a reduction in the size of the terminals. As the size of the terminals decrease, the fragility of the terminals increases and the potential for misalignment occurring after the stamping of the terminals increases. Although in a stamping and forming process, the terminal tail portions which extend out from a carrier strip are secured in a predetermined position which can maintain the pitch at that position, the free ends, in this case the engagement portions, are not. The present invention is directed to a solution for this problem.

Referring now to FIGS. 5-7, it can be seen that each terminal 3 is composed of an elongated contact portion 13, a solder tail portion 14 connected to one end of the contact portion 13 and extending outwardly therefrom. A mold engagement portion 15 is connected to the other end of the contact portion 13 and is set within

This Sheet Has Been Replaced



12. Jul. 1995 14:58

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 12/28

THIS SHEET HAS BEEN
REPLACED

8

95-041 SN

the connector housing sidewalls 19, 20. The contact portion 13 is exposed along the central space 9 of the housing 1, and serves to provide contact with an opposing terminal of the plug housing. The solder tail portion 14 extends out of the bottom 21 of the housing 1. Finally, the engagement portion 15 is situated in a recess 30 made in the top of the housing 1. As shown, a portion of each terminal 3 is embedded in the housing 1.

Prior to the mounting of terminals 3 to the housing 1, these terminals 3 exist in a form wherein they are connected to a lateral carrier strip 4 via joint parts 5 (FIGS. 11 and 12) to define a series arrangement of terminals 2 which have a predetermined pitch P. The carrier strip-terminal assembly is formed by stamping and forming such that each terminal is formed so as to have a body portion 6 (synonymous with the contact portion 13 illustrated in FIGS. 5-7) interconnected to the carrier strip 4 by means of a joint portion 5, which when cut along line C, defines the solder tail portion 14 of each terminal 3. Each terminal of the arrangement 2 has a tapered free-end 7.

The free-end 7 has two opposing angled sides or surfaces 8 converging toward the centerline 10 of each terminal. After completing the mounting of terminals 3 to the housing 1, the carrier strip 4 is cut along the line C (FIG. 12) and is removed from the arrangement of terminals 2. The remaining portion of the joint portion 5 serves as the solder tail portion, which is soldered to a selected conductor on a printed circuit board (not shown).

The housing 1 has positioning pegs 22 on its bottom 21 (FIGS. 4 and 7) so that the electrical connector 1 may be fixed to a printed circuit board with the positioning pegs 22 fitted in the positioning holes of the printed circuit board. The tapered free-end 7 (FIGS. 11-13) of each terminal 3 serves as the mold engagement portion.

This Sheet Has Been Replaced



12. Jul. 1995 14:59

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 13/28

THIS SHEET HAS BEEN
REPLACED

9

95-641 SN

As described earlier, the tapered free-end 7 of the terminal 3 has opposing slanted edges or surfaces 8 inclined symmetrically with respect to the centerline 10 between the opposite parallel sides 11 and 12 of the rectangular terminal body. This symmetrical shape of the tapered free-end is advantageous to help in laterally aligning terminals 3 at the correct terminal spacing or pitch P.

In mounting terminals 3 in the connector housing 1, the arrangement of terminals 3 at exact intervals is attained by using appropriate jig means having notches 18 arranged at regular intervals corresponding to the intervals P at which all terminals 3 are to be arranged when mounted in the housing 1. Specifically such jig means is used to keep all terminals 3 arranged at exact intervals P by interdigitally nesting the tapered free-ends 7 of the terminals 3 with the counter notches of the jig means. Without the use of such jig means, the terminal tails 14 are positioned by virtue of their connection to the carrier strip but the mold engagement portions 15 are not positioned because they are free ends. Thus, irregular arrangement or spacing of terminals can be substantially reduced in a forcible manner by the jig means until the terminals 3 are put in correct position. Such jig means is preferably provided in the form of a series of notches in either one of the mold parts 16 and 17. (FIG. 13) The array of terminals 3 is placed between the two mold parts 16 and 17 with the tapered free-end 7 of each terminal 3 fitted in the corresponding notch in the mold part prior to injection molding, thereby assuring arrangement of all terminals 3 at exact intervals P, which is effective in maintaining very small pitches, such as 0.625mm or the like.

The method of making electrical connectors having small pitch terminals according to the present invention will now be described. As shown in FIG. 13,

This Sheet Has Been Replaced



12. Jul. 1995 14:59

BLUMBACH KRAMER & PARTNER

N. 2296

S. 14/28

THIS SHEET HAS BEEN
REPLACED

10

95-041 SN

two mold parts 16 and 17 are used for molding insulative connector housings 1 as is known in the art. An array 2 of terminals 3 (FIG. 12) having been previously stamped and formed as described above is placed between the mold parts 16 and 17, and an insulative material, such as plastic, is injection-molded therearound. Thereafter, the mold parts 16 and 17 are removed to leave an electrical connector having the arrangement 2 of terminals 3 arranged at regular intervals P and embedded in the insulation housing 1. As described above, one of the inside and outside mold parts 16 and 17 (outside mold part 16 in FIG. 13) has a series of notches 18 spaced at regular intervals corresponding to the interval P at which the arrangement 2 of terminals 3 are to be set.

The array 2 of terminals 3 is connected to its associated carrier strip 4, and each terminal 3 has a tapered free-end 7 corresponding in shape and size to the notch 18 made in the mold block 16. The terminal arrangement 2 is placed between the mold block 16 and 17 with the tapered free-end 7 of each terminal 3 fitted in the corresponding notch 18 in the mold part 16 prior to injection molding. Simultaneously, the notchless mold block 17 (shown on the inside of FIG. 13) pushes all of the terminals 3 against the notched mold block 16, thereby forcibly reducing any deviations N which may occur by providing a force M as indicated by arrow M in FIG. 13, to thus arrange all of the terminals 3 at their intended pitch intervals P as seen in FIG. 14.

Whereas the terminal tail portions 14 are positioned by means of their connection to the carrier strip 4, the mold engagement portions 15 (by way of their free ends 7) are now positioned with the notched mold block 16 and held thereagainst by mold block 17. This corrective arrangement can be performed at an increased efficiency, and accordingly, highly precise electrical connectors can be produced more efficiently.

The notched mold 16 may have a series of

This Sheet Has Been Replaced



12. Jul. 1995 15:00

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 15/28

THIS SHEET HAS BEEN
REPLACED

11

95-041 SN

projections (shown) formed thereon to properly position and support the terminals 3 prior to and during molding. These mold projections form a series of holes 23. These holes 23 can be used for testing the terminals 3 if desired. FIGS. 8 and 10 illustrate the shape of the insulative housing 1 made by using an outer mold 16 having a series of notches 18 and an inner mold 17 having no notches. The resultant notches 24 are formed in the connector housing 1 as a result of the configuration of the mold block 16 and have no adverse effect on the function of the electric connector. Since the notches 18 of the mold engage the slanted edges 8 of terminal engagement portions 15, substantially no plastic is molded onto these edges. There is, however, plastic above and below the engagement portions 15.

In this particular embodiment, the electrical connector is described as a receptacle, but it may be a plug-style electrical connector. The tapered free-end of the terminal is described above as converging toward the center line 10, thus defining two opposing slanted edges extending from the opposing parallel sides 11 and 12 of the terminal rectangular body. The tapered free-ends of the terminals, however, may also have a single slanted edge inclining from one of its opposing parallel sides 11 and 12 of the terminal rectangular body and traversing the centerline 10 and ending at the other parallel side of the terminal rectangular body. The single inclined edge can be formed more easily than the double angled edge in the tapered end of the terminal. In addition, other tapered surfaces such as arcuate, stepped or other shapes that would accurately guide and position the tapered ends into the recesses in the mold could be used.

As may be understood from the above, terminals according to the present invention have tapered free-ends formed so as to be complimentary in shape to counter notches made in either of the inner and outer molds, thereby permitting corrective adjustment of terminals

This Sheet Has Been Replaced



12. Jul. 1995 15:01

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 16/28

THIS SHEET HAS BEEN
REPLACED

12

95-041 SN

thus to arrange them at exact intervals in injection
molding.

This Sheet Has Been Replaced



12 Jul 1995 15:01

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 17/28

THIS SHEET HAS BEEN
REPLACED

12 95-041 SN

Claims:

1. An electrical connector (1) comprising:
an insulative housing having a pair of spaced apart,
generally parallel sidewalls (19, 20);
a plurality of terminals (3) mounted in said housing
generally along the length of said housing sidewalls,
said terminals being generally parallel and spaced apart
a predetermined distance; and
each terminal including a first end (14) for
interconnection to an electrical component, a second
opposite end (15) positioned within said housing, and a
terminal body portion (6) between said first and second
ends, each said second end having a tapered portion (7)
adapted for engagement with a correspondingly shaped
recess (18) in a mold component (16) to maintain said
terminal second ends in a predetermined array said
predetermined distance (P) apart in order to maintain
said terminal body portions in a generally parallel array
and spaced apart said predetermined distance prior to
overmolding said housing about said terminals.

2. The electrical connector as defined in
claim 1, wherein each of said terminal body portions has
two generally parallel sides (11, 12) which define a
width of each of said terminals, and each of said second
ends has at least one tapered end edge (8) extending from
one of said body portion sides towards a centerline (10)
of said terminal.

3. The electrical connector as defined in
claim 2, wherein substantially no plastic is molded onto
said tapered end edge of said second end upon overmolding
said housing about said terminals.



This Sheet Has Been Replaced



12 Jul 1995 15:02

BLUMBACH KRAMER & PARTNER

NY 2286

S. 18/28

THIS SHEET HAS BEEN
REPLACED

14

95-041 SN

5

4. The electrical connector as defined in claim 2, wherein each of said terminal second ends includes two tapered end edges extending from said generally parallel sides of said body portions toward said terminal centerline.

5. The electrical connector as defined in claim 4, wherein said two tapered end edges converge and intersect with each other generally at said centerline to define said tapered second end of said terminals.

6. The electrical connector as defined in claim 5 wherein said first end is a solder tail for solder interconnection to circuitry of an electronic circuit.

7. The electrical connector as defined in claim 1, wherein each of said terminal second ends has two generally parallel sides and at least one tapered end edge extending from one of said second end sides towards a centerline of said second end.

8. The electrical connector as defined in claim 7, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.

5

9. The electrical connector as defined in claim 8, wherein each of said terminal second ends includes two tapered end edges extending from said generally parallel sides of said second ends toward said centerline.



This Sheet Has Been Replaced



12. Jul. 1995 15:02

BLUMBACH KRAMER & PARTNER

Nr. 2296

S. 19/28

THIS SHEET HAS BEEN
REPLACED

15

95-041 SN

10. The electrical connector as defined in claim 9, wherein said two tapered end edges converge and intersect with each other generally at said centerline to define said tapered portion of said second end of said terminals.

11. The electrical connector as defined in claim 1, wherein said body portion of each terminal is generally rectangular and said first and second ends are generally parallel.

12. The electrical connector as defined in claim 11, wherein said first and second ends extend away from said terminal body portions.

13. The electrical connector as defined in claim 1, wherein said housing includes a series of projections extending from said housing sidewalls and generally conforming to the shape of said tapered portion of said second end of said terminals.

14. The electrical connector as defined in claim 13, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.

15. A method of manufacturing an electrical connector having an insulative housing (1) molded about a plurality of terminals (3), said insulative housing having a pair of spaced apart, generally parallel sidewalls (19, 20), said plurality of terminals being mounted in said housing generally along the length of said housing sidewalls, said terminals being generally parallel and spaced apart a predetermined distance, the method comprising the steps of:

providing interengaging mold components (16, 17) that cooperate to define a mold cavity corresponding



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

16

95-041 SN

to the configuration of said connector housing, at least one of said mold components having a series of engagement recesses (18) in a surface thereof, said recesses being spaced apart said predetermined distance (P);

providing a carrier strip assembly (2) having an elongated carrier strip (4) with a plurality of stamped and formed terminals (3) extending generally transversely from said strip spaced apart said predetermined distance, each terminal including a first end (14) for interconnection to an electrical component, a second opposite, cantilevered end (15) for positioning within said housing, and a terminal body portion (6) between said first and second ends, each said terminal being connected to said carrier strip generally adjacent said first end, said carrier strip maintaining said terminals in an array spaced apart by said predetermined distance, each said second end having a tapered portion (8) adapted for engagement with one of said engagement recesses in said at least one mold component, said tapered portion and said engagement recess being correspondingly shaped to maintain said terminal second ends in a predetermined array said predetermined distance apart within said mold cavity in order to maintain said terminal body portions in a generally parallel array and spaced apart said predetermined distance prior to overmolding said housing about said terminals,

inserting said tapered portion of said terminal second ends into said mold component recesses in order to align said second ends in an array said predetermined distance apart;

securing said carrier strip assembly substantially within said mold cavity; and

injecting an insulative molding material into said mold cavity defined by said mold components to form said connector housing about said terminals.

This Sheet Has Been Replaced



16. The method of claim 15, further including the step of removing said terminals from said carrier strip adjacent said first ends to define free solder tail portions extending away from said connector housing.

17. The method of claim 15, further including the step of holding said terminals proximate their body portion during said injection molding in order to define a series of openings (23) in said connector housings in which a portion of said terminals are exposed.

5

18. The method of claim 15, wherein said securing step includes clamping said carrier strip assembly between some of said mold components.



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

18 93-041 SN

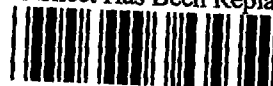
ABSTRACT OF THE DISCLOSURE

ELECTRICAL CONNECTOR TERMINAL AND METHOD OF MAKING
ELECTRICAL CONNECTOR WITH SAME

5

An improved electrical connector has terminals (3) with tapered mold engaging ends (8, 15) formed to be complimentary in shape to notches (18) made in a mold component (16) in order to retain the pitch (P) of the terminal ends during injection molding of a connector housing (1) thereabout.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

FIG. 1

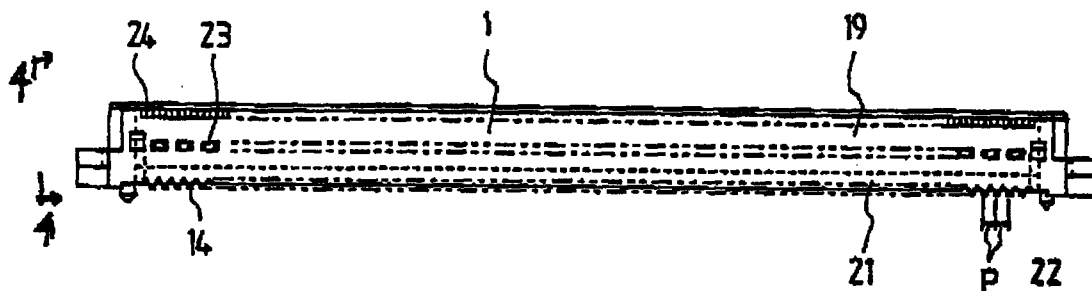


FIG. 2

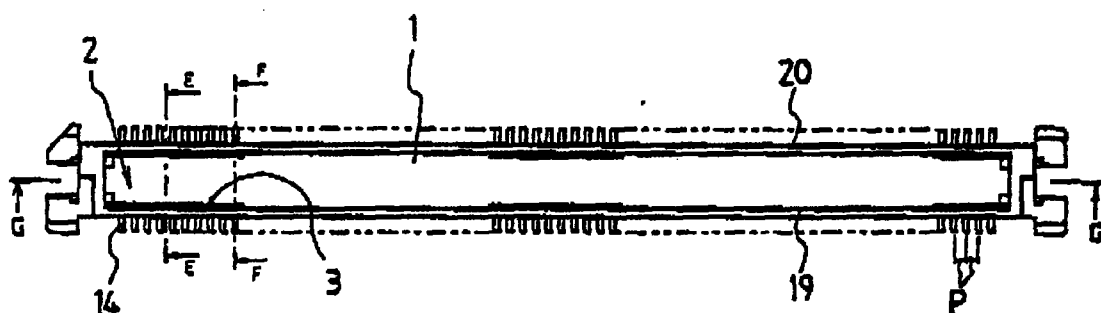
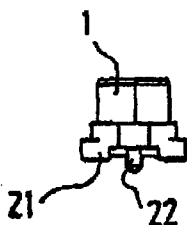


FIG. 3



FIG. 4



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

FIG. 5

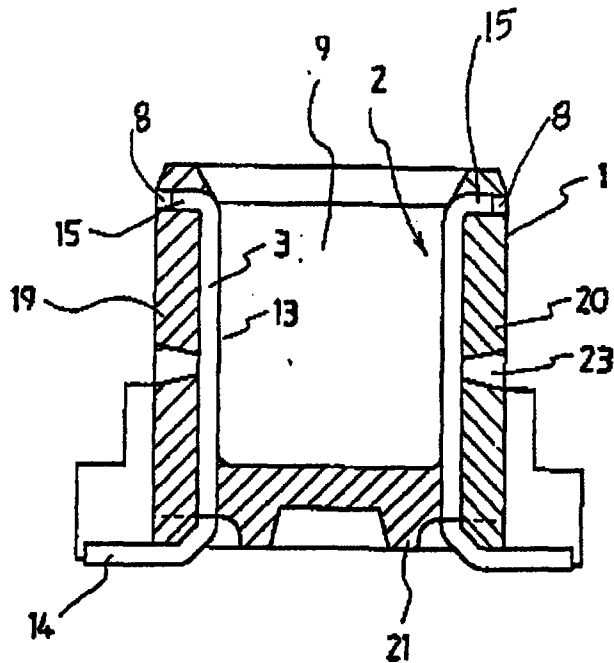
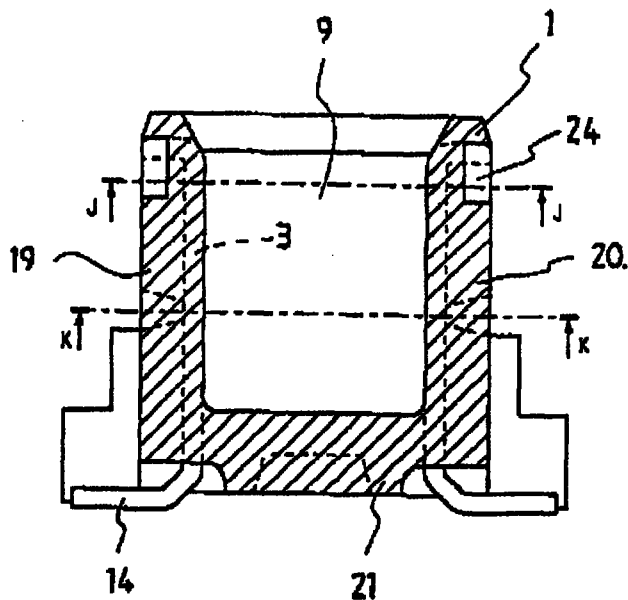


FIG. 6



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

FIG. 7

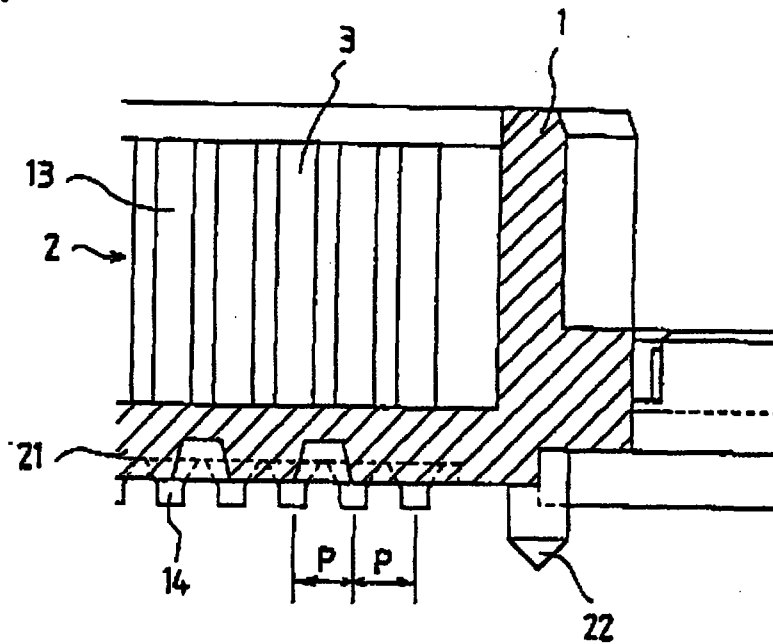


FIG. 8

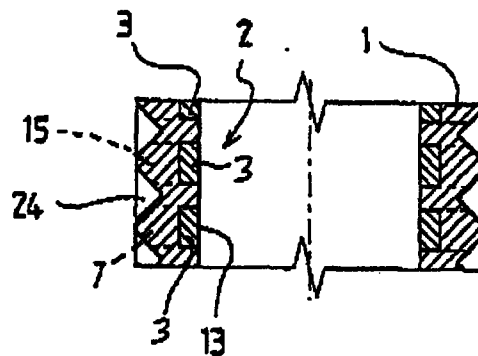
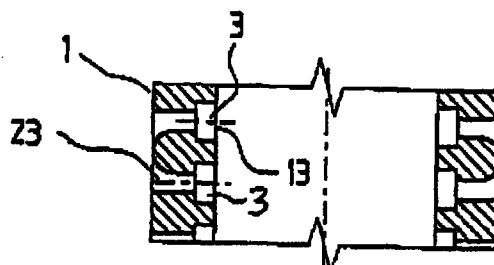


FIG. 9



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

FIG. 10

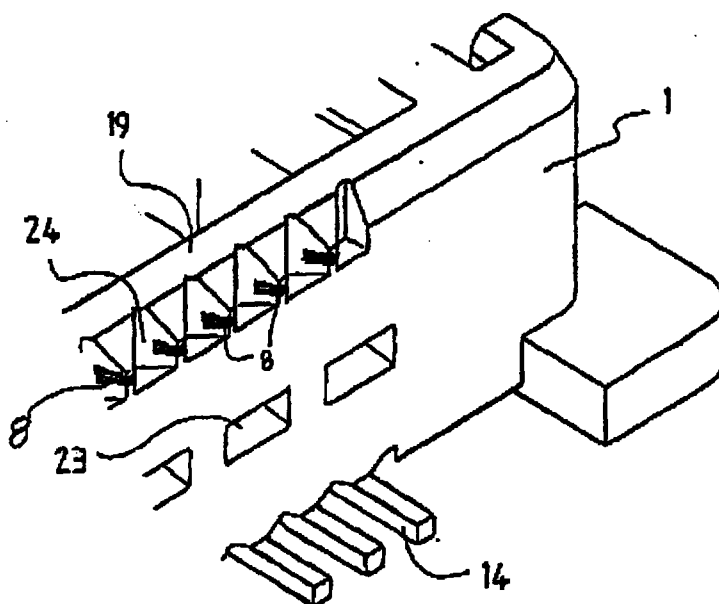
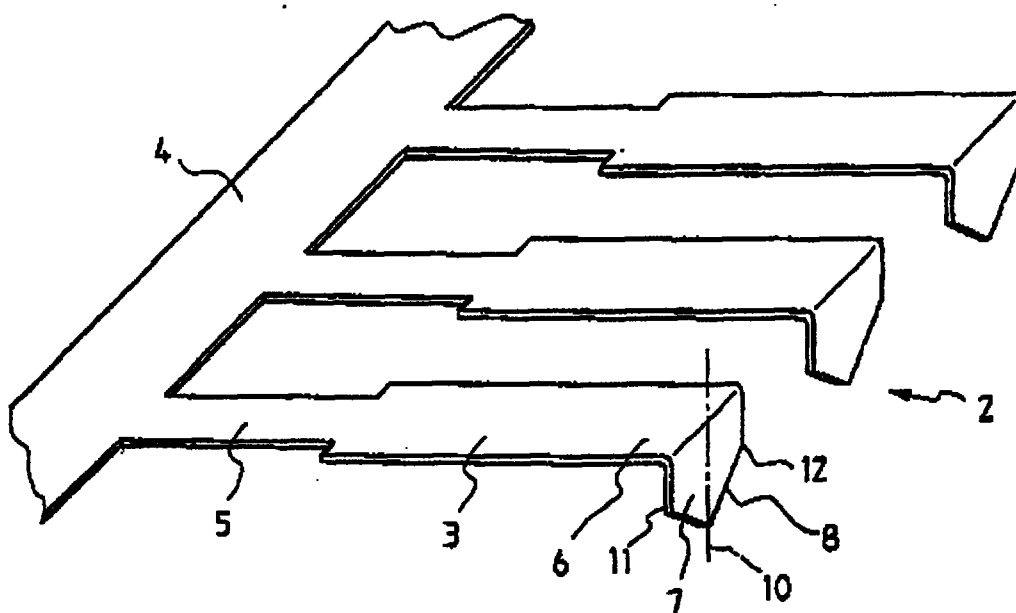


FIG. 11



This Sheet Has Been Replaced

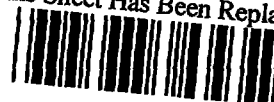
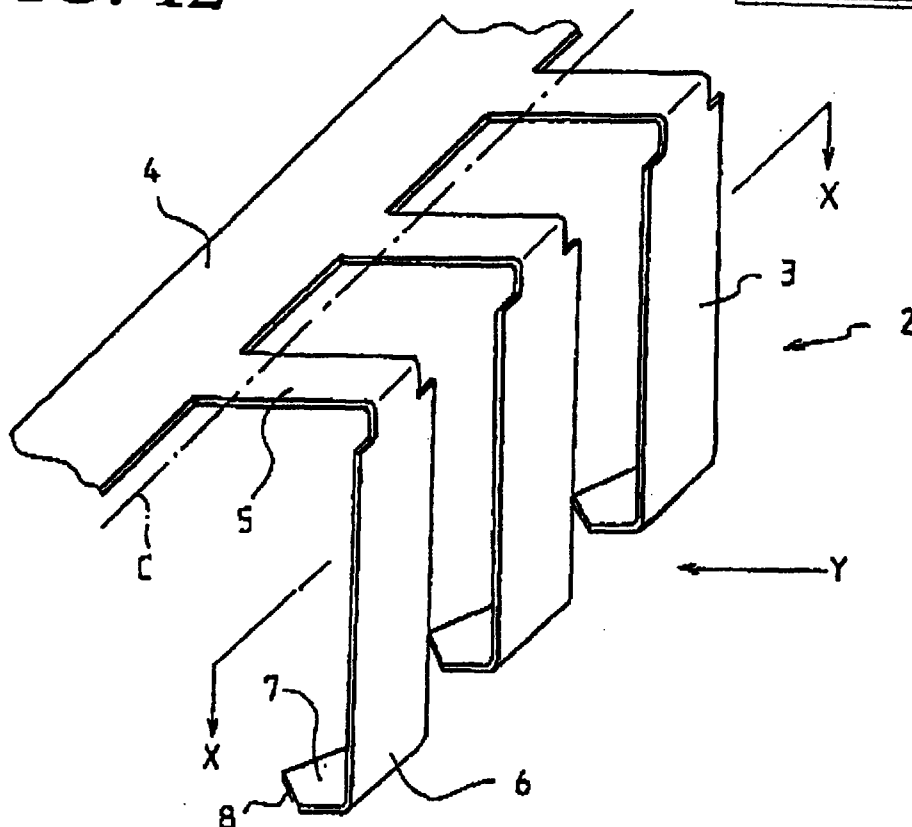
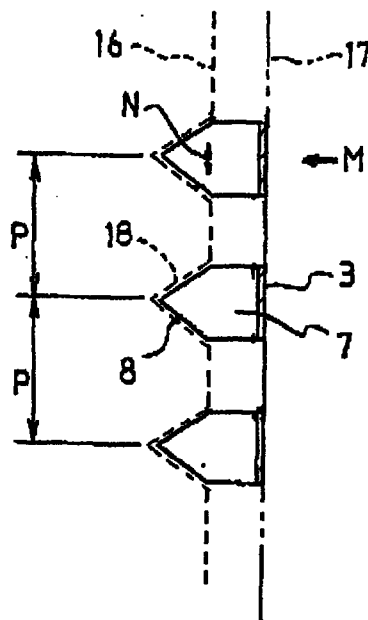


FIG. 12



THIS SHEET HAS BEEN REPLACED

FIG. 13



This Sheet Has Been Replaced



12 Jul 1995 15:10

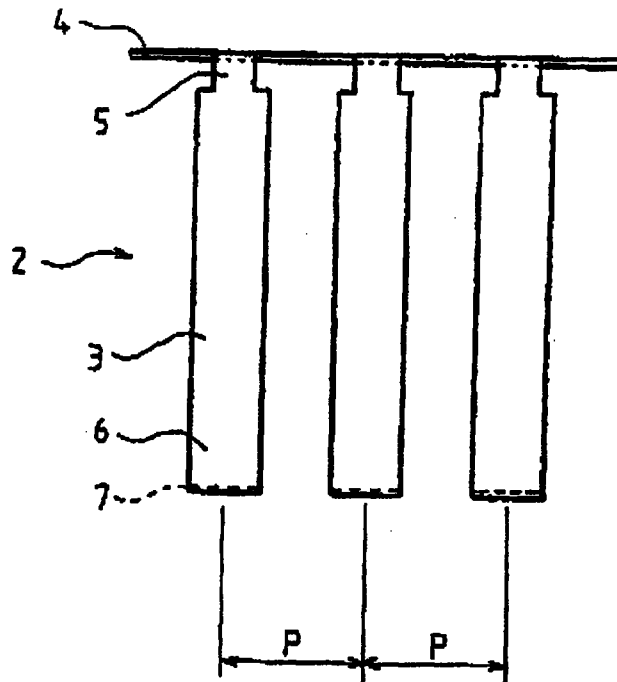
BLUMBACH KRAMER & PARTNER

Nr. 2296 S. 28/28

6 of 6

FIG. 14

THIS SHEET HAS BEEN
REPLACED



This Sheet Has Been Replaced



SPECIFICATIONELECTRICAL CONNECTOR TERMINAL AND METHOD OF
MAKING ELECTRICAL CONNECTOR WITH SAMEBackground of the Invention

The present invention relates to terminals used in electrical connectors and a method of making electrical connectors, and more particularly to an improved terminal assembly of reduced pitch which assures reliable arrangement during mounting in an associated connector housing, as well as a method of making electrical connectors using such terminals.

As is well known, electrical connectors are used to connect different electrical components to each other, and wires to printed circuit boards in various electrical apparatus. Such connectors are of multi-pole or terminal structure and use a plurality of terminals laterally arranged at regular intervals and fixed to the housing of the connector. Each terminal typically has a solder tail portion extending from the base of the housing for soldering to an associated wire or electrical trace or contact pad.

In making such connectors, a plurality of terminals may be either press-fitted in corresponding holes of a connector housing, or may be embedded in the housing during injection molding of the housing. Specifically, a plurality of terminals may be integrally connected in series to an associated lateral carrier strip, and the series is either press-fit into the connector housing or embedded as a whole in the housing by injection molding an insulative material, such as a plastic, therearound. Finally, the lateral carrier strip is cut and separated from the terminals thus press-fitted or embedded in the housing.

In the injection molding of connector housings, inner and outer molds are used to define a mold cavity

and a series terminal-arrangement is inserted therebetween, so that an insulative housing may be molded with the series terminal-arrangement embedded therein. Then, the inner and outer molds are removed and the carrier strip is cut and removed to provide an electric connector.

Undesired irregular arrangement of terminals, however, may occur in press-fitting terminals into the holes of a housing or when inserting them into a mold cavity where terminals and the inner and outer molds are potentially misaligned relative to each other. The terminals are very thin and small, and therefore, they are prone to being misaligned or bent. As the pitch of the terminals (i.e., the spacing between adjacent terminals) decreases, the potential for misalignment during assembly of the terminals into a connector housing increases.

In an attempt to reduce such problems, some proposals have been made for the manner of press-fitting or for special jigs for setting terminals in molds and special designed molds. Such proposals are satisfactory to some extent in improving precision of products, but they require extra steps and complicated or time-consuming work. Accordingly the manufacturing cost increases, and the manufacturing efficiency decreases.

Summary of the Invention

It is therefore an object of the invention to provide electrical connectors in which the terminals are substantially free of the disadvantages described above, assuring the exact positioning of terminals in their associated connector housings and attaining substantial improvement of production thereof.

Another object of the invention is to provide a method of making electrical connectors using terminals having a very small pitch.

To attain these objects, a group of terminals

are laterally arranged at regular intervals and connected to a lateral carrier strip via joint portions and contained within an insulative housing. Each terminal has a tapered end at the side opposite to the side on which the terminal is connected to the lateral carrier strip.

This tapered end may converge toward the centerline of the terminal, thus defining two opposing angled, or slanted, surfaces extending from the opposite parallel sides of the terminal rectangular body.

An electrical connector comprising an insulative housing and a group of terminals arranged at regular intervals and mounted to the housing, is therefore improved according to the present invention in that each terminal has a contact portion, a first end at one end thereof and a mold engagement portion at the other end thereof, the engagement portion having a tapered end.

In mounting a plurality of terminals in a connector housing, the arranging of such terminals at reliable and exact intervals can be attained by using appropriate jig means in the form of specially configured mold components having notches arranged at regular intervals corresponding to the desired intervals between the terminals and at which the terminals are to be arranged when fixed in the connector housing. The jig means is used to keep all terminals arranged at exact intervals by interdigitally nesting the tapered ends of the terminals with the notches of the jig means. Thus, irregular arrangement of terminals may be substantially reduced once these terminals are put in the jig means.

Such jig means may be provided in the form of a series of notches in one of the connector housing mold components. The arrangement of terminals are secured between the inside and outside mold components or blocks with the tapered end of each terminal fitted in the corresponding notch in the appropriate mold part prior to

injection molding, thereby assuring arrangement of all terminals at exact intervals.

5 The present invention also leads itself to a method of making electrical connector, which includes the steps of: providing interengaging mold components that form a cavity for molding insulative connector housings; placing a group of terminals into the mold cavity defined by the mold components; injection-molding an insulative material into the mold cavity and about a portion of the group of terminals, then removing the mold components to expose an electrical connector having the group of terminals arranged at regular intervals and embedded in the insulative connector housing. Such a method is improved according to the present invention in that one of the mold components is provided with a series of notches formed therein at regular intervals corresponding to those at which the group of terminals are to be arranged; the group of terminals are integrally connected to an associated carrier strip, each terminal having a tapered end complementary in shape to the notch made in the appropriate mold component; and the group of terminals are put between the interfitting mold components with the tapered free-end of each terminal fitted in the mold component notch prior to injection molding, thereby assuring arrangement of all terminals at exact intervals.

Other objects and advantages of the present invention will be understood from the following description of a preferred embodiment of the present invention.

Brief Description of the Drawing

In the course of the following detailed description, reference will be made to the attached drawings wherein like reference numerals identify like parts and wherein:

FIG. 1 is an elevational view of an electrical connector constructed in accordance with the principles of the present invention;

FIG. 2 is a top plan view of the electrical connector of FIG. 1;

FIG. 3 is a bottom plan view of the electrical connector of FIG. 1;

FIG. 4 is an end view of the electrical connector of FIG. 1 taken along lines 4-4 thereof;

FIG. 5 is a cross sectional view of the electrical connector of FIG. 2 taken along the line F-F thereof;

FIG. 6 is a cross sectional view of the electrical connector of FIG. 2 taken along the line E-E thereof;

FIG. 7 is a longitudinal section of a portion of electrical connector of FIG. 2 taken along the line G-G thereof;

FIG. 8 is a longitudinal section of a portion of electrical connector of FIG. 6 taken along the line J-J thereof;

FIG. 9 is a longitudinal section of a portion of electrical connector of FIG. 6 taken along the line K-K thereof;

FIG. 10 is an enlarged perspective view of a portion of electrical connector of FIG. 1;

FIG. 11 is an enlarged perspective view of a portion of the group of terminals integrally connected to their lateral carrier strip;

FIG. 12 is a perspective view of a portion of the group of terminals connected to a carrier strip, showing how they are placed into a mold cavity between

Date : 15 FEB 1996

6

inner and outer mold blocks;

FIG. 13 is a longitudinal section of the terminals of FIG. 12 taken along the line X-X thereof after positioned in place within the mold blocks, and;

5

FIG. 14 is a front view of terminals as seen in the direction indicated by arrow M in Fig. 13.

Detailed Description of the Preferred Embodiments

Referring to FIGS. 1-6, an electrical connector is shown as a receptacle housing with a central elongated space 9 and a plurality of terminals 3 arranged at regular intervals P in its insulative housing 1. Specifically, all of the terminals 3 are arranged laterally at regular intervals P in the central space 9 defined by opposite side walls 19 and 20 of the connector housing. This central space 9 is adapted to receive a mating electrical connector, that is, a plug housing (not shown) for establishing a required electrical connection between the two connector components.

As the trend for reduction in size of consumer electronics grows, the need for connectors of reduced size likewise increases. One way to reduce the overall size of electrical connectors is to reduce the pitch of the connectors, that is, the spacing between adjoining connector terminals. By reducing the pitch, a connector of a given size may accommodate more circuits. The reduction in pitch down to 0.625 mm and the like typically necessitates a reduction in the size of the terminals. As the size of the terminals decrease, the fragility of the terminals increases and the potential for misalignment occurring after the stamping of the terminals increases. Although in a stamping and forming process, the terminal tail portions which extend out from a carrier strip are secured in a predetermined position which can maintain the pitch at that position, the free ends, in this case the engagement portions, are not. The present invention is directed to a solution for this problem.

Referring now to FIGS. 5-7, it can be seen that each terminal 3 is composed of an elongated contact portion 13, a solder tail portion 14 connected to one end of the contact portion 13 and extending outwardly therefrom. A mold engagement portion 15 is connected to the other end of the contact portion 13 and is set within

the connector housing sidewalls 19, 20. The contact portion 13 is exposed along the central space 9 of the housing 1, and serves to provide contact with an opposing terminal of the plug housing. The solder tail portion 14 extends out of the bottom 21 of the housing 1. Finally, the engagement portion 15 is situated in a recess 30 made in the top of the housing 1. As shown, a portion of each terminal 3 is embedded in the housing 1.

Prior to the mounting of terminals 3 to the housing 1, these terminals 3 exist in a form wherein they are connected to a lateral carrier strip 4 via joint parts 5 (FIGS. 11 and 12) to define a series arrangement of terminals 2 which have a predetermined pitch P. The carrier strip-terminal assembly is formed by stamping and forming such that each terminal is formed so as to have a body portion 6 (synonymous with the contact portion 13 illustrated in FIGS. 5-7) interconnected to the carrier strip 4 by means of a joint portion 5, which when cut along line C, defines the solder tail portion 14 of each terminal 3. Each terminal of the arrangement 2 has a tapered free-end 7.

The free-end 7 has two opposing angled sides or surfaces 8 converging toward the centerline 10 of each terminal. After completing the mounting of terminals 3 to the housing 1, the carrier strip 4 is cut along the line C (FIG. 12) and is removed from the arrangement of terminals 2. The remaining portion of the joint portion 5 serves as the solder tail portion, which is soldered to a selected conductor on a printed circuit board (not shown).

The housing 1 has positioning pegs 22 on its bottom 21 (FIGS. 4 and 7) so that the electrical connector 1 may be fixed to a printed circuit board with the positioning pegs 22 fitted in the positioning holes of the printed circuit board. The tapered free-end 7 (FIGS. 11-13) of each terminal 3 serves as the mold engagement portion.

As described earlier, the tapered free-end 7 of the terminal 3 has opposing slanted edges or surfaces 8 inclined symmetrically with respect to the centerline 10 between the opposite parallel sides 11 and 12 of the rectangular terminal body. This symmetrical shape of the tapered free-end is advantageous to help in laterally aligning terminals 3 at the correct terminal spacing or pitch P.

In mounting terminals 3 in the connector housing 1, the arrangement of terminals 3 at exact intervals is attained by using appropriate jig means having notches 18 arranged at regular intervals corresponding to the intervals P at which all terminals 3 are to be arranged when mounted in the housing 1. Specifically such jig means is used to keep all terminals 3 arranged at exact intervals P by interdigitally nesting the tapered free-ends 7 of the terminals 3 with the counter notches of the jig means. Without the use of such jig means, the terminal tails 14 are positioned by virtue of their connection to the carrier strip but the mold engagement portions 15 are not positioned because they are free ends. Thus, irregular arrangement or spacing of terminals can be substantially reduced in a forcible manner by the jig means until the terminals 3 are put in correct position. Such jig means is preferably provided in the form of a series of notches in either one of the mold parts 16 and 17. (FIG. 13) The array of terminals 3 is placed between the two mold parts 16 and 17 with the tapered free-end 7 of each terminal 3 fitted in the corresponding notch in the mold part prior to injection molding, thereby assuring arrangement of all terminals 3 at exact intervals P, which is effective in maintaining very small pitches, such as 0.625mm or the like.

The method of making electrical connectors having small pitch terminals according to the present invention will now be described. As shown in FIG. 13,

15 FEB 1996

Date :.....

two mold parts 16 and 17 are used for molding insulative connector housings 1 as is known in the art. An array 2 of terminals 3 (FIG. 12) having been previously stamped and formed as described above is placed between the mold parts 16 and 17, and an insulative material, such as plastic, is injection-molded therearound. Thereafter, the mold parts 16 and 17 are removed to leave an electrical connector having the arrangement 2 of terminals 3 arranged at regular intervals P and embedded in the insulation housing 1. As described above, one of the inside and outside mold parts 16 and 17 (outside mold part 16 in FIG. 13) has a series of notches 18 spaced at regular intervals corresponding to the interval P at which the arrangement 2 of terminals 3 are to be set.

The array 2 of terminals 3 is connected to its associated carrier strip 4, and each terminal 3 has a tapered free-end 7 corresponding in shape and size to the notch 18 made in the mold block 16. The terminal arrangement 2 is placed between the mold block 16 and 17 with the tapered free-end 7 of each terminal 3 fitted in the corresponding notch 18 in the mold part 16 prior to injection molding. Simultaneously, the notchless mold block 17 (shown on the inside of FIG. 13) pushes all of the terminals 3 against the notched mold block 16, thereby forcibly reducing any deviations N which may occur by providing a force M as indicated by arrow M in FIG. 13, to thus arrange all of the terminals 3 at their intended pitch intervals P as seen in FIG. 14.

Whereas the terminal tail portions 14 are positioned by means of their connection to the carrier strip 4, the mold engagement portions 15 (by way of their free ends 7) are now positioned with the notched mold block 16 and held thereagainst by mold block 17. This corrective arrangement can be performed at an increased efficiency, and accordingly, highly precise electrical connectors can be produced more efficiently.

The notched mold 16 may have a series of

projections (shown) formed thereon to properly position and support the terminals 3 prior to and during molding. These mold projections form a series of holes 23. These holes 23 can be used for testing the terminals 3 if
5 desired. FIGS. 8 and 10 illustrate the shape of the insulative housing 1 made by using an outer mold 16 having a series of notches 18 and an inner mold 17 having no notches. The resultant notches 24 are formed in the connector housing 1 as a result of the configuration of
10 the mold block 16 and have no adverse effect on the function of the electric connector. Since the notches 18 of the mold engage the slanted edges 8 of terminal engagement portions 15, substantially no plastic is molded onto these edges. There is, however, plastic
15 above and below the engagement portions 15.

In this particular embodiment, the electrical connector is described as a receptacle, but it may be a plug-style electrical connector. The tapered free-end of the terminal is described above as converging toward the
20 center line 10, thus defining two opposing slanted edges extending from the opposing parallel sides 11 and 12 of the terminal rectangular body. The tapered free-ends of the terminals, however, may also have a single slanted edge inclining from one of its opposing parallel sides 11
25 and 12 of the terminal rectangular body and traversing the centerline 10 and ending at the other parallel side of the terminal rectangular body. The single inclined edge can be formed more easily than the double angled edge in the tapered end of the terminal. In addition,
30 other tapered surfaces such as arcuate, stepped or other shapes that would accurately guide and position the tapered ends into the recesses in the mold could be used.

As may be understood from the above, terminals according to the present invention have tapered free-ends
35 formed so as to be complimentary in shape to counter notches made in either of the inner and outer molds, thereby permitting corrective adjustment of terminals

REPLACEMENT SHEET
Date : 15 FEB 1996

12

thus to arrange them at exact intervals in injection molding.

THIS SHEET HAS BEEN
REPLACED

13

REPLACEMENT SHEET
Date: 15 FEB 1996

Claims:

1. An electrical connector (1) comprising:
an insulative housing having a pair of spaced apart,
5 generally parallel sidewalls (19, 20);

a plurality of terminals (3) mounted in said housing
generally along the length of said housing sidewalls,
said terminals being generally parallel and spaced apart
a predetermined distance; and

10 each terminal including a first end (14) for
interconnection to an electrical component, a second
opposite end (15) positioned within said housing, and a
terminal body portion (6) between said first and second
ends, each said second end having a tapered portion (7)
15 adapted for engagement with a correspondingly shaped
recess (18) in a mold component (16) to maintain said
terminal second ends in a predetermined array said
predetermined distance (P) apart in order to maintain
said terminal body portions in a generally parallel array
20 and spaced apart said predetermined distance prior to
overmolding said housing about said terminals.

2. The electrical connector as defined in
claim 1, wherein each of said terminal body portions has
two generally parallel sides (11, 12) which define a
width of each of said terminals, and each of said second
5 ends has at least one tapered end edge (8) extending from
one of said body portion sides towards a centerline (10)
of said terminal.

3. The electrical connector as defined in
claim 2, wherein substantially no plastic is molded onto
said tapered end edge of said second end upon overmolding
said housing about said terminals.



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

REPLACEMENT SHEET

Date **15 FEB 1996**

14

4. The electrical connector as defined in claim 2, wherein each of said terminal second ends includes two tapered end edges extending from said generally parallel sides of said body portions toward said terminal centerline.

5

5. The electrical connector as defined in claim 4, wherein said two tapered end edges converge and intersect with each other generally at said centerline to define said tapered second end of said terminals.

6. The electrical connector as defined in claim 5 wherein said first end is a solder tail for solder interconnection to circuitry of an electronic circuit.

7. The electrical connector as defined in claim 1, wherein each of said terminal second ends has two generally parallel sides and at least one tapered end edge extending from one of said second end sides towards a centerline of said second end.

8. The electrical connector as defined in claim 7, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.

9. The electrical connector as defined in claim 8, wherein each of said terminal second ends includes two tapered end edges extending from said generally parallel sides of said second ends toward said centerline.

5



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

15

REPLACEMENT SHEET
Date : 15 FEB 1996

10. The electrical connector as defined in claim 9, wherein said two tapered end edges converge and intersect with each other generally at said centerline to define said tapered portion of said second end of said terminals.

11. The electrical connector as defined in claim 1, wherein said body portion of each terminal is generally rectangular and said first and second ends are generally parallel.

12. The electrical connector as defined in claim 11, wherein said first and second ends extend away from said terminal body portions.

13. The electrical connector as defined in claim 1, wherein said housing includes a series of projections extending from said housing sidewalls and generally conforming to the shape of said tapered portion of said second end of said terminals.

14. The electrical connector as defined in claim 13, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.

15. A method of manufacturing an electrical connector having an insulative housing (1) molded about a plurality of terminals (3), said insulative housing having a pair of spaced apart, generally parallel sidewalls (19, 20), said plurality of terminals being mounted in said housing generally along the length of said housing sidewalls, said terminals being generally parallel and spaced apart a predetermined distance, the method comprising the steps of:

providing interengaging mold components (16, 17) that cooperate to define a mold cavity corresponding



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

REPLACEMENT SHEET
Date **15 FEB 1996**

16

15 to the configuration of said connector housing, at least one of said mold components having a series of engagement recesses (18) in a surface thereof, said recesses being spaced apart said predetermined distance (P);

providing a carrier strip assembly (2) having an elongated carrier strip (4) with a plurality of stamped and formed terminals (3) extending generally transversely from said strip spaced apart said predetermined distance, each terminal including a first end (14) for interconnection to an electrical component, a second opposite, cantilevered end (15) for positioning within said housing, and a terminal body portion (6) between said first and second ends, each said terminal being
20 connected to said carrier strip generally adjacent said first end, said carrier strip maintaining said terminals in an array spaced apart by said predetermined distance, each said second end having a tapered portion (8) adapted for engagement with one of said engagement recesses in
25 said at least one mold component, said tapered portion and said engagement recess being correpondingly shaped to maintain said terminal second ends in a predetermined array said predetermined distance apart within said mold cavity in order to maintain said terminal body portions
30 in a generally parallel array and spaced apart said predetermined distance prior to overmolding said housing about said terminals,

inserting said tapered portion of said terminal second ends into said mold component recesses in order to
40 align said second ends in an array said predetermined distance apart;

securing said carrier strip assembly substantially within said mold cavity; and

injecting an insulative molding material into
45 said mold cavity defined by said mold components to form said connector housing about said terminals.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

REPLACEMENT SHEET

Date : 15 FEB 1996

17

16. The method of claim 15, further including the step of removing said terminals from said carrier strip adjacent said first ends to define free solder tail portions extending away from said connector housing.

17. The method of claim 15, further including the step of holding said terminals proximate their body portion during said injection molding in order to define a series of openings (23) in said connector housings in which a portion of said terminals are exposed.

5

18. The method of claim 15, wherein said securing step includes clamping said carrier strip assembly between some of said mold components.



This Sheet Has Been Replaced



1

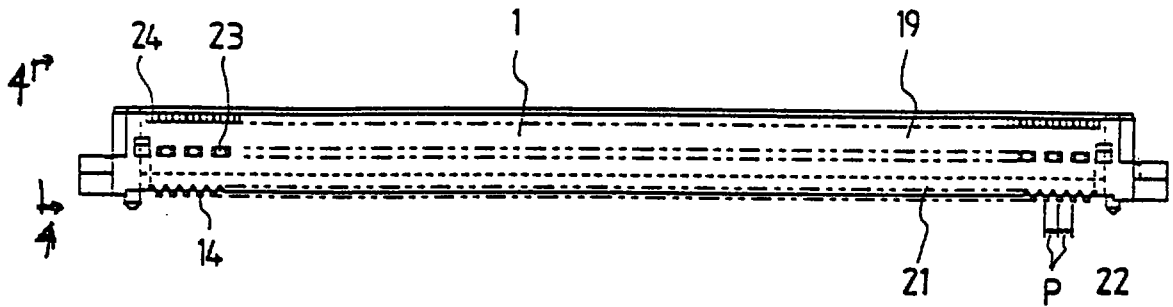


Fig. 1

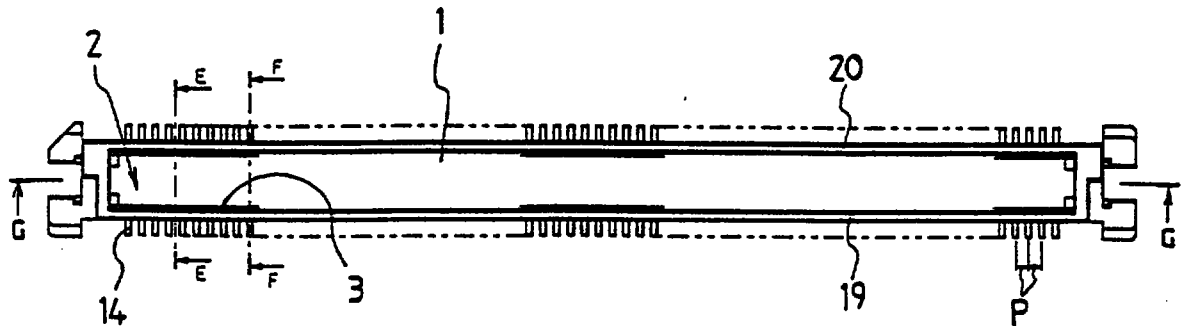


Fig. 2

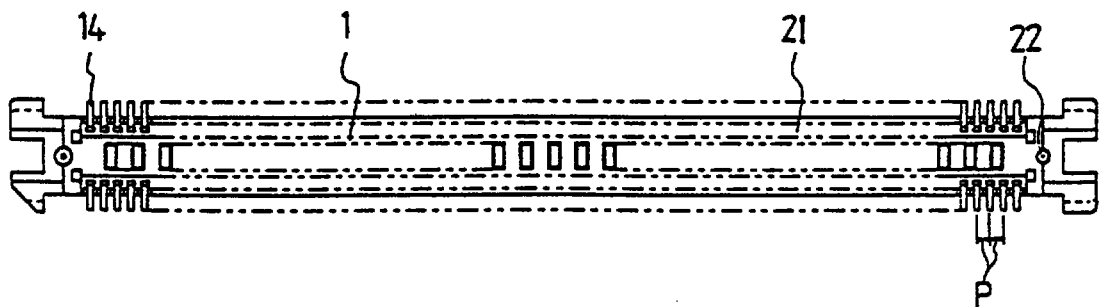


Fig. 3

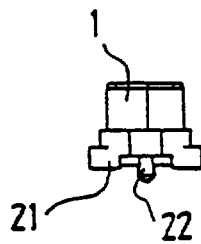


Fig. 4

2

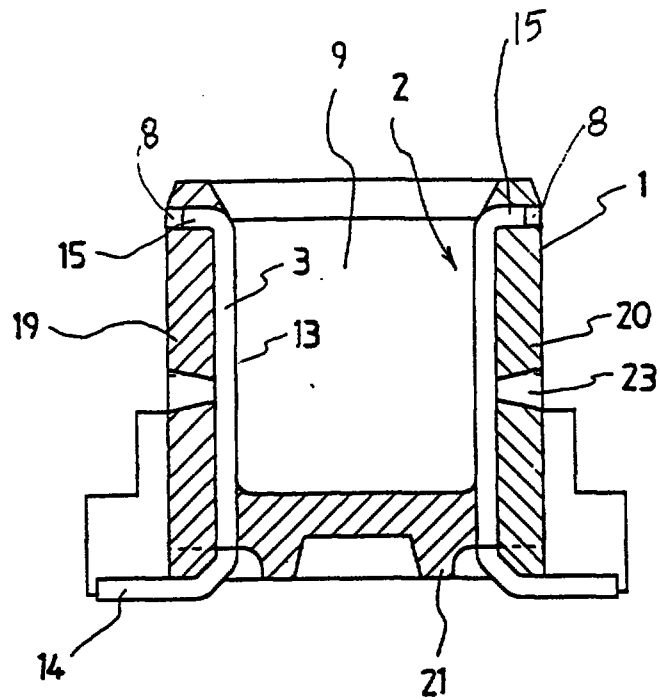


Fig. 5

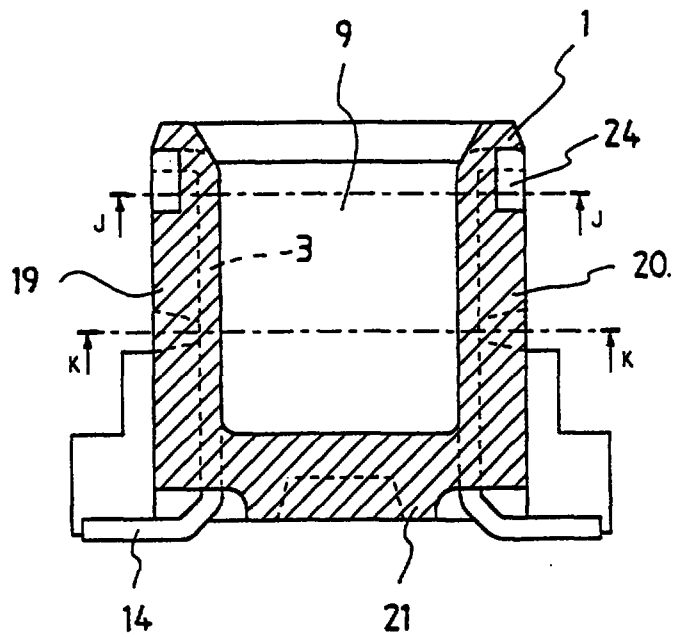


Fig. 6

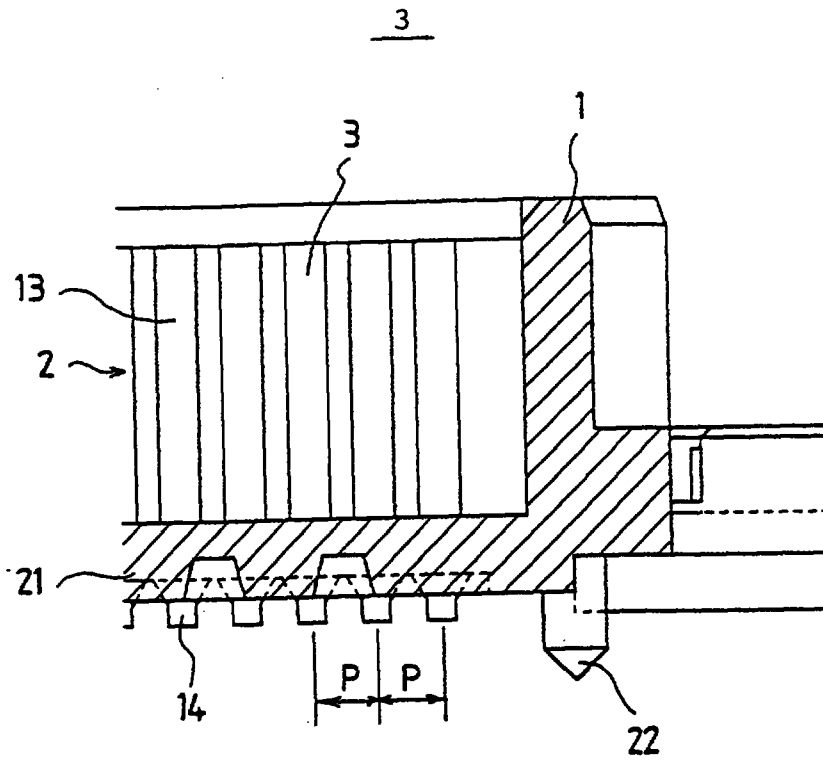


Fig. 7

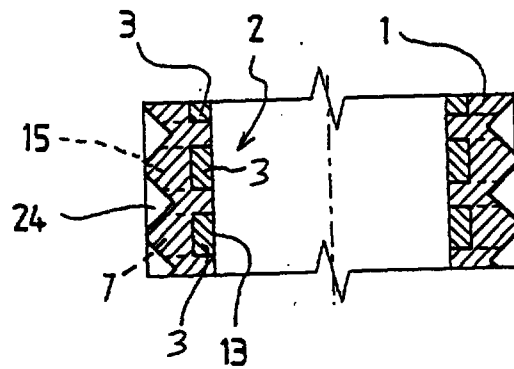


Fig. 8

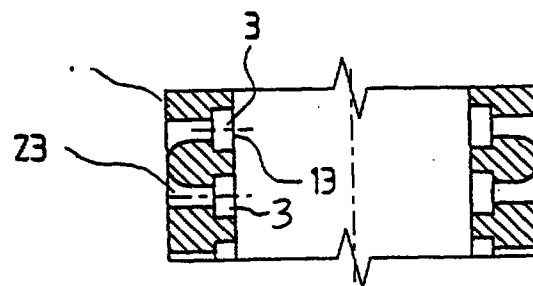


Fig. 9

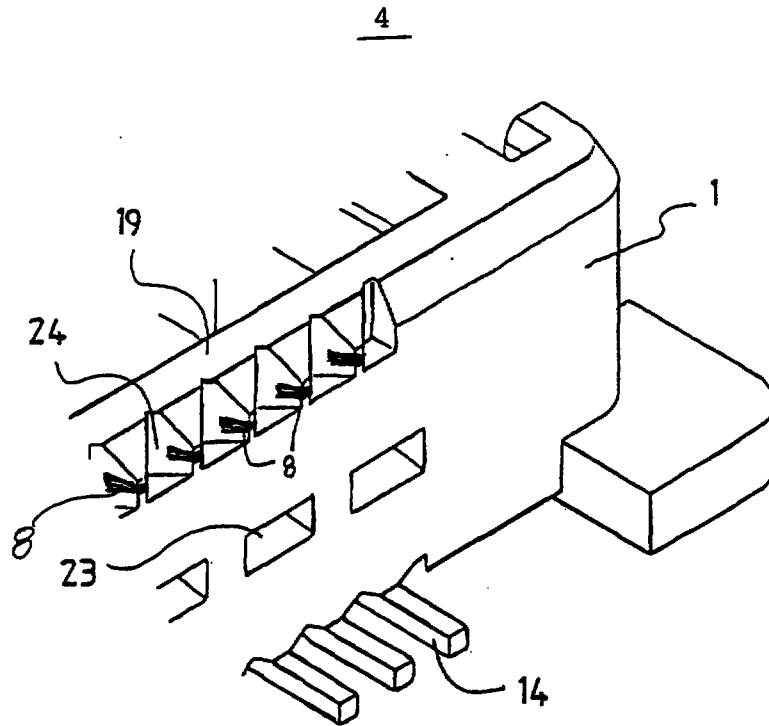


Fig. 10

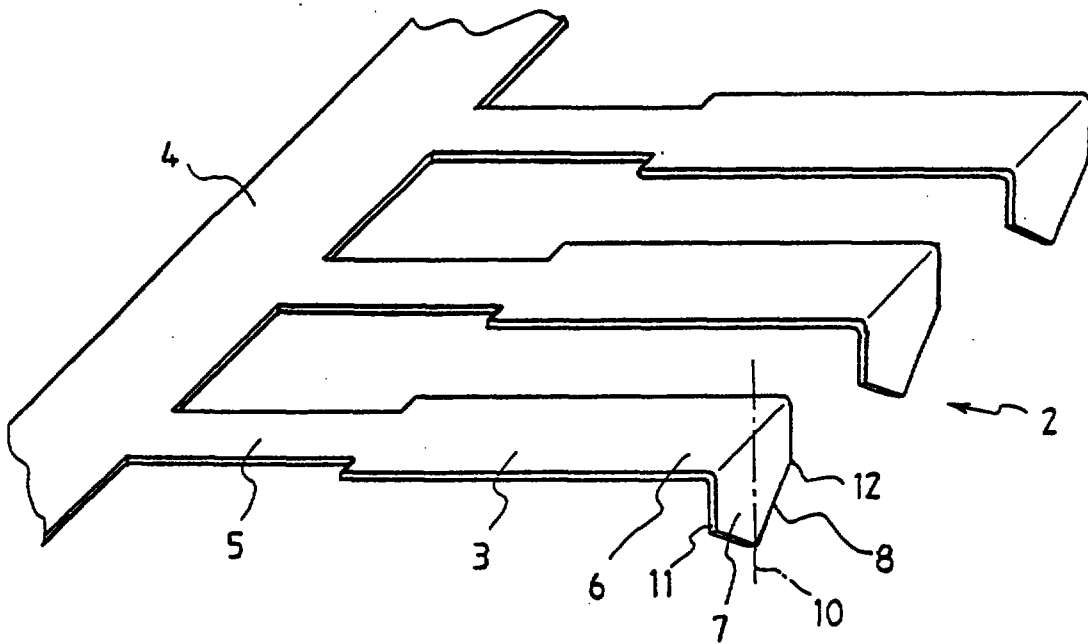


Fig. 11

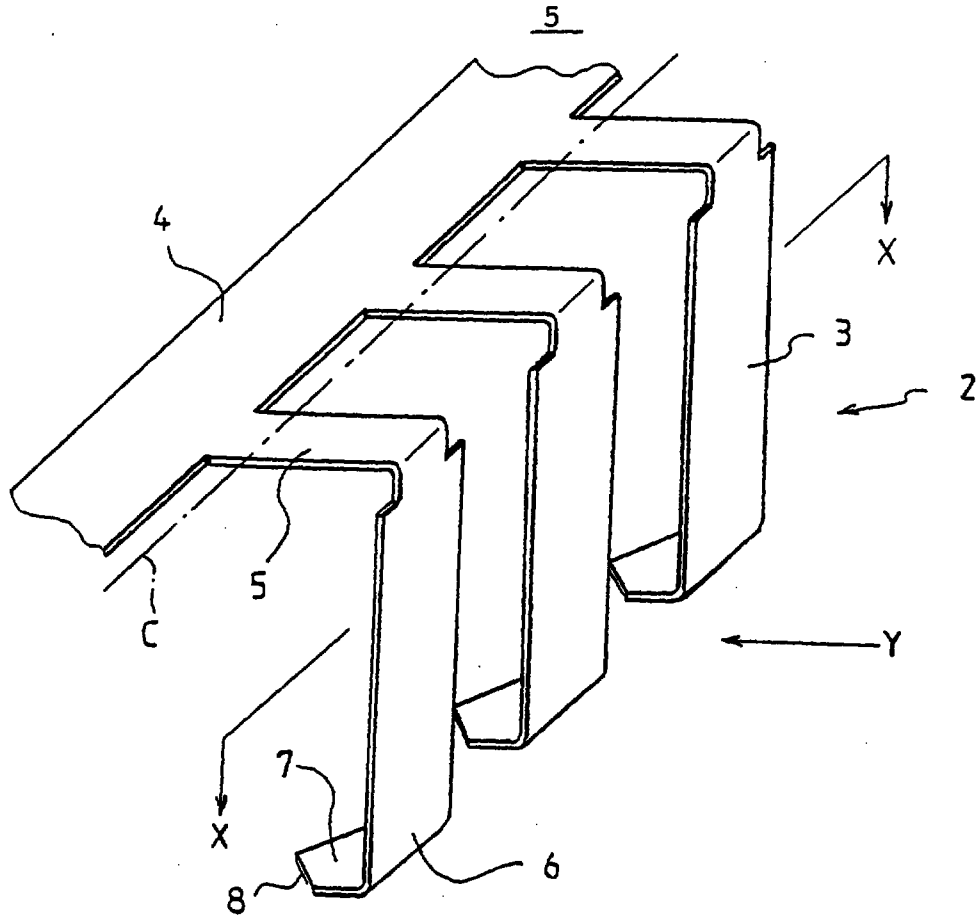


Fig. 12

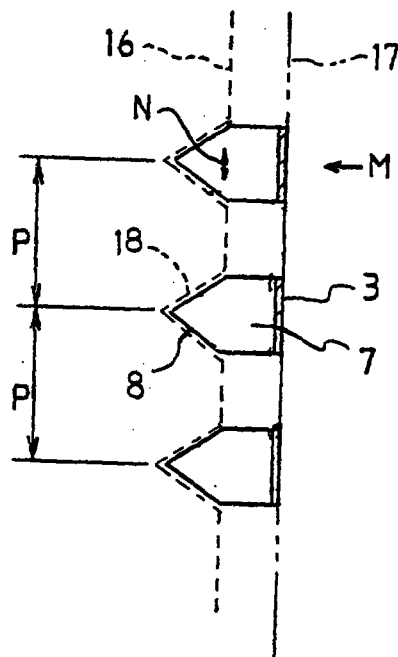


Fig. 13

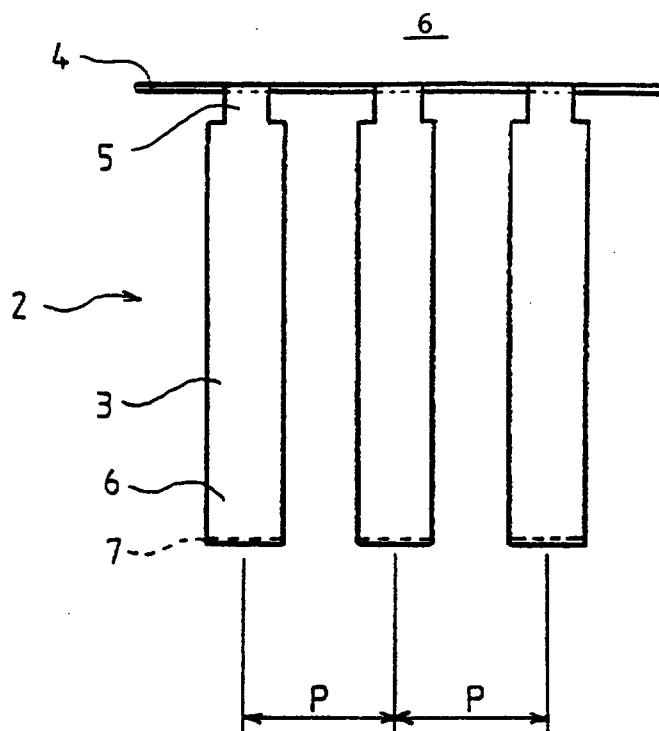
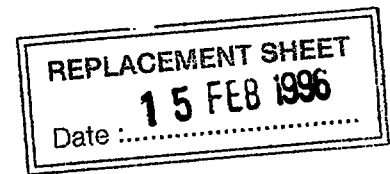


Fig.14

ABSTRACT OF THE DISCLOSUREELECTRICAL CONNECTOR TERMINAL AND METHOD OF MAKING
ELECTRICAL CONNECTOR WITH SAME

5 An improved electrical connector has terminals
(3) with tapered mold engaging ends (8, 15) formed to be
complimentary in shape to notches (18) made in a mold
component (16) in order to retain the pitch (P) of the
terminal ends during injection molding of a connector
housing (1) thereabout.

Figure 1



13

REPLACEMENT SHEET

Date 08 OCT 1996

Claims:THIS SHEET HAS BEEN
REPLACED

1. An electrical connector (1) comprising:
 an insulative housing having a pair of spaced apart,
 5 generally parallel sidewalls (19, 20);
 a plurality of terminals (3) mounted in said housing
 generally along the length of said housing sidewalls,
 said terminals being generally parallel and spaced apart
 a predetermined distance; and
 10 each terminal including a first end (14) for
 interconnection to an electrical component, a second
 opposite end (15) positioned within said housing, and a
 terminal body portion (6) between said first and second
 ends, each said second end having a tapered portion (7)
 15 and being overmolded in said housing
 adapted for engagement with a correspondingly shaped
 recess (18) in a mold component (16) to maintain said
 terminal second ends in a predetermined array said
 predetermined distance (P) apart in order to maintain
 said terminal body portions in a generally parallel array
 20 and spaced apart said predetermined distance. ~~prior to~~
~~overmolding said housing about said terminals.~~

2. The electrical connector as defined in
 claim 1, wherein each of said terminal body portions has
 two generally parallel sides (11, 12) which define a
 width of each of said terminals, and each of said second
 5 ends has at least one tapered end edge (8) extending from
 one of said body portion sides towards a centerline (10)
 of said terminal.

3. The electrical connector as defined in
 claim 2, wherein substantially no plastic is molded onto
 said tapered end edge of said second end upon overmolding
 said housing about said terminals.

This Sheet Has Been Replaced





* C L M S *

REPLACEMENT SHEET

11 FEB 1997

Date :

13

We Claim:

1. (Amended) An electrical connector comprising:
 - an insulative housing having a pair of spaced apart, generally parallel sidewalls;
 - a plurality of terminals mounted in said housing generally along the length of said housing sidewalls, said terminals being generally parallel and spaced apart a predetermined distance; and
 - each terminal including a first end for interconnection to an electrical component, a second opposite end positioned within said housing, and a terminal body portion between said first and second ends, each said second end having a tapered portion adapted for engagement with a correspondingly shaped recess in a mold component to maintain said terminal second ends in a predetermined array, said predetermined distance apart in order to maintain said terminal body portions in a generally parallel array and spaced apart said predetermined distance prior to overmolding said housing about said terminals; whereby said tapered portions assist [and align] in aligning said terminals at said predetermined distance.
2. The electrical connector as defined in claim 1, wherein each of said terminal body portions has two generally parallel sides which define a width of each of said terminals, and each of said second ends has at least one tapered end edge extending from one of said body portion sides towards a centerline of said terminal.
3. The electrical connector as defined in claim 2, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.
4. The electrical connector as defined in claim 2, wherein each of said terminal second ends includes two tapered end edges extending from said generally parallel sides of said body portions toward said terminal centerline.
5. The electrical connector as defined in claim 4, wherein said two tapered end edges converge and intersect with each other generally at said centerline to define said tapered second end of said terminals.
6. The electrical connector as defined in claim 5 wherein said first end is a solder tail for solder interconnection to circuitry of an electronic circuit.
7. The electrical connector as defined in claim 1, wherein each of said terminal second ends has two generally parallel sides and at least one tapered end edge extending from one of said second end sides towards a centerline of said second end.
8. The electrical connector as defined in claim 7, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said

This Sheet Has Been Replaced





* C L M S *

REPLACEMENT SHEET

Date: 11 FEB 1997

14

terminals.

2

9. The electrical connector as defined in claim 8,
2 wherein each of said terminal second ends includes two tapered end
edges extending from said generally parallel sides of said second
4 ends toward said centerline.

10. The electrical connector as defined in claim 9,
2 wherein said two tapered end edges converge and intersect with each
other generally at said centerline to define said tapered portion
4 of said second end of said terminals.

11. The electrical connector as defined in claim 1,
2 wherein said body portion of each terminal is generally rectangular
and said first and second ends are generally parallel.

4

12. The electrical connector as defined in claim 11,
2 wherein said first and second ends extend away from said terminal
body portions.

4

13. The electrical connector as defined in claim 1,
2 wherein said housing includes a series of projections extending
from said housing sidewalls and generally conforming to the shape
4 of said tapered portion of said second end of said terminals.

14. The electrical connector as defined in claim 13,
2 wherein substantially no plastic is molded onto said tapered end
edge of said second end upon overmolding said housing about said
4 terminals.

15. (Amended) An improved electrical connector,
2 comprising an elongated insulative housing having two opposing
sidewalls, a series of electrical terminals spaced apart along said
4 sidewalls of said housing in a predetermined, generally parallel
array, said terminals being spaced apart by a predetermined pitch,
6 each of said terminals including a solder tail portion disposed at
one end thereof extending away from said housing, a mold engagement
8 portion disposed at an opposite end of said terminal and a body
portion interconnecting said solder tail and said mold engagement
10 portions, said mold engagement portion being angularly disposed
with respect to said body portion and including a tapered end
12 portion adapted to be received in a complementary notch formed in
a mold component for maintaining said mold engagement portions in
14 an array spaced apart by said predetermined pitch prior to
overmolding said housing about said terminals, said terminal body
16 portions also being spaced apart by said predetermined pitch within
said connector [between said free ends and said mold engagement
18 portions].

16. The connector as defined in claim 15, wherein said
2 housing includes a series of projections extending from said
sidewall of said housing and generally conforming to the shape of
4 said tapered end portion of said terminals, and substantially no
plastic is molded onto end edges of said tapered end portion upon

This Sheet Has Been Replaced





* C L M S *

REPLACEMENT SHEET

Date 11 FEB 1997

15

overmolding said housing about said terminals.

2

4

6

10

12

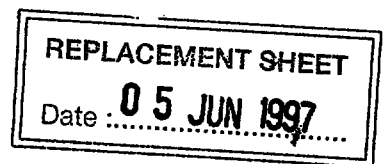
14

16

17 . (New) An electrical connector comprising:
an insulative housing having a pair of spaced apart, generally
parallel sidewalls each having an exterior surface;
a plurality of terminals mounted in said housing generally
along the length of said housing sidewalls, said terminals being
generally parallel and spaced apart a predetermined distance; and
each terminal including a first end for interconnection to an
electrical component, a second opposite end positioned within said
housing, and a terminal body portion between said first and second
ends, each said second end having a tapered portion flush with a
generally correspondingly tapered portion of said exterior surface
of a respective one of said sidewalls, a portion of said second end
being overmolded in said housing.

This Sheet Has Been Replaced





1. An electrical connector (1) comprising:
an insulative housing having a pair of spaced apart, generally parallel sidewalls (19,20);
a plurality of terminals (3) mounted in said housing generally along the length of said housing sidewalls, said terminals being generally parallel and spaced apart a predetermined distance; and
each terminal including a first end (14) for interconnection to an electrical component, a second opposite end (15) positioned within said housing, and a terminal body portion (6) between said first and second ends, each said second end having a tapered portion (7) adapted for engagement with a correspondingly shaped recess (18) in a mold component (16) to maintain said terminal second ends in a predetermined array said predetermined distance (P) apart in order to maintain said terminal body portions in a generally parallel array and spaced apart said predetermined distance prior to overmolding said housing about said terminals; whereby said tapered portions assist and align in aligning said terminals at said predetermined distance.
2. The electrical connector as defined in claim 1, wherein each of said terminal body portions has two generally parallel sides (11,12) which define a width of each of said terminals, and each of said second ends has at least one tapered end edge (8) extending from one of said body portions sides towards a centerline (10) of said terminal.
3. The electrical connector as defined in claim 2, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.
4. The electrical connector as defined in claim 2, wherein each of said terminal second ends includes two tapered end edges extending from said generally parallel sides of said body portions toward said terminal centerline.
5. The electrical connector as defined in claim 4, wherein said two tapered end edges converge and intersect with each other generally at said centerline to define said tapered second end of said terminals.
6. The electrical connector as defined in claim 5 wherein said first end is a solder tail for solder interconnection to circuitry of an electronic circuit.



7. The electrical connector as defined in claim 1, wherein each of said terminal second ends has two generally parallel sides and at least one tapered end edge extending from one of said second end sides towards a centerline of said second end.
8. The electrical connector as defined in claim 7, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.
9. The electrical connector as defined in claim 8, wherein each of said terminal second ends includes two tapered end edges extending from said generally parallel sides of said second ends toward said centerline.
10. The electrical connector as defined in claim 9, wherein said two tapered end edges converge and intersect with each other generally at said centerline to define said tapered portion of said second end of said terminals.
11. The electrical connector as defined in claim 1, wherein said body portion of each terminal is generally rectangular and said first and second ends are generally parallel.
12. The electrical connector as defined in claim 11, wherein said first and second ends extend away from said terminal body portions.
13. The electrical connector as defined in claim 1, wherein said housing includes a series of projections extending from said housing sidewalls and generally conforming to the shape of said tapered portion of said second end of said terminals.
14. The electrical connector as defined in claim 13, wherein substantially no plastic is molded onto said tapered end edge of said second end upon overmolding said housing about said terminals.
15. An improved electrical connector, comprising an elongated insulative housing having two opposing sidewalls, a series of electrical terminals spaced apart along said sidewalls of said housing in a predetermined, generally parallel array, said terminals being spaced apart by a predetermined pitch, each of said terminals including a solder tail portion disposed at one end thereof extending away from said housing, a mold



engagement portion disposed at an opposite end of said terminal and a body portion interconnecting said solder tail and said mold engagement portions, said mold engagement portion being angularly disposed with respect to said body portion and including a tapered end portion adapted to be received in a complementary notch formed in a mold component for maintaining said mold engagement portions in an array spaced apart by said predetermined pitch prior to overmolding said housing about said terminals, said terminal body portions also being spaced apart by said predetermined pitch within said connector.

16. The connector as defined in claim 15, wherein said housing includes a series of projections extending from said sidewall of said housing and generally conforming to the shape of said tapered end portion of said terminals, and substantially no plastic is molded onto end edges of said tapered end portion upon overmolding said housing about said terminals.

17. An electrical connector comprising:

an insulative housing having a pair of spaced apart, generally parallel sidewalls each having an exterior surface;

a plurality of terminals mounted in said housing generally along the length of said housing sidewalls, said terminals being generally parallel and spaced apart a predetermined distance; and

each terminal including a first end for interconnection to an electrical component, a second opposite end positioned within said housing, and a terminal body portion between said first and second ends, each said second end having a tapered portion flush with a generally correspondingly tapered portion of said exterior surface of a respective one of said sidewalls, said tapered portion of said second end being overmolded in said housing.



18. A method of manufacturing an electrical connector having an insulative housing (1) molded about a plurality of terminals (3), said insulative housing having a pair of spaced apart, generally parallel sidewalls (19,20), said plurality of terminals being mounted in said housing generally along the length of said housing sidewalls, said terminals being generally parallel and spaced apart a predetermined distance, the method comprising the steps of:

providing interengaging mold components (16, 17) that cooperate to define a mold cavity corresponding to the configuration of said connector housing, at least one of said mold components having a series of engagement recesses (18) in a surface thereof, said recesses being spaced apart said predetermined distance (P);

providing a carrier strip assembly (2) having an elongated carrier strip (45) with a plurality of stamped and formed terminals (3) extending generally transversely from said strip spaced apart said predetermined distance, each terminal including a first end (14) for interconnection to an electrical component, a second opposite, cantilevered end (15) for positioning within said housing, and a terminal body portion (6) between said first and second ends, each said terminal being connected to said carrier strip generally adjacent said first end, said carrier strip maintaining said terminals in an array spaced apart by said predetermined distance, each said second end having a tapered portion (8) adapted for engagement with one of said engagement recesses in said at least one mold component, said tapered portion and said engagement recess being correspondingly shaped to maintain said terminal second ends in a predetermined array said predetermined distance apart within said mold cavity in order to maintain said terminal body portions in a generally parallel array and spaced apart said predetermined distance prior to overmolding said housing about said terminals,

inserting said tapered portion of said terminal second ends into said mold component recesses in order to align said second ends in an array said predetermined distance apart;

securing said carrier strip assembly substantially within said mold cavity; and
injecting an insulative molding material into said mold cavity defined by said mold components to form said connector housing about said terminals.

19. The method of claim 18, further including the step of removing said terminals from said carrier strip adjacent said first ends to define free solder tail portions extending away from said connector housing.



Date : 05 JUN 1997

20. The method of claim 18, further including the step of holding said terminals proximate their body portion during said injection molding in order to define a series of openings (23) in said connector housings in which a portion of said terminals are exposed.

21. The method of claim 18, wherein said securing step includes clamping said carrier strip assembly between some of said mold components.